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STAR

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Langley Research Center

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

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Table of Contents

Subject Divisions

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

A. Aeronautics
B. Astronautics
C. Chemistry and Materials
D. Engineering
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

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03 Air Transportation and Safety 12

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 14

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 15

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 25

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 27

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) 38

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) 39

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

13 Astrodynamics N.A.

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

14 Ground Support Systems and Facilities (Space) N.A.

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 41

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 42

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

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

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

18 Spacecraft Design, Testing and Performance 43

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 46

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

20 Spacecraft Propulsion and Power 47

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) 49

24 Composite Materials 50

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

25 Inorganic and Physical Chemistry 54

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

26 Metallic Materials 58

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

27 Nonmetallic Materials 61

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 65

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 66

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) 67

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

32 Communications and Radar 69

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 73

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 75

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 84

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 85

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

37 Mechanical Engineering 88

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

38 Quality Assurance and Reliability 90

Includes product sampling procedures and techniques; and quality control.

39 Structural Mechanics 90

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) 96

43 Earth Resources and Remote Sensing 102

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 103

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 106

Includes atmospheric, noise, thermal, and water pollution.

46 Geophysics 112

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

47 Meteorology and Climatology 116

Includes weather forecasting and modification.

48 Oceanography 120

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) 122

52 Aerospace Medicine 124

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

53 Behavioral Sciences 125

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

54 Man/System Technology and Life Support 126

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) 128

60 Computer Operations and Hardware 130

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

61 Computer Programming and Software 130

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

62 Computer Systems 136

Includes computer networks and special application computer systems.

63 Cybernetics 140

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 142

Includes iteration, difference equations, and numerical approximation.

65 Statistics and Probability 144

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

66 Systems Analysis 145

Includes mathematical modeling; network analysis; and operations research.

67 Theoretical Mathematics 148

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) 148

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 149

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

72 Atomic and Molecular Physics 153

Includes atomic structure, electron properties, and molecular spectra.

73 Nuclear and High-Energy Physics N.A.

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

74 Optics 154

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

75 Plasma Physics 155

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

76 Solid-State Physics 162

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

77 Thermodynamics and Statistical Physics 166

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

Subject Categories of the Division I. Social Sciences

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80 Social Sciences (General) 166

Includes educational matters.

81 Administration and Management 166

Includes management planning and research.

82 Documentation and Information Science 167

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

83 Economics and Cost Analysis N.A.

Includes cost effectiveness studies.

84 Law, Political Science and Space Policy 171

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

85 Urban Technology and Transportation N.A.

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

Subject Categories of the Division J. Space Sciences

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

88 Space Sciences (General) N.A.

89 Astronomy 171

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

90 Astrophysics 172

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 173

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

92 Solar Physics 174

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

93 Space Radiation 175

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.*

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99 General N.A.

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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*

Key

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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VOLUME 37, AUGUST 2, 1999

01
AERONAUTICS (GENERAL)

19990052647 NASA Lewis Research Center, Cleveland, OH USA
Research and Technology, 1998
1999; 206p; In English
Report No.(s): NASA/TM-1999-208815; NAS 1.15:208815; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This report selectively summarizes the NASA Lewis Research Center's research and technology accomplishments for the fiscal year 1998. It comprises 134 short articles submitted by the staff scientists and engineers. The report is organized into five major sections: Aeronautics, Research and Technology, Space, Engineering and Technical Services, and Commercial Technology. A table of contents and an author index have been developed to assist readers in finding articles of special interest. This report is not intended to he a comprehensive summary of all the research and technology work done over the past fiscal year. Most of the work is reported in Lewis-published technical reports, journal articles, and presentations prepared by Lewis staff and contractors. In addition, university grants have enabled faculty members and graduate students to engage in sponsored research that is reported at technical meetings or in journal articles. For each article in this report, a Lewis contact person has been identified, and where possible, reference documents are listed so that additional information can be easily obtained. The diversity of topics attests to the breadth of research and technology being pursued and to the skill mix of the staff that makes it possible. At the time of publication, NASA Lewis was undergoing a name change to the NASA John H. Glenn Research Center at Lewis Field.
Author
Aeronautics; NASA Programs; Research and Development; Technology Utilization; Spaceborne Experiments

19990053351 NASA Langley Research Center, Hampton,VA USA
Aeronautical Engineering: A Continuing Bibliography With Indexes, Supplement 404
Jul. 09, 1999; 63p; In English
Report No.(s): NASA/SP-1999-7037/SUPPL404; NAS 1.21:7037/SUPPL404; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This supplemental issue of Aeronautical Engineering, A Continuing Bibliography with Indexes (NASA/SP-1999-7037) lists reports, articles, and other documents recently announced in the NASA STI Database. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. Two indexes-subject and author are included after the abstract section.
CASI
Bibliographies; Aeronautical Engineering; Aerodynamics; Indexes (Documentation)

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.

19990049398 NASA Dryden Flight Research Center, Edwards, CA USA
Design and Predictions for a High-Altitude (Low-Reynolds-Number) Aerodynamic Flight Experiment
Greer, Donald, NASA Dryden Flight Research Center, USA; Hamory, Phil, NASA Dryden Flight Research Center, USA; Krake,

Keith, Sparta, Inc., USA; Drela, Mark, Massachusetts Inst. of Tech., USA; July 1999; 22p; In English; 17th Applied Aerodynamics, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA
Contract(s)/Grant(s): RTOP 529-10-04
Report No.(s): NASA/TM-1999-206579; NAS 1.15:206579; H-2340; AIAA Paper 99-3183; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A sailplane being developed at NASA Dryden Flight Research Center will support a high-altitude flight experiment. The experiment will measure the performance parameters of an airfoil at high altitudes (70,000 to 100,000 ft), low Reynolds numbers (200,000 to 700,000), and high subsonic Mach numbers (0.5 and 0.65). The airfoil section lift and drag are determined from pitot and static pressure measurements. The locations of the separation bubble, Tollmien-Schlichting boundary layer instability frequencies, and vortex shedding are measured from a hot-film strip. The details of the planned flight experiment are presented. Several predictions of the airfoil performance are also presented. Mark Drela from the Massachusetts Institute of Technology designed the APEX-16 airfoil, using the MSES code. Two-dimensional Navier-Stokes analyses were performed by Mahidhar Tatineni and Xiaolin Zhong from the University of California, Los Angeles, and by the authors at NASA Dryden.
Author
Airfoils; High Altitude; Low Reynolds Number; Navier-Stokes Equation; Aerodynamic Drag; Static Pressure; Subsonic Speed; Boundary Layer Stability; Flight Tests

19990050911 NASA Langley Research Center, Hampton, VA USA
CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999, Pt. 1
Woodrow Whitlow, Jr., Editor, NASA Glenn Research Center, USA; Todd, Emily N., Editor, Institute for Computer Applications in Science and Engineering, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999; 437p; In English; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999, 22-25 Jun. 1999, Williamsburg, VA, USA; Sponsored by Confederation of European Aerospace Societies, Unknown; See also 19990050912 through 19990050948
Contract(s)/Grant(s): RTOP 505-90-52-01
Report No.(s): NASA/CP-1999-209136/PT1; L-17863A; NAS 1.55:209136/PT1; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

These proceedings represent a collection of the latest advances in aeroelasticity and structural dynamics from the world community. Research in the areas of unsteady aerodynamics and aeroelasticity, structural modeling and optimization, active control and adaptive structures, landing dynamics, certification and qualification, and validation testing are highlighted in the collection of papers. The wide range of results will lead to advances in the prediction and control of the structural response of aircraft and spacecraft.
Author
Conferences; Dynamic Structural Analysis; Unsteady Aerodynamics; Aeroelasticity; Flutter Analysis; Mathematical Models

19990050912 Research and Technology Organization, Neuilly-sur-Seine, France
A New Compendium of Unsteady Aerodynamic Test Cases for CFD: Summary of AVT WG-003 Activities
Ruiz-Calavera, Luis P., Instituto Nacional de Tecnica Aeroespacial, Spain; Bennett, Robert, NASA Langley Research Center, USA; Fox, John H., Sverdrup Technology, Inc., USA; Galbraith, Robert W., Glasgow Univ., UK; Geurts, Evert, National Aerospace Lab., Netherlands; Henshaw, Micahel J. deC., British Aerospace Aircraft Group, UK; Huang, XingZhong, Institute for Aerospace Research, Canada; Kaynes, Ian W., Defence Evaluation Research Agency, UK; Loeser, Thomas, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Naudin, Pierre, Office National d'Etudes et de Recherches Aerospatiales, France; Tamayama, Masato, National Aerospace Lab., Japan; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 1-12; In English; See also 19990050911; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

With the continuous progress in hardware and numerical schemes, Computational Unsteady Aerodynamics (CUA), that is, the application of Computational Fluid Dynamics (CFD) to unsteady flowfields, is slowly finding its way as a useful and reliable tool (turbulence and transition modeling permitting) in the aircraft, helicopter, engine and missile design and development process. Before a specific code may be used with confidence it is essential to validate its capability to describe the physics of the flow correctly, or at least to the level of approximation required, for which purpose a comparison with accurate experimental data is needed. Unsteady wind tunnel testing is difficult and expensive; two factors which dramatically limit the number of organizations with the capability and/or resources to perform it. Thus, unsteady experimental data is scarce, often classified and scattered in diverse documents. Additionally, access to the reports does not necessarily assure access to the data itself. The collaborative effort described in this paper was conceived with the aim of collecting into a single easily accessible document as much quality data

as possible. The idea is not new. In the early 80's NATO's AGARD (Advisory Group for Aerospace Research & Development) Structures and Material Panel (SMP) produced AGARD Report No. 702 "Compendium of Unsteady Aerodynamic Measurements", which has found and continues to find extensive use within the CUA Community. In 1995 AGARD's Fluid Dynamics Panel (FDP) decided to update and expand the former database with new geometries and physical phenomena, and launched Working Group WG-22 on "Validation Data for Computational Unsteady Aerodynamic Codes". Shortly afterwards AGARD was reorganized as the RTO (Research and Technology Organization) and the WG was renamed as AVT (Applied Vehicle Technolology) WG-003. Contributions were received from AEDC, BAe, DLR, DERA, Glasgow University, IAR, NAL, NASA, NLR, and ONERA. The final publication with the results of the exercise is expected in the second part of 1999. The aim of the present paper is to announce and present the new database to the Aeroelasticity community. It is also intended to identify, together with one of the groups of end users it targets, deficiencies in the compendium that should be addressed by means of new wind tunnel tests or by obtaining access to additionally existing data.
Derived from text
Data Bases; Unsteady Aerodynamics; Wind Tunnel Tests; Data Management; Data Integration; Aerodynamic Configurations

19990050916 Pisa Univ., Dipt. di Ingegneria Aerospaziale, Italy
MDO of an Innovative Configuration: Aerodynamic Issues
Bernardini, G., Pisa Univ., Italy; Frediani, A., Pisa Univ., Italy; Morino, L., Rome III Univ., Italy; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 43-52; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A numerical methodology for the evaluation of aerodynamic loads acting on a complex lifting configuration is presented. The work is limited to the case of attached high-Reynolds number flows. A viscous/potential interaction technique is utilized to take into account the effects of the viscosity. For the potential-flow analysis, a boundary element formulation is used; for simplicity, only incompressible flows are examined; the wake geometry is either prescribed a priori or is determined as part of the solution (free-wake analysis). The theoretical basis of the present methodology is briefly described. Comparisons of present numerical results with analytical, numerical, and experimental results available in the literature are included.
Author
Aerodynamic Loads; Multidisciplinary Design Optimization; Potential Flow; Viscous Flow; Mathematical Models

19990050939 Aerospatiale, Airbus Division, Toulouse, France
A Reduced Basis Model for Aeroelastic Optimization
Grihon, S., Aerospatiale, France; Esquerre, J. P., Aerospatiale, France; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 325-332; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A method is proposed by which the computational efficiency of the aeroelastic sizing optimization process is improved. It uses a reduced basis model approach. This reduced basis model is first validated through flutter simulations under large structural modifications. The test case is a simplified model of a four engine aircraft wing . It is then applied to a flutter optimization study. The case studied is a full model of a large four engine aircraft. The flutter behavior of this model is controlled through an optimization of engine pylons. For a comparison purpose, two optimization methods are applied to this second case. The first one is the classical approach using exact modal and flutter reanalysis at each iteration, the second one uses the reduced basis model. Results are very close, but the optimization with the reduced basis model is considerably faster. It facilitates mode tracking during the optimization process as well as rapid evaluations of alternative optimization problem formulations.
Author
Aeroelasticity; Optimization; Flutter Analysis; Wings; Mathematical Models; Aircraft Models; Dynamic Models

19990050942 NASA Langley Research Center, Hampton, VA USA
Reduced Order Models Based on Linear and Nonlinear Aerodynamic Impulse Responses
Silva, Walter A., NASA Langley Research Center, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 369-380; In English; See also 19990050911; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper discusses a method for the identification and application of reduced-order models based on linear and nonlinear aerodynamic impulse responses. The Volterra theory of nonlinear systems and an appropriate kernel identification technique are described. Insight into the nature of kernels is provided by applying the method to the nonlinear Riccati equation in a non-aerodynamic application. The method is then applied to a nonlinear aerodynamic model of an RAE 2822 supercritical airfoil undergoing

plunge motions using the CFL3D Navier-Stokes flow solver with the Spalart-Allmaras turbulence model. Results demonstrate the computational efficiency of the technique.
Author
Turbulence Models; Mathematical Models; Dynamic Response; Volterra Equations; Nonlinear Systems; Navier-Stokes Equation; Kernel Functions; Dynamic Models; Computational Fluid Dynamics; Aeroelasticity

19990050946 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia
Influence of Nonplanar Supersonic Interference on Aeroelastic Characteristics
Kouzmin, V., Tsentralni Aerogidrodinamicheskii Inst., Russia; Kouzmina, S., Tsentralni Aerogidrodinamicheskii Inst., Russia; Mosounov, V., Tsentralni Aerogidrodinamicheskii Inst., Russia; Ishmuratov, F., Tsentralni Aerogidrodinamicheskii Inst., Russia; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 415-424; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A new version of supersonic panel method for computing the generalized aerodynamic forces on nonplanar lifting surfaces is described. Integral equation relating the velocity potential and a unit value of pressure distribution has been used. A flexible improved numerical procedure has been developed for the achievement of the high accuracy at different Mach numbers, reduced frequencies and panels dimensions. In practice proposed computer code has no restrictions for above mentioned parameters. Applied for the computational flutter investigations a software package KC-2 includes unified computer code for analysis in subsonic and supersonic flow because of the basic data organization is the same in both cases. Proposed method is illustrated by the flutter and static aeroelastic characteristics calculations for modern aircraft. The influence of nonplanar supersonic interference on obtained results is analyzed.
Author
Flutter Analysis; Panel Method (Fluid Dynamics); Supersonic Flow; Aerodynamic Interference; Aeroelasticity; Aerodynamic Forces; Unsteady Aerodynamics

19990052585 Boeing Commercial Airplane Co., Advanced Development Aerodynamics, Seattle, WA USA
High Reynolds Number Hybrid Laminar Flow Control (HLFC) Flight Experiment, Report 4, Suction System Design and Manufacture, *Dec. 1987 - Aug. 1991*
April 1999; 110p; In English
Contract(s)/Grant(s): NAS1-18574; RTOP 522-32-31-01
Report No.(s): NASA/CR-1999-209326; NAS 1.26:209326; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This document describes the design of the leading edge suction system for flight demonstration of hybrid laminar flow control on the Boeing 757 airplane. The exterior pressures on the wing surface and the required suction quantity and distribution were determined in previous work. A system consisting of porous skin, sub-surface spanwise passages (”flutes”), pressure regulating screens and valves, collection fittings, ducts and a turbocompressor was defined to provide the required suction flow. Provisions were also made for flexible control of suction distribution and quantity for HLFC research purposes. Analysis methods for determining pressure drops and flow for transpiration heating for thermal anti-icing are defined. The control scheme used to observe and modulate suction distribution in flight is described.
Author
Laminar Boundary Layer; High Reynolds Number; Boundary Layer Control; Flight Tests; Suction

19990052586 Boeing Commercial Airplane Co., Advanced Development Aerodynamics, Seattle, WA USA
High Reynolds Number Hybrid Laminar Flow Control (HLFC) Flight Experiment, Report 2, Aerodynamic Design
April 1999; 170p; In English
Contract(s)/Grant(s): NAS1-18574; RTOP 522-32-31-01
Report No.(s): NASA/CR-1999-209324; NAS 1.26:209324; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This document describes the aerodynamic design of an experimental hybrid laminar flow control (HLFC) wing panel intended for use on a Boeing 757 airplane to provide a facility for flight research on high Reynolds number HLFC and to demonstrate practical HLFC operation on a full-scale commercial transport airplane. The design consists of revised wing leading edge contour designed to produce a pressure distribution favorable to laminar flow, definition of suction flow requirements to laminarize the boundary layer, provisions at the inboard end of the test panel to prevent attachment-line boundary layer transition, and a Krueger leading edge flap that serves both as a high lift device and as a shield to prevent insect accretion on the leading edge when the airplane is taking off or landing.
Author
Laminar Flow; Boundary Layer Control; Laminar Boundary Layer; High Reynolds Number; Boundary Layer Transition; Aerodynamics

19990052613 NASA Dryden Flight Research Center, Edwards,CA USA

Flight-Determined Subsonic Lift and Drag Characteristics of Seven Lifting-Body and Wing-Body Reentry Vehicle Configurations With Truncated Bases

Saltzman, Edwin J., Analytical Services and Materials, Inc., USA; Wang, K. Charles, Aerospace Corp., USA; Iliff, Kenneth W., NASA Dryden Flight Research Center, USA; Jan. 1999; 33p; In English; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 529-50-04

Report No.(s): H-2287; AIAA Paper 99-0383; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper examines flight-measured subsonic lift and drag characteristics of seven lifting-body and wing-body reentry vehicle configurations with truncated bases. The seven vehicles are the full-scale M2-F1, M2-F2, HL-10, X-24A, X-24B, and X-15 vehicles and the Space Shuttle prototype. Lift and drag data of the various vehicles are assembled under aerodynamic performance parameters and presented in several analytical and graphical formats. These formats unify the data and allow a greater understanding than studying the vehicles individually allows. Lift-curve slope data are studied with respect to aspect ratio and related to generic wind-tunnel model data and to theory for low-aspect-ratio planforms. The proper definition of reference area was critical for understanding and comparing the lift data. The drag components studied include minimum drag coefficient, lift-related drag, maximum lift-to-drag ratio, and, where available, base pressure coefficients. The effects of fineness ratio on forebody drag were also considered. The influence of forebody drag on afterbody (base) drag at low lift is shown to be related to Hoerner's compilation for body, airfoil, nacelle, and canopy drag. These analyses are intended to provide a useful analytical framework with which to compare and evaluate new vehicle configurations of the same generic family.

Author

Lift; Reentry Vehicles; Aerodynamic Drag; Body-Wing Configurations; Subsonic Flow; Lifting Reentry Vehicles

19990052644 NASA Langley Research Center, Hampton, VA USA

Experimental and Computational Investigation of a Translating-Throat Single-Expansion-Ramp Nozzle

Deere, Karen A., NASA Langley Research Center, USA; Asbury, Scott C., NASA Langley Research Center, USA; May 1999; 51p; In English

Contract(s)/Grant(s): RTOP 522-21-51-04

Report No.(s): NASA/TP-1999-209138; NAS 1.60:209138; L-17708; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An experimental and computational study was conducted on a high-speed, single-expansion-ramp nozzle (SERN) concept designed for efficient off-design performance. The translating-throat SERN concept adjusts the axial location of the throat to provide a variable expansion ratio and allow a more optimum jet exhaust expansion at various flight conditions in an effort to maximize nozzle performance. Three design points (throat locations) were investigated to simulate the operation of this concept at subsonic-transonic, low supersonic, and high supersonic flight conditions. The experimental study was conducted in the jet exit test facility at the Langley Research Center. Internal nozzle performance was obtained at nozzle pressure ratios (NPR's) up to 13 for six nozzles with design nozzle pressure ratios near 9, 42, and 102. Two expansion-ramp surfaces, one concave and one convex, were tested for each design point. Paint-oil flow and focusing schlieren flow visualization techniques were utilized to acquire additional flow data at selected NPR'S. The Navier-Stokes code, PAB3D, was used with a two-equation k-e turbulence model for the computational study. Nozzle performance characteristics were predicted at nozzle pressure ratios of 5, 9, and 13 for the concave ramp, low Mach number nozzle and at 10, 13, and 102 for the concave ramp, high Mach number nozzle.

Author

Navier-Stokes Equation; Throats; Exhaust Nozzles; Nozzle Design; Computational Fluid Dynamics; K-Epsilon Turbulence Model; Nozzle Efficiency

19990052669 Academy of Sciences (USSR), Inst. of Theoretical and Applied Mathematics, Novosibirsk, USSR

Supersonic Leading Edge Receptivity

Maslov, Anatoly A., Academy of Sciences (USSR), USSR; June 1998; 140p; In English

Contract(s)/Grant(s): NCC1-240; RTOP 282-10-01-01

Report No.(s): NASA/CR-1999-208445; NAS 1.26:208445; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This paper describes experimental studies of leading edge boundary layer receptivity for imposed stream disturbances. Studies were conducted in the supersonic T-325 facility at ITAM and include data for both sharp and blunt leading edges. The data

are in agreement with existing theory and should provide guidance for the development of more complete theories and numerical computations of this phenomena.
Author
Boundary Layer Transition; Viscous Flow; Sharp Leading Edges; Leading Edges

19990052671 Boeing Commercial Airplane Co., Advanced Development Aerodynamics, Seattle, WA USA
High Reynolds Number Hybrid Laminar Flow Control (HLFC) Flight Experiment, 3, Leading Edge Design, Fabrication, and Installation
April 1999; 92p; In English
Contract(s)/Grant(s): NAS1-18574; RTOP 522-32-31
Report No.(s): NASA/CR-1999-209325; NAS 1.26:209325; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This document describes the design, fabrication, and installation of the suction panel and the required support structure, ducting, valving, and high-lift system (Krueger flaps) for flight demonstration of hybrid laminar flow control on the Boeing 757 airplane.
Author
Boundary Layer Control; Laminar Boundary Layer; Laminar Flow; Flight Tests; Suction

19990052675 NASA Langley Research Center, Hampton, VA USA
CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999, Pt. 2
Whitlow, Jr., Woodrow, Editor, NASA Glenn Research Center, USA; Todd, Emily N., Editor, Institute for Computer Applications in Science and Engineering, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999; 419p; In English; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999, 22-25 Jun. 1999, Williamsburg, VA, USA; Sponsored by Confederation of European Aerospace Societies, Unknown; See also 19990052676 through 19990052709
Contract(s)/Grant(s): RTOP 505-90-52-01
Report No.(s): NASA/CP-1999-209136/PT2; L-17863B; NAS 1.55:209136/PT2; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche
The proceedings of a workshop sponsored by the Confederation of European Aerospace Societies (CEAS), the American Institute of Aeronautics and Astronautics (AIAA), the National Aeronautics and Space Administration (NASA), Washington, D.C., and the Institute for Computer Applications in Science and Engineering (ICASE), Hampton, Virginia, and held in Williamsburg, Virginia June 22-25, 1999 represent a collection of the latest advances in aeroelasticity and structural dynamics from the world community. Research in the areas of unsteady aerodynamics and aeroelasticity, structural modeling and optimization, active control and adaptive structures, landing dynamics, certification and qualification, and validation testing are highlighted in the collection of papers. The wide range of results will lead to advances in the prediction and control of the structural response of aircraft and spacecraft.
Author
Conferences; Dynamic Structural Analysis; Unsteady Aerodynamics; Aeroelasticity; Flutter Analysis; Mathematical Models

19990052676 Virginia Polytechnic Inst. and State Univ., Center for Intelligent Materials, Systems, and Structures, Blacksburg, VA USA
Vortex-Lattice-Method to Analyze Aerodynamic Interference of Wing/Pylon/Store Configurations of an F16 Wing
Cattarius, J., Virginia Polytechnic Inst. and State Univ., USA; Preidikman, S., Virginia Polytechnic Inst. and State Univ., USA; Mook, D. T., Virginia Polytechnic Inst. and State Univ., USA; Inman, D. J., Virginia Polytechnic Inst. and State Univ., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 443-456; In English; See also 19990052675; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche
This paper will show initial results of a complete aeroelastic F16-like semi-span wing model, used to analyze the feasibility of piezoelectric stack actuation as a wing/store flutter suppression system. The model can identify the presence of aerodynamic interference between the store, pylon, and wing wakes and examine its significance with respect to the pressure and lift forces on the participating bodies. The wing and store data considered in this analysis, represent an F16 configuration that was identified to induce flutter in flight at subsonic speeds. The pylon is based on the concept of the decoupler pylon, introduced by Reed and Foughner in 1978 and flight tested in the early 1980's, and models both yaw and pitching motion of the store. The complete aeroelastic model is simulated in ABAQUS which has been augmented by the unsteady-vortex-lattice-method (UVLM) to calculate the aerodynamic loading. Both codes communicate through an iterative handshake procedure during which displacements and air loads are updated. For each increment in time the force/displacement equilibrium is found in this manner. At this point, the analysis is confined to a static analysis

of the flexible structure. The wing is modeled as an elastic plate and pylon and store are rigid bodies. The store is connected to the pylon through an elastic joint possessing two degrees of freedom, pitch and yaw, respectively.
Author
Aerodynamic Interference; Aerodynamic Loads; Aeroelasticity; Flutter; Vibration Damping; Vortex Lattice Method; Wing-Fuselage Stores; Semispan Models; Body-Wing Configurations

19990052678 Technion - Israel Inst. of Tech., Faculty of Aerospace Engineering, Haifa, Israel
Structural Optimization Using Computational Aerodynamics
Raveh, Daniella E., Georgia Inst. of Tech., USA; Levy, Yuval, Technion - Israel Inst. of Tech., Israel; Karpel, Moti, Technion - Israel Inst. of Tech., Israel; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 469-482; In English; See also 19990052675; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A recently developed methodology for aircraft structural design, based on nonlinear airloads, is extended to include a modal-based optimization option, and an optional different computational aerodynamics code for loads analysis. Nonlinear maneuver loads are evaluated by a newly developed computational scheme that efficiently combines fluid dynamics iterations with iterations for elastic shape deformations and trim corrections. An efficient design process is obtained by performing several optimization runs during one maneuver loads analysis, where each optimization is based on the interim non-converged airloads. This method was recently presented with structural optimization based on full-size, discrete-coordinate analyses. to allow the application of the method with large finite-element models and many constraints, the discrete-coordinates optimization is replaced by a modal-based optimization where a set of low-frequency vibration modes of the baseline structure is used to represent the structure throughout the optimization, both for response analysis and for sensitivity analysis. Comparative modal-based and discrete-coordinate design cases are shown to converge to the same optimal design variable values, even though they do not follow the same path. The current study also extends the loads analysis by replacing the flow computation with a newly developed code that handles complex geometries by using the Chimera overset grid method. This method greatly simplifies the process of grid generation and therefore allows for realistic complex configurations to be considered. Moreover, the method avoids the problem of mesh discontinuities due to elastic shape deformations and control surface deflections, as the displacements of each component only affect the component's mesh. The method is demonstrated with a wing-fuselage-elevator transport aircraft model performing symmetric and antisymmetric maneuvers at Mach 0.85.
Author
Aerodynamic Loads; Computational Fluid Dynamics; Aircraft Structures; Optimization; Elastic Deformation; Vibration Mode; Computational Grids; Structural Design; Applications Programs (Computers)

19990052703 Boeing Co., Loads and Dynamics, Long Beach, CA USA
Improving the Convergence of the Doublet-Lattice Method Through Tip Corrections
Baker, Myles L., Boeing Co., USA; Rodden, William P., Rodden (William P.), USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 763-776; In English; See also 19990052675; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In 1973 Hough studied the slow convergence of the Vortex-Lattice Method (VLM) as the number of spanwise divisions (strips) is increased. Specifically, the lift curve slope of a lifting surface was shown to decrease significantly as the resolution of the lattice was increased, converging to the "true" value only with relatively fine spanwise divisions. Impressive improvements in the converged results were achieved when equally spaced divisions of the lifting surface were inset from the tip by a fraction of the strip width. Hough demonstrated the improvement via the tip inset on a number of wing planforms at a constant angle of attack. Hough's argument was based on an elliptical lift distribution which is a reasonable assumption in the steady, symmetric case. The present paper investigates also cases where elliptical lift distributions are not expected, specifically, the antisymmetric motion of rolling, elastic motions, and oscillatory motions with high reduced frequencies. The beneficial effect of the tip inset is observed in all cases investigated.
Author
Convergence; Correction; Unsteady Aerodynamics; Vortex Lattice Method; Wing Tips; Lift; Control Surfaces

19990052751 Washington Univ., Seattle, WA USA
Integrated Aeroservoelastic Optimization: Status and Direction
Livne, Eli, Washington Univ., USA; Journal of Aircraft; February 1999; Volume 36, No. 1, pp. 122-145; In English; Structures, Structural Dynamics, and Materials, 7-10 Apr. 1997, Kissimmee, FL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAG2-723
Report No.(s): Paper-97-1409; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The interactions of lightweight flexible airframe structures, steady and unsteady aerodynamics, and wide-bandwidth active controls on modern airplanes lead to considerable multidisciplinary design challenges. More than 25 years of mathematical and numerical methods' development, numerous basic research studies, simulations and wind-tunnel tests of simple models, wind-tunnel tests of complex models of real airplanes, as well as flight tests of actively controlled airplanes, have all contributed to the accumulation of a substantial body of knowledge in the area of aeroservoelasticity. A number of analysis codes, with the capabilities to model real airplane systems under the assumptions of linearity, have been developed. Many tests have been conducted, and results were correlated with analytical predictions. A selective sample of references covering aeroservoelastic testing programs from the 1960s to the early 1980s, as well as more recent wind-tunnel test programs of real or realistic configurations, are included in the References section of this paper. An examination of references 20-29 will reveal that in the course of development (or later modification), of almost every modern airplane with a high authority active control system, there arose a need to face aeroservoelastic problems and aeroservoelastic design challenges.
Derived from text
Aeroservoelasticity; Aircraft Structures; Active Control; Flight Tests; Numerical Analysis

19990053149 Office National d'Etudes et de Recherches Aerospatiales, Dept. Commande des Systemes et Dynamique de Vol, Paris, France
Aerodynamic Perturbations Encountered by a Helicopter Landing on a Ship: Effects on the Helicopter Flight Dynamics
Taghizad, A., Office National d'Etudes et de Recherches Aerospatiales, France; Verbeke, C., Institut de Mecanique des Fluides de Lille, France; Desopper, A., Office National d'Etudes et de Recherches Aerospatiales, France; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 6-1 - 6-16; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes a French activity on helicopter ship landing operations simulation improvement. ONERA, under SPAe funding (Service des Programmes Aeronautiques), has developed an aerodynamic disturbance model around the landing deck of a frigate La Fayette, and has tested its effects on helicopter flight dynamics. Wind tunnel tests were carried out in ONERA-IMFL with a 1/50th scaled model of the La Fayette. Three dimensional measurements of the mean wind speed and velocity fluctuations were performed around the landing deck area. The La Fayette aerodynamic wake model includes a mean wake mode (1) to which a turbulence model adds velocity fluctuations measurements. The model was connected to the Eurocopter Helicopter Overall Simulation Tool (HOST). Simulations of flights above the deck with this model demonstrated important effects of the ship air-wake on the helicopter flight dynamics. This paper describes the test results obtained and the work performed in modelling the La Fayette wake and its influence on the helicopter flight dynamics.
Author
Perturbation; Aerodynamic Characteristics; Landing Simulation; Turbulence Models; Velocity Measurement; Wind Velocity; Ships

19990053161 Academy of Sciences of the Ukraine, Inst. of Hydromechanics, Kiev, Ukraine
Hydrodynamical Characteristics of an Ekranoplane Wing Flying Near the Wavy Sea Surface
Byelinskyy, V. G., Academy of Sciences of the Ukraine, Ukraine; Zinchuk, P. I., Academy of Sciences of the Ukraine, Ukraine; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 18-1 - 18-12; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Some results of experimental studies conducted at the Institute of Hydromechanics of Ukrainian National Academy of Sciences applicable to the problem of ekranoplane creating are presented in this paper. The aim of these research works was to determine the influence of proximity of the flat and wavy screen upon aerodynamics of the ekranoplane's wing. Experimental installation and procedure of the experiment are described. Instantaneous values of lift, drag and position of the center of pressure for a wing moving above the flat and wavy screen have been defined. It has been determined that influence of the angle of attack, the aspect ratio, the distance to a flat and wavy screen as well as the wave length and wave height of a wavy screen on the wing lift. The measurement results of forces and moments on the wing moving above the oblique waves are given.
Author
Aerodynamics; Hydromechanics; Hydrodynamics; Wings; Ground Effect Machines; Surface Effect Ships; Water Vehicles

19990053162 Marine Technical Univ., Saint Petersburg, Russia
Theoretical Analysis of Dynamics of a WIG Vehicle in Extreme Ground Effect
Rozhdestvensky, K. V., Marine Technical Univ., Russia; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea

Interface; February 1999, pp. 19-1 - 19-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The paper discusses asymptotic form of the equations of longitudinal motion of ekranoplane in extreme ground effect, i.e. for very small relative ground clearances h. Derivation of ”quartic” and ”quintic” characteristic equations of unsteady perturbed motion is presented. One-dimensional unsteady non-linear theory of a simple flying wing with endplates, moving in close proximity to the ground, is used to determine derivatives of major aerodynamic coefficients with respect to perturbations of height and pitch as well as asymptotic behavior of these derivatives for vanishing h. Asymptotics of perturbed equations of motion is derived for distances of the order of the chord from the moment of perturbation. It is shown that in very close proximity to the ground parameters of stability and motion of the lifting system depend on ratios of design pitch angle and curvature of the lower side of the wing to relative ground clearance h as well as on a ”reduced” density of the vehicle. The analysis also shows that at distances of the order of the chord from the moment of perturbation the vehicle performs corresponding induced motions in height and pitch, its speed remaining almost the same. At distances of the order of chord/h there takes place variation of speed mostly driven by height and pitch perturbations. At distances of the order of chord/h(exp 2) variation of speed of the craft is due to speed perturbation proper.

Author

Unsteady Aerodynamics; Asymptotic Properties; Equations of Motion; Ground Effect (Aerodynamics); Ground Effect Machines

19990053164 Saint Petersburg Inst. of Aerospace Instrumentation, Saint Petersburg, Russia

Aerodynamic Scheme of Ekranoplane Optimization with Reference to New Areas of Application

Nebylov, A. V., Saint Petersburg Inst. of Aerospace Instrumentation, Russia; Zhigalko, E. T., Saint Petersburg State Univ., Russia; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 21-1 - 21-8; In English; See also 19990053143

Contract(s)/Grant(s): RFBR-96-01-00010; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Opportunities of a choice of the expedient scheme of a large scale ekranoplane (LE) which would ensure the self-stabilization of an angle of attack and the controllability and would improve its properties required, for example, in using LE as a booster for an aerospace plane or as a sea rescue carrier are considered herein. The treated arrangement differs from known ones by utilizing less amount of aircraft elements which are not fully effective in flight of this type.

Author

Flight Optimization; Flight Mechanics; Air Transportation

19990053166 National Aerospace Lab., Amsterdam, Netherlands

Aerodynamic Analysis of a Surface Piercing Hydrofoil-Controlled Wing-In-Ground Effect Seabus Configuration *Progress Report*

vanBeek, C. M., National Aerospace Lab., Netherlands; Oskam, B., National Aerospace Lab., Netherlands; Fantacci, G., Intermarine S.p.A., Italy; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 23-1 - 23-18; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Preliminary design investigations are presented for a Wing-In-Ground effect craft (SEABUS) in the framework of a European project on technology development for this type of vehicle. The concept of the craft features hydrodynamic control surfaces and a water jet propulsion system. A computational tool is developed and used to investigate the static equilibrium of lift, drag and pitching moment on the complete configuration over the entire speed range by taking the aerodynamic, hydrodynamic and propulsion contributions into account at the same time. Hydrodynamics turns out to be one of the key factors. At cruise speed the total drag of the presently proposed configuration is dominated by the hydrodynamic contributions of the submerged components. Limited effort has been spent on the design of the wing and the high lift system. Aerodynamic analysis of this design shows fair correspondence in terms of lift with the required lift values obtained from the preliminary design method. Ground effect trends on performance are correctly calculated. Optimization of the wing and high lift system has to be pursued.

Author

Piercing; Hydrofoils; Ground Effect (Aerodynamics); Design Analysis; Aircraft Design; Wings; Ground Effect Machines

19990053168 Joint Stock Co. Agency for Technologies and Transport, Nizhny Novgorod, Russia

A View of the Present State of Research in Aero- and Hydrodynamics of Ekranoplans

Maskalik, A. I., Joint Stock Co. Agency for Technologies and Transport, Russia; Rozhdestvensky, K. V., Marine Technical Univ., Russia; Sinitsyn, D. N., Joint Stock Co. Agency for Technologies and Transport, Russia; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 25-1 - 25-12; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Ekranoplans as a novel very high-speed craft is one of the promising transportation alternatives of the next millennium. The paper presents a viewpoint upon present state of research relevant to development of ekranoplans with focus on Russian achievements in this field. Discussed are the problems of aerodynamics, hydrodynamics and dynamics of ekranoplans with particular attention to the matters related to use of power augmentation and peculiarities of static and dynamic stability.
Author
Air Transportation; Hydrodynamics; Static Stability; Dynamic Stability; Ground Effect Machines

19990053173 Fischer-Flugmechanik, Willich, Germany
The Hoverwing Technology: Bridge Between WIG and ACV
Fischer, Hanno, Fischer-Flugmechanik, Germany; Matjasic, Klaus, Fischer-Flugmechanik, Germany; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 30-1 - 30-8; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Wingships (WIG, Wing in Ground) utilize water as runways to reach their lift-off speed, which is determined by the wing loading. High Wing loadings are desirable for high cruising speeds with inherent height and longitudinal stability. to build up the necessary dynamic air pressure under the wing, they need roughly 3 times more power to overcome the hydrodynamic hump-drag compared to the drag during ground effect flight. So it is necessary to develop suitable devices as lift-off-aids in order to reduce the recommended power. With support of the German Ministry for R and D (BMB+F) Fischer-Flugmechanik (FF) has developed the ”Hoverwing - Technology” in order to further reduce the necessary lift-off power. The principle of this technology, for which FF has patent rights, is the building up of static air pressure between the catamaran float. After lift-off the dynamic pressure will replace the static pressure and the craft operates as a WIG with high lift to drag ratios. FF is developing the ”Hoverwing 80”, with the target to transport 80 passengers at 100 kts. Some tests results with a scaled down two Seater will be demonstrated by video extracts.
Author
Ground Effect (Aerodynamics); Aircraft Design; Ground Effect Machines

19990053326 Air Force Flight Test Center, Edwards AFB, CA USA
Results of Attempts to Prevent Departure and/or Pilot-Induced Oscillations (PIO) Due to Actuator Rate Limiting in Highly-Augmented Fighter Flight Control Systems (HAVE FILTER)*, 1 - 18 Sep. 1998*
Chapa, Michael; Flick, Eric; Kraabel, Darren; Letourneau, Matthew; Parker, Terry; Mar. 1999; 76p; In English
Report No.(s): AD-A362947; AFFTC-TR-98-26; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The objective of this effort was to evaluate the effects of software rate limiting the pilot command with and without a software pre-filter on a highly-augmented fighter aircraft flight control system. The software rate limiter and software pre-filter were designed to provide protection from departure and/or pilot-induced oscillation (PIO). In statically unstable aircraft stabilized with feedback, elevator/stabilator actuator rate limiting may lead to PIOs and/or departure during aggressive maneuvers. This project examined the use of a software rate limiter (SWRL) on the pilot command and compared the results with those for the unprotected airframe. Additionally, a nonlinear rate limiter pre-filter (RLPF) was used in conjunction with the SWRL. Previous attempts to suppress PIO and/or departure tendencies using similar technologies have encountered difficulty with noise-in-the-loop and out-of-trim bias development during filter operation. This project attempted to improve previous designs using a different algorithm for the RLPF. The SWRL was found to help prevent PIO and/or departure. The RLPF plus SWRL was generally found to be more helpful than the SWRL alone at preventing PIO and/or departure. However, handling qualities deficiencies arose when using low SWRL settings and worsened with low SWRL settings used in conjunction with the RLPF.
DTIC
Pilot Induced Oscillation; Actuators; Flight Control

19990053471 Innovative Scientific Solutions, Inc., Beavercreek, OH USA
Development and Application of an Advanced Optical Based Pressure Instrument for Low-Speed Flows *Final Report, 7 Aug. 1997 - 7 Feb. 1998*
Jordan, Jeff D.; Goss, Larry P.; Feb. 07, 1998; 47p; In English
Contract(s)/Grant(s): F33615-97-C-3005
Report No.(s): AD-A362829; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The STTR Phase I program targeted the development and application of advanced optical based systems the determination of surface-pressure distributions on test models in the Subsonic Aerodynamic Research Laboratory (SARL) at Wright Laboratory. The low-speed flows (0.1 less than or equal M less than or equal 0.5) encountered in the SARL facility effect relatively small changes in surface pressure, typically 1-2 psi about ambient (14.7 psia). As a result, quantitative surface-pressure determination

in this environment remained contingent on the development of innovative pressure-sensitive paint (PSP)-coating and optical-measurement technology possessing the requisite sensitivity characteristics. The technical effort encompasses three primary objectives-the development of advanced PSP systems, data-acquisition instrumentation and measurement techniques, and post-processing software. In the Phase I effort, we have coupled the tools of sol-gel-processing technology and inorganic synthetic chemistry for the development of stable PSP's exhibiting tunable performance characteristics. Phase I research has produced sol-gel-based PSP's exhibiting significant improvements in sensitivity about ambient pressure, reduced temperature sensitivity (80%), and fast (>1 kHz) temporal response. Non-intrusive, optical-based measurement techniques capable of accurate pressure measurements in low-speed wind tunnels will find immediate application in commercial- and military-aircraft, automotive, and architectural industries in the USA.
DTIC
Pressure Measurement; Optical Measurement; Nonintrusive Measurement; Inorganic Chemistry; Data Acquisition; Commercial Aircraft; Aerodynamics

19990053472 Dayton Univ., Structural Integrity Div., OH USA
An Evaluation of Methods to Separate Maneuver and Gust Load Factors From Measured Acceleration Time Histories ***Final Report***
Rustenburg, John W., Dayton Univ., USA; Skinn, Donald, Dayton Univ., USA; Tipps, Daniel O., Dayton Univ., USA; Apr. 1999; 34p; In English
Contract(s)/Grant(s): RTOP 437-25-14
Report No.(s): AD-A363333; URD-TM-1998-00011; DOT/FAA/AR-99/14; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The University of Dayton is supporting Federal Aviation Administration (FAA) research on the structural integrity requirements for the U.S. commercial transport airplane fleet. The primary objective of this research is to support the FAA Airborne Data Monitoring Systems program by developing new and improved methods and criteria for processing and presenting large commercial transport airplane flight and ground loads usage data. The accelerations recorded in flight result from maneuver inputs initiated by the pilot and atmospheric turbulence. to determine the gust and maneuver load factor spectra from the recorded flight loads data, it is necessary to separate the gust and maneuver load factors. Various means to separate the accelerations due to pilot maneuvers and turbulence from measured acceleration time histories have been used. This report presents the results of a study to evaluate the validity and operational processing efficiency of three different methods for the separation of maneuvers and gusts from measured acceleration data obtained from Optical Quick Access Recorder (OQAR)-equipped commercial aircraft. Conclusions and recommendations for the use of a maneuver-gust separation method are also provided.
DTIC
Gust Loads; Flight Operations; Aircraft Maintenance; Operational Problems; Airline Operations; Structural Design Criteria; Design Analysis

19990053497 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA
Innovative Control Effectors (Configuration 101) Dynamic Wind Tunnel Test Report. Rotary Balance and Forced Oscillation Tests ***Final Report, 11 Mar. - 24 Apr. 1998***
Gillard, William J.; Jul. 1998; 205p; In English
Contract(s)/Grant(s): Proj-2403
Report No.(s): AD-A362903; AFRL-VA-WP-TR-1998-3043; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
This report describes the technical effort investigating the dynamic characteristics of the Innovative Control Effectors Configuration 101 tailless aircraft concept. A series of static, rotary balance, and forced oscillation tests were conducted to acquire more information on the aerodynamic properties associated with this 65 degree, delta wing concept. Results show the vehicle to be well damped in pitch and roll motions and neutrally damped in yaw motions. Significant oscillating frequency effects were identified during forced oscillation testing with the impact most notable in the 15 is less than AOA is less than 45 degree region.
DTIC
Wind Tunnel Tests; Tailless Aircraft; Rotary Stability; Oscillations; Dynamic Characteristics; Aircraft Design

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.

19990052747 Federal Aviation Administration, Washington, DC USA
Notices to Airmen, Domestic/International, April 22, 1999
Apr. 22, 1999; 244p; In English
Report No.(s): PB99-147373; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche
Contents include the following: Airway Notams; Airports, Facilities, and Procedural Notams; General FDC Notams; Part 94 Revisions to Minimum En Route IFR Altitudes and Changeover Points; International Notices to Airmen; and Graphic Notices.
NTIS
National Airspace System; National Airspace Utilization System; Air Traffic Control; Air Navigation; Navigation Aids; Flight Paths

19990052842 Federal Aviation Administration, Fire Safety Section, Atlantic City, NJ USA
Effectiveness of Flight Attendants Attempting to Extinguish Fires in an Accessible Cargo Compartment
Blake, D.; Apr. 1999; 18p; In English
Report No.(s): PB99-150096; DOT/FAA/AR-TN99/29; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This technical note documents the results of a project to evaluate the ability of flight attendants to extinguish cargo fires in small Class B cargo compartments. Thirteen fire tests were conducted in a modified Shorts 330 airplane in which flight attendants attempted to extinguish cargo fires. Some of the selected test variables included the cargo compartment size, the width of the access door, the size and type of fire extinguishers available, the presence and absence of an unobstructed center aisle in the cargo compartment, the type of Protective Breathing Equipment (PBE), and the delay between the smoke detector alarm and the start of the firefighting efforts. The results of the testing indicated that in most cases the flight attendants were unable to successfully extinguish these fires.
NTIS
Flight Crews; Fire Extinguishers; Crew Procedures (Inflight); Fire Fighting; Fire Prevention

19990052846 National Transportation Safety Board, Washington, DC USA
Annual Review of Aircraft Accident Data: U.S. General Aviation, Calendar Year 1995
Sep. 1998; 76p; In English
Report No.(s): PB98-172463; NTSB/ARG-98/01; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
A total of 2,078 U.S. registered general aviation aircraft were involved in 2,054 accidents during calendar year 1995. of these 2,054 accidents, 411 accidents (involving 419 aircraft) resulted in fatal injuries. This report presents a statistical review of these accidents, all involving U.S. registered aircraft that were not conducting air carrier revenue operations under Title 14 Code of Federal Regulations (14 CFR) Part 121 or 135. The accident data on which this review is based were extracted from the Safety Board's automated Aviation Accident Data System.
NTIS
Aircraft Accidents; General Aviation Aircraft; Data Systems; Air Transportation

19990052847 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Safety Recommendations Adopted during the Month of March, 1999
Mar. 1999; 16p
Report No.(s): PB99-916603; NTSB/REC-99/03; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This publication contains safety recommendations in aviation (only) mode of transportation adopted by the National Transportation Safety Board during the month of March, 1999.
NTIS
Safety; Accident Prevention; Safety Management

19990052850 Civil Aeromedical Inst., Oklahoma City, OK USA
The Role of Shift Work and Fatigue in Air Traffic Control Operational Errors and Incidents
DellaRocco, P. S.; SPIE; Jan. 1999; Volume 3334, pp. 470-479; In English
Contract(s)/Grant(s): F19628-95-C-0002

Report No.(s): AD-A360731; MS-12899; DOT/FAA/AM-99/2; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

This report was developed from a collaborative effort between the FAA Civil Aeromedical Institute's (CAMI's) Shift Work and Fatigue Research Program and the National Aeronautics and Space Administration (NASA) Ames Research Center's Fatigue Countermeasures Program. The purpose of this report was to examine existing databases to assess the extent to which shift work and fatigue might be factors associated with incidents and errors in air traffic control (ATC) operations.

DTIC

Air Traffic Control; Air Traffic Controllers (Personnel); Fatigue (Biology); Errors; Aerospace Medicine

19990052944 LB and M Associates, Inc., Oklahoma City, OK USA

Analysis of Ditching and Water Survival Training Programs of Major Airframe Manufacturers and Airlines ***Final Report***

Cosper, D. K.; McLean, G. A.; Jul. 1998; 40p; In English

Report No.(s): PB99-146839; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Current transport category aircrew training programs related to ditching and water survival are reviewed for content and attention to detail. This activity resulted from industry and regulatory inquiries about the state-of-the-art in ditching and water survival operations, especially with regard to the increasing number of aircraft operations, and associated opportunities for emergency water landing events, that the future will bring. The information on water landing events was gathered from published reports related to these issues.

NTIS

Flight Crews; Water Landing; Ditching (Landing); Evacuating (Transportation)

19990052977 Civil Aeromedical Inst., Oklahoma City, OK USA

Comparison of Buckle Release Timing for Push-Button and Lift-Latch Belt Buckles

Gowdy, V.; George, M.; McLean, G. A.; Feb. 1999; 11p; In English

Report No.(s): AD-A360725; DOT/FAA/AM-99/5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Small aircraft passenger restraint systems most commonly use lift-latch type buckle release mechanisms. Push-button buckle release mechanisms, similar to those used in contemporary automobiles, have rarely been used on passenger restraints. Although push-button buckles are not explicitly prohibited by Federal Aviation Administration (FAA) regulations, the human factors aspects of introducing push-button buckles in an aircraft environment are important considerations from the standpoint of safety. A test program was conducted by the FAA Civil Aeromedical Institute (CAMI) with volunteer human subjects to measure and compare the times it takes a passenger to release a push-button buckle on a 3-point restraint, a common lift-latch buckle on a 3-point restraint, and a lift-latch buckle on a common lap belt. Sixty subjects were tested in a repeated-measures counterbalanced test protocol, which included instrumentation to measure the response times to release the buckle. Response time for the subjects to exit the seat and press a remote button was also acquired. This report includes the physical profiles of the subjects, the test protocol, and a statistical summary of the results. Based on the data acquired in this project, there was no major difference in the response times of the human subjects to release or egress from a 3-point restraint with a push-button buckle, compared with a lift-latch buckle on a 3- point or a common lap belt restraint. This study was intended to address factors associated with the use of push-button buckles restraint systems in small airplanes. Any consideration of the use of push-button buckles on commercial transport aircraft passenger seats should include data on a broader range of human factors.

DTIC

Seat Belts; Transport Aircraft; Mechanical Devices

19990053243 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Bird Strike Risk Assessment for USA Air Force Airfields and Aircraft

Tedrow, Christine A.; Apr. 21, 1999; 165p; In English

Report No.(s): AD-A363170; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Analysis of strike data is critical to determine the true economic costs of bird strikes, determine the magnitude of safety issues, and develop preventive measures. Analysis of USAF bird-strike data identified trends and indicated suggested relationships among factors contributing to damaging strikes. From FY 1988 through FY 1997, the annual mean was 2,668 bird strikes with peaks evident in fall and spring. Daylight and dusk were hazardous for bird strikes. More bird strikes occurred during airfield operations - aircraft are at low altitudes and soaring birds are more numerous. Aircraft speed, phase of flight, taxonomic group, bird mass and aircraft group were the strongest predictors of damaging bird strikes. Bird strike rates were calculated for USAF aircraft and selected USAF airfields. Bomber aircraft had the highest strike rate; these aircraft frequently fly long missions at low altitudes where they are likely to encounter birds. Logistic regression analyses estimated odds of occurrence for damaging bird

strikes during airfield operations General statistics, odds for a damaging airfield strike, and airfield strike rates, were used to identify USAF airfields with higher bird strike risks. Howard AFB, Panama, had a higher number and rate of bird strikes, and greater odds for a damaging bird strike than other airfields analyzed.
DTIC
Bird-Aircraft Collisions; Predictions; Costs; Airspeed; Regression Analysis

19990053303 Electro Magnetic Applications, Inc., Denver, CO USA
Statistical Study of the Closest Approach of Aircraft to Ground-Based Emitters: Results for Seattle and Comparison with Denver *Final Report*
Elliott, James R., Electro Magnetic Applications, Inc., USA; Perala, Rodney A., Electro Magnetic Applications, Inc., USA; Mar. 1999; 46p; In English
Contract(s)/Grant(s): DTFA03-97-P-00158
Report No.(s): AD-A363147; EMA-97-R-011; DOT/FAA/AR-99/5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A Technical Program was initiated by the Federal Aviation Administration (FAA) William J. Hughes Technical Center to measure the distances that aircraft fly within high-intensity radiation emitters. This program was launched as the FAA and the High-Intensity Radiated Fields (HIRF) advisory committees were defining HIRF regulatory rulemaking requirements. This study was a follow-on of the work conducted at the Denver International Airport to determine the actual distances that aircraft flew within emitters. This study focused on a similar effort at Seattle International Airport. This program presented the data gathered from the Seattle Airport along with a detailed comparison of the data between the two airports. Any observable patterns and similarities between the two airports were recorded. Information on emitter location, frequency, power, etc., was obtained from the Government Master File. Aircraft flight information was obtained from the System Analysis Recordings (SAR) tapes at the Seattle En Route Center. This program was used in conjunction with a research effort which located all high-powered emitters in the U.S. and Europe and established the actual HIRF environment.
DTIC
Electromagnetic Shielding; Radiation Shielding; Aircraft Safety; Flight Safety; Air Traffic Control; Beacon Collision Avoidance System

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.

19990052721 Norwegian Defence Research Establishment, Kjeller, Norway
Evaluation of GPS Attitude Determining System *Evaluering av Retningsbestemmende GPS*
Dyva, Ronnie Roger, Norwegian Defence Research Establishment, Norway; Dec. 14, 1998; 19p; In Norwegian; Original contains color illustrations
Contract(s)/Grant(s): FFIE Proj. 69702/134
Report No.(s): FFI/Rapport-98/06383; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document discusses availability of attitude information from a Global Positioning System (GPS) Attitude Determining System (ADS) receiver. The intention was to find out what influence different types of terrain had on availability of heading information.
Author
Attitude (Inclination); Global Positioning System

19990053474 Civil Aeromedical Inst., Civil Aeromedical Inst., Oklahoma City, OK USA
GPS User-Interface Design Problems *Final Report*
Williams, Kevin W., Civil Aeromedical Inst., USA; Apr. 1999; 11p; In English
Report No.(s): AD-A363331; DOT/FAA/AM-99/13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper is a review of human factors problems associated with the user-interface design of a set of Global Positioning System (GPS) receivers, certified for use in aircraft for instrument non-precision approaches. The paper focuses on design problems associated with the interfaces and specific inconsistencies across the set of interfaces that could cause confusion or errors during

operation. Some specific problems addressed involve the layout and design of knobs and buttons; control labeling inconsistencies across units; the placement and use of warnings; feedback, or the lack thereof; and the integration of specific flying tasks while using the receivers. Recommendations for solving some of the problems are provided, as well as suggestions to the FAA, GPS manufacturers, and pilots regarding the future development and use of these products.
DTIC
Global Positioning System; Design Analysis

19990053485 Smiths Industries Aerospace and Defense Systems, Inc., Grand Rapids Div., Grand Rapids, MI USA
Navy AV-8B Crash Survivable Flight Incident Recorder (CSFIR)
May 03, 1999; 33p; In English
Contract(s)/Grant(s): N00019-98-F-0016; GS-24F-3027G
Report No.(s): AD-A363122; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Navy AV-8B Crash Survivable Flight Incident Recorder (CSFIR) meeting minutes of the program on April 28, 1999 are presented.
DTIC
Flight Recorders; Crashes; Harrier Aircraft

19990053486 Smiths Industries Aerospace and Defense Systems, Inc., Grand Rapids Div., Grand Rapids, MI USA
Navy F/A-18 Crash Survivable Flight Incident Recorder (CSFIR)
May 06, 1999; 26p; In English
Contract(s)/Grant(s): N00019-99-F-0680; GS-24F-3027G
Report No.(s): AD-A363120; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
On 28 April, 1999 representatives from the Navy, Boeing and Smiths Industries (SI) met at the Naval Air Weapons Development Center, China Lake, CA for a Coordination I Kick Off Meeting in support of the F/A- 18 Crash Survivable Flight Incident Recorder System (CSFIR) integration program. Smiths Industries is enhancing the software currently under development for its Voice and Data Recorder (VADR) under this contract. This enhancement will allow the uploading of software updates and version verifications of the F/A-18 flight software via a MIL-STD-1553 multiplex data bus. This will be accomplished using the Memory Loader I Verifier Set (MLVS).
DTIC
Attack Aircraft; Flight Recorders; Weapons Development; Channels (Data Transmission); Data Recorders; Applications Programs (Computers)

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.

19990050915 La Sapienza Univ., Dipt. Aerospaziale, Rome, Italy
Aeroelastic Contraints in MDO
Mastroddi, F., La Sapienza Univ., Italy; Ciancaleoni, E., La Sapienza Univ., Italy; Morino, L., Rome III Univ., Italy; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 33-42; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche
A Multidisciplinary Design Optimization (MDO) study for a transport configuration with emphasis on the integrated aerodynamic and structural design of the wing is presented. The novelty is in the use of aeroelastic constraints for flutter as well as gust response (both deterministic and stochastic).
Author
Aeroelasticity; Dynamic Response; Multidisciplinary Design Optimization; Structural Design; Wing Planforms

19990050924 Rome III Univ., Dept. of Mechanical and Industrial Engineering, Rome, Italy
Analysis of Fuselage Vibrations Induced by the Proprotor in a Tiltrotor Aircraft
Gennaretti, M., Rome III Univ., Italy; Iemma, U., Rome III Univ., Italy; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 139-148; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The aim of the present paper is the analysis of the aerodynamically induced fuselage vibrations for proprotor-fuselage configurations which are of interest in tiltrotor aircraft. As widely known, the development of technology concerning tiltrotor aircraft is of primary interest in modern aeronautical research. This type of vehicle combines advantageous takeoff and landing procedures (similar to those needed by helicopters), with cruise performances that are analogous to those of currently used propeller-driven airplanes. Noting such flexibility in flight operations, it may be anticipated a large impact of this kind of aircraft on the aeronautical transport field in the near future. Here, we consider different proprotor-fuselage configurations which include those related to vertical takeoff and landing (horizontal proprotor disk), and cruise conditions (vertical proprotor disk). In the fuselage vibration analysis, the elastic displacements are expressed in terms of series expansions on a complete set of orthogonal functions. The forcing terms in the structural dynamics equations, which depend on the exterior pressure field, are obtained from the analysis of the interactional aerodynamics of the fuselage-proprotor system. This will be accomplished by a boundary element method for compressible potential flows, based on a boundary integral equation for the velocity potential. The application of the Bernoulli theorem yields the pressure distribution and hence the aerodynamic loads acting on the fuselage. The formulation presented has been applied to a simple, but realistic, fuselage configuration. Numerical results are presented for external pressure fields generated by a proprotor in three different flight conditions, corresponding to the takeoff and landing phase (horizontal rotor disk), cruise (vertical rotor disk), and the conversion phase (45 degrees angle between the rotor axis and the fuselage axis). In order to validate the methodology on a simple test case, the results obtained for an external pulsating point source are also included.
Author
Interactional Aerodynamics; Fuselages; Forced Vibration; Aircraft Configurations; Orthogonal Functions; Rotor Aerodynamics; Tilt Rotor Aircraft; Mathematical Models; Dynamic Structural Analysis; Propellers; Rotors

19990050947 Boeing Co., Stability, Control and Flying Qualities, Long Beach, CA USA
An Application of the P-Transform Method for Transient Maneuvering Analysis
Dykman, John R., Boeing Co., USA; Rodden, William P., Rodden (William P.), USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 425-432; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The P-Transform method provides an alternative to the Rational Function Approximation (RFA) methods for representing oscillatory aerodynamics in the time domain. It is based on the flutter eigenvalues and eigenvectors obtained for each mode at a given velocity from a PK-flutter analysis. As such it avoids the curve fitting errors of the RFA and assures exact agreement with flutter predictions. Furthermore, it makes no assumptions regarding the transient aerodynamic lagging mechanism and is therefore equally valid at subsonic and supersonic speeds. An application is presented to a forward-swept wing aircraft configuration that has been the subject of earlier maneuvering studies by quasisteady methods. The differences between the responses using quasisteady aerodynamic loads and general unsteady loads are illustrated in this example.
Author
Flutter Analysis; Aeroelasticity; Prediction Analysis Techniques; Transient Response; Unsteady Aerodynamics; Aerodynamic Loads

19990051022 California Univ., Dept. of Mechanical and Aeronautical Engineering, Davis, CA USA
Airfoil Design Using a Coupled Euler and Integral Boundary Layer Method with Adjoint Based Sensitivities
Edwards, S., California Univ., USA; Reuther, J., California Univ., USA; Chattot, J. J., California Univ., USA; [1997]; In English
Contract(s)/Grant(s): NCC2-5201; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The objective of this paper is to present a control theory approach for the design of airfoils in the presence of viscous compressible flows. A coupled system of the integral boundary layer and the Euler equations is solved to provide rapid flow simulations. An adjunct approach consistent with the complete coupled state equations is employed to obtain the sensitivities needed to drive a numerical optimization algorithm. Design to target pressure distribution is demonstrated on an RAE 2822 airfoil at transonic speed.
Author
Airfoils; Equations of State; Boundary Layers; Control Theory; Pressure Distribution; Viscous Flow

19990051024 Washington Univ., Dept. of Aeronautics and Astronautics, Seattle, WA USA
Equivalent Plate Structural Modeling for Wing Shape Optimization Including Transverse Shear
Livne, Eli, Washington Univ., USA; AIAA Journal; June 1994; Volume 32, No. 6, pp. 1278-1288; In English
Contract(s)/Grant(s): NAG2-723; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A new technique for structural modeling of airplane wings is presented taking transverse shear effects into account. The kinematic assumptions of first-order shear deformation plate theory In combination with numerical analysis, where simple polyno-

mials are used to define geometry, construction, and displacement approximations, lead to analytical expressions for elements of the stiffness and mass matrices and load vector. Contributions from the cover skins, spar and rib caps, and spar and rib webs are included as well as concentrated springs and concentrated masses. Limitations of wing modeling techniques based on classical plate theory are discussed, and the Improved accuracy of the new equivalent plate technique is demonstrated through comparison with finite element analysis and test results. Expressions for analytical derivatives of stiffness, mass, and load terms with respect to wing shape are given. Based on these, it is possible to obtain analytic sensitivities of displacements, stresses, and natural frequencies with respect to planform shape and depth distribution. This makes the new capability an effective structural tool for wing shape optimization.
Author
Shear Stress; Transverse Loads; Wings; Finite Element Method; Loads (Forces); Numerical Analysis; Deformation; Kinematics

19990051025 Washington Univ., Dept. of Aeronautics and Astronautics, Seattle, WA USA
Analytic Sensitivities for Shape Optimization in Equivalent Plate Structural Wing Models
Livne, Eli, Washington Univ., USA; Journal of Aircraft; August 1994; Volume 31, No. 4, pp. 961-969; In English
Contract(s)/Grant(s): NAG2-723; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Equivalent plate modeling techniques based on Ritz analysis with simple polynomials prove to be efficient tools for structural modeling of wings in the preliminary design stage. Accuracy problems are encountered, however, when these models are used to obtain finite difference behavior sensitivities with respect to planform shape. The accuracy problems are associated with the poor numerical conditioning of static and eigenvalue equations. As higher-order polynomials are being used to Improve the analysis itself, the more sensitive is the finite difference derivative to the step size used. This article describes a formulation of wing equivalent plate modeling in which it is simple to obtain analytic, explicit expressions for stiffness and mass matrix elements without the need to perform numerical integration. This formulation leads naturally to analytic expressions for the derivatives of displacements, stresses, and natural frequencies with respect to shape design variables. This article examines the accuracy of finite difference derivatives compared with the analytic derivatives, and shows that In some cases it is impossible to obtain any information of value by finite differences. Analytic sensitivities, in this case, are still sufficiently accurate for design optimization.
Author
Design Analysis; Numerical Integration; Stiffness Matrix; Finite Difference Theory; Optimization; Planforms; Shapes

19990052602 Mississippi State Univ., Computational Fluid Dynamics Lab., Mississippi State, MS USA
Aerodynamics and Maneuvering of Tiltrotor Aircraft *Final Report*
Whitfield, David L., Mississippi State Univ., USA; Briley, W. Roger, Mississippi State Univ., USA; 1999; In English
Contract(s)/Grant(s): NAG2-114; Copyright; Avail: Issuing Activity (Mississippi State Univ., P.O. Box 9627, Mississippi State, MS 39762-9627), Hardcopy, Microfiche

A physics based capability is being developed for flow simulations and maneuvering predictions for tiltrotor aircraft, including treatments of the rotors both as actual rotating blades and as body force (actuator disk) models. Simulations of relevance to tiltrotor aircraft include isolated rotors, quasisteady airframes with actuator disk rotors, and full configurations with rotating blades. Flow regimes of interest include hover, cruise and transition or conversion conditions. Body force models of rotors that include radial distributions of thrust and torque have significant advantages in reducing grid size, grid complexity and runtimes, and in excluding high Mach number tip regions. A time step that is larger than that needed to resolve detailed unsteady rotor physics can be used, and hence fewer time steps are required. However, this model does not adequately predict details of unsteady rotor flows such as blade/vortex and rotor wake/airframe interactions of interest during transition, and for noise reduction. This type of flow problem can introduce variable Mach number effects due to large regions of low velocity flow during hover, and possible transonic rotor tip effects (flutter, increased drag, and aerodynamic interference) during high speed cruise. Accordingly, there is a need for variable Mach number algorithms and simulations, and this capability is also being developed and applied in this study. Icing effects on both airframe and rotor are also of interest in connection with maneuverability and stability. Simulations for isolated rotors and airframe/disk/rotor combinations are all of interest. This study will explore influences of icing by including existing icing models in flow simulations, through collaboration with Tennessee State University.
Derived from text
Tilt Rotor Aircraft; Aerodynamic Characteristics; Maneuverability; Unsteady Flow; Hovering

19990052617 Arizona State Univ., Tempe, AZ USA

Multidisciplinary Optimization of Tilt Rotor Blades Using Comprehensive Composite Modeling Technique

Chattopadhyay, Aditi, Arizona State Univ., USA; McCarthy, Thomas R., Arizona State Univ., USA; Rajadas, John N., Arizona State Univ., USA; 1997; In English, 29 Apr. - 1 May 1997, Virginia Beach, VA, USA; Sponsored by American Helicopter Society, Inc., USA

Contract(s)/Grant(s): NAG2-1046; NAG2-771; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An optimization procedure is developed for addressing the design of composite tilt rotor blades. A comprehensive technique, based on a higher-order laminate theory, is developed for the analysis of the thick composite load-carrying sections, modeled as box beams, in the blade. The theory, which is based on a refined displacement field, is a three-dimensional model which approximates the elasticity solution so that the beam cross-sectional properties are not reduced to one-dimensional beam parameters. Both inplane and out-of-plane warping are included automatically in the formulation. The model can accurately capture the transverse shear stresses through the thickness of each wall while satisfying stress free boundary conditions on the inner and outer surfaces of the beam. The aerodynamic loads on the blade are calculated using the classical blade element momentum theory. Analytical expressions for the lift and drag are obtained based on the blade planform with corrections for the high lift capability of rotor blades. The aerodynamic analysis is coupled with the structural model to formulate the complete coupled equations of motion for aeroelastic analyses. Finally, a multidisciplinary optimization procedure is developed to improve the aerodynamic, structural and aeroelastic performance of the tilt rotor aircraft. The objective functions include the figure of merit in hover and the high speed cruise propulsive efficiency. Structural, aerodynamic and aeroelastic stability criteria are imposed as constraints on the problem. The Kreisselmeier-Steinhauser function is used to formulate the multiobjective function problem. The search direction is determined by the Broyden-Fletcher-Goldfarb-Shanno algorithm. The optimum results are compared with the baseline values and show significant improvements in the overall performance of the tilt rotor blade.

Author

Rotor Blades (Turbomachinery); Algorithms; Design Analysis; Equations of Motion; Three Dimensional Models; Tilt Rotor Aircraft

19990052618 Washington Univ., Dept. of Aeronautics and Astronautics, Seattle, WA USA

Automated Finite Element Modeling of Wing Structures for Shape Optimization

Harvey, Michael Stephen, Washington Univ., USA; Nov. 12, 1993; 183p; In English

Contract(s)/Grant(s): NAG2-723; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The displacement formulation of the finite element method is the most general and most widely used technique for structural analysis of airplane configurations. Modem structural synthesis techniques based on the finite element method have reached a certain maturity in recent years, and large airplane structures can now be optimized with respect to sizing type design variables for many load cases subject to a rich variety of constraints including stress, buckling, frequency, stiffness and aeroelastic constraints (Refs. 1-3). These structural synthesis capabilities use gradient based nonlinear programming techniques to search for improved designs. For these techniques to be practical a major improvement was required in computational cost of finite element analyses (needed repeatedly in the optimization process). Thus, associated with the progress in structural optimization, a new perspective of structural analysis has emerged, namely, structural analysis specialized for design optimization application, or.what is known as ”design oriented structural analysis” (Ref. 4). This discipline includes approximation concepts and methods for obtaining behavior sensitivity information (Ref. 1), all needed to make the optimization of large structural systems (modeled by thousands of degrees of freedom and thousands of design variables) practical and cost effective.

Derived from text

Finite Element Method; Structural Analysis; Aircraft Structures; Aeroelasticity; Cost Effectiveness; Optimization; Stiffness; Design Analysis

19990052681 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA

Characterizing the Effects of Geometrical Nonlinearities on Aeroelastic Behavior of High-Aspect-Ratio Wings

Patil, Mayuresh J., Georgia Inst. of Tech., USA; Hodges, Dewey H., Georgia Inst. of Tech., USA; Cesnik, Carlos E. S., Massachusetts Inst. of Tech., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 501-510; In English; See also 19990052675

Contract(s)/Grant(s): F49620-98-1-0032; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper presents the results of nonlinear aeroelastic analysis of a representative large-aspect-ratio wing. The effects of steady-state lift and drag are characterized and quantified. Certain simplifications for obtaining nonlinear results are given and a way of avoiding deleterious nonlinear effects is presented.
Author
Nonlinearity; Aeroelasticity; High Aspect Ratio; Mathematical Models; Dynamic Response; Dynamic Structural Analysis; Slender Wings

19990052682 Northrop Grumman Corp., Integrated Systems and Aerostructures, Pico Rivera, CA USA
Simulation of Non-Linear Transonic Aeroelastic Behavior on the B-2
Dreim, D. R., Northrop Grumman Corp., USA; Jacobson, S. B., Northrop Grumman Corp., USA; Britt, R. T., Northrop Grumman Corp., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 511-522; In English; See also 19990052675
Contract(s)/Grant(s): NAS1-19347; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

At high subsonic flight speeds, large flexible aircraft begin to encounter unsteady airloads which are not predicted by most currently available aerodynamic analysis and design methods. With increasing speed and the development of transonic flow and shocks, viscous effects quickly become very important, and flow separation can occur. The Northrop Grumman USAF B-2 Bomber encountered a nonlinear aeroelastic Residual Pitch Oscillation (RPO) under these conditions. Simulation studies were performed with the Computational Aeroelasticity Program-Transonic Small Disturbance, Viscous (CAPTSDv) computer program to evaluate its ability to predict these nonlinear aeroelastic responses. Open and closed loop simulations were performed to assess the participation of the flight control system. Control, system actuator hysteresis characteristics were modeled and found to be a significant participant in the RPO phenomenon. Simulations were also performed for varying Mach numbers and altitudes to establish the stability boundaries and compare with flight test data. These CAPTSDv simulations compared well with flight data and revealed many potential further modeling enhancements.
Author
Aeroelasticity; Nonlinearity; Subsonic Speed; Wing Oscillations; Unsteady Aerodynamics; Applications Programs (Computers); Viscous Flow; B-2 Aircraft

19990052694 NASA Langley Research Center, Hampton, VA USA
An Overview of Landing Gear Dynamics
Pritchard, Jocelyn, NASA Langley Research Center, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 649-664; In English; See also 19990052675; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

One of the problems facing the aircraft community is landing gear dynamics, especially shimmy and brake-induced vibration. Although neither shimmy nor brake-induced vibrations are usually catastrophic, they can lead to accidents due to excessive wear and shortened life of gear parts and contribute to pilot and passenger discomfort. Recently, NASA has initiated an effort to increase the safety of air travel by reducing the number of accidents by a factor of five in ten years. This safety initiative has spurred an increased interest in improving landing gear design to minimize shimmy and brake-induced vibration that are still largely misunderstood phenomena. In order to increase the understanding of these problems, a literature survey was performed. The major focus of the paper is to summarize work documented from the last ten years to highlight the latest efforts in solving these vibration problems. Older publications are included to understand the longevity of the problem and the findings from earlier researchers. The literature survey revealed a variety of analyses, testing, modeling, and simulation of aircraft landing gear. Experimental validation and characterization of shimmy and brake-induced vibration of aircraft landing gear are also reported. This paper presents an overview of the problem documented in the references together with a history of landing gear dynamic problems and solutions. Based on the assessment of this survey, recommendations of the most critically needed enhancements to the state of the art are given.
Author
Structural Vibration; Landing Gear; Aircraft Landing; Wheel Brakes; Aircraft Brakes; Aircraft Safety; General Overviews

19990052695 NASA Langley Research Center, Hampton, VA USA
Actively Controlled Landing Gear for Aircraft Vibration Reduction
Horta, Lucas G., NASA Langley Research Center, USA; Daugherty, Robert H., NASA Langley Research Center, USA; Martinson, Veloria J., NASA Langley Research Center, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 665-678; In English; See also 19990052675; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Concepts for long-range air travel are characterized by airframe designs with long, slender, relatively flexible fuselages. One aspect often overlooked is ground induced vibration of these aircraft. This paper presents an analytical and experimental study of reducing ground-induced aircraft vibration loads using actively controlled landing gears. A facility has been developed to test various active landing gear control concepts and their performance. The facility uses a NAVY A6-intruder landing gear fitted with an auxiliary hydraulic supply electronically controlled by servo valves. An analytical model of the gear is presented including modifications to actuate the gear externally and test data is used to validate the model. The control design is described and closed-loop test and analysis comparisons are presented.
Author
Active Control; Feedback Control; Landing Gear; Mathematical Models; Vibration Damping; Equations of Motion; Control Systems Design

19990052697 Kyushu Univ., Dept. of Aeronautics and Astronautics, Fukuoka, Japan
Application of Direct Search Method to Aeroelastic Tailoring of an Arrow Wing Configuration
Isogai, Koji, Kyushu Univ., Japan; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 691-698; In English; See also 19990052675; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A computer code for aeroelastic tailoring of an arrow wing supersonic cruise configuration is developed. A direct search method is employed to find the optimum fiber orientation angles and thickness distributions of the upper and lower skin panels of the wing box for the minimum weight design under multiple constraints. The static strength symmetric and antisymmetric flutter velocities are taken into account at the same time as the thickness constraints. The code is applied to a typical arrow wing configuration to demonstrate its capabilities.
Author
Aeroelasticity; Arrow Wings; Aerodynamic Configurations; Applications Programs (Computers); Optimization; Design Analysis; Supersonic Airfoils

19990052699 DaimlerChrysler Aerospace Airbus G.m.b.H., Hamburg, Germany
Influence of Aeroelastic Tailoring in the Multidisciplinary Design of a New Aircraft
Kelm, Roland, DaimlerChrysler Aerospace Airbus G.m.b.H., Germany; Dugas, Michael, Technische Hochschule, Germany; Voit-Nitschmann, Rudolf, Technische Hochschule, Germany; Grabietz, Michael, Ingenieurbuero Michael Grabietz, Germany; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 709-718; In English; See also 19990052675; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper discusses ways of determining the effects of aeroelastic tailoring in the predevelopment phase of wings. At DaimlerChrysler Aerospace Airbus, the program system FAME (Fast and Advanced Multidisciplinary Engineering) has been developed. The part FAME-w deals with the mass prognosis of wings. In order to achieve reliable data within a short period of time, it is imperative to take into account the elastic properties of the structure for the determination of the aerodynamic loads and for the preliminary dimensioning. Only by regarding these effects, the FAME-w program has been successful in providing reliable prognoses of wing mass and, of course, of the occurring loads and deformation. This report describes the extensions carried out so far which make it possible to investigate the effects and possibilities of composite wings, as well, using FAME-w.
Author
Aeroelasticity; Multidisciplinary Design Optimization; Wings; Applications Programs (Computers); Aerodynamic Loads; Aircraft Design

19990052704 California Univ., Mechanical and Aerospace Engineering Dept., Los Angeles, CA USA
Aeroelastic Analysis of a Trimmed Generic Hypersonic Vehicle
Nydick, I., California Univ., USA; Friedmann, P. P., California Univ., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 777-809; In English; See also 19990052675
Contract(s)/Grant(s): NCC2-374; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The aeroelastic equations of motion governing a hypersonic vehicle in free flight are derived. The equations of motion for a translating and rotating flexible body using Lagrange's equations in terms of quasi-coordinates are presented. These equations are simplified for the case of a vehicle with pitch and plunge rigid body degrees of freedom and small elastic displacements. The displacements are approximated by a truncated series of the unrestrained mode shapes, which are obtained using equivalent plate theory. Subsequently, the nonlinear equations of motion are linearized about the trim state, which is obtained using a rigid body

trim model and steady hypersonic aerodynamics. The appropriate flutter derivatives are calculated from piston theory. Results describing mode shapes, trim behavior, and aeroelastic stability of a generic hypersonic vehicle are presented.
Author
Aerodynamic Stability; Aeroelasticity; Equations of Motion; Hypersonic Vehicles; Flexible Spacecraft; Aerodynamic Balance; Hypersonics; Flutter

19990052727 Washington Univ., Seattle, WA USA
Conceptual Design Oriented Wing Structural Analysis and Optimization
Lau, May Yuen, Washington Univ., USA; Dec. 11, 1996; 80p; In English
Contract(s)/Grant(s): NAG2-723; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Airplane optimization has always been the goal of airplane designers. In the conceptual design phase, a designer's goal could be tradeoffs between maximum structural integrity, minimum aerodynamic drag, or maximum stability and control, many times achieved separately. Bringing all of these factors into an iterative preliminary design procedure was time consuming, tedious, and not always accurate. For example, the final weight estimate would often be based upon statistical data from past airplanes. The new design would be classified based on gross characteristics, such as number of engines, wingspan, etc., to see which airplanes of the past most closely resembled the new design. This procedure works well for conventional airplane designs, but not very well for new innovative designs. With the computing power of today, new methods are emerging for the conceptual design phase of airplanes. Using finite element methods, computational fluid dynamics, and other computer techniques, designers can make very accurate disciplinary-analyses of an airplane design. These tools are computationally intensive, and when used repeatedly, they consume a great deal of computing time. In order to reduce the time required to analyze a design and still bring together all of the disciplines (such as structures, aerodynamics, and controls) into the analysis, simplified design computer analyses are linked together into one computer program. These design codes are very efficient for conceptual design. The work in this thesis is focused on a finite element based conceptual design oriented structural synthesis capability (CDOSS) tailored to be linked into ACSYNT.
Derived from text
Design Analysis; Wing Profiles; Structural Failure; Optimization; Aircraft Design

19990052755 Old Dominion Coll., Dept. of Aerospace Engineering, Norfolk, VA USA
Control Design Strategies to Enhance Long-Term Aircraft Structural Integrity ***Final Report, Period ending 11 Jan. 1999***
Newman, Brett A., Old Dominion Coll., USA; June 1999; 31p; In English
Contract(s)/Grant(s): NCC1-273
Report No.(s): ODURF-181210; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Over the operational lifetime of both military and civil aircraft, structural components are exposed to hundreds of thousands of low-stress repetitive load cycles and less frequent but higher-stress transient loads originating from maneuvering flight and atmospheric gusts. Micro-material imperfections in the structure, such as cracks and debonded laminates, expand and grow in this environment, reducing the structural integrity and shortening the life of the airframe. Extreme costs associated with refurbishment of critical load-bearing structural components in a large fleet, or altogether reinventoring the fleet with newer models, indicate alternative solutions for life extension of the airframe structure are highly desirable. Increased levels of operational safety and reliability are also important factors influencing the desirability of such solutions. One area having significant potential for impacting crack growth/fatigue damage reduction and structural life extension is flight control. to modify the airframe response dynamics arising from command inputs and gust disturbances, feedback loops are routinely applied to vehicles. A dexterous flight control system architecture senses key vehicle motions and generates critical forces/moments at multiple points distributed throughout the airframe to elicit the desired motion characteristics. In principle, these same control loops can be utilized to influence the level of exposure to harmful loads during flight on structural components. Project objectives are to investigate and/or assess the leverage control has on reducing fatigue damage and enhancing long-term structural integrity, without degrading attitude control and trajectory guidance performance levels. In particular, efforts have focused on the effects inner loop control parameters and architectures have on fatigue damage rate. to complete this research, an actively controlled flexible aircraft model and a new state space modeling procedure for crack growth have been utilized. Analysis of the analytical state space model for crack growth revealed the critical mathematical factors, and hence the physical mechanism they represent, that influenced high rates of airframe crack growth. The crack model was then exercised with simple load inputs to uncover and expose key crack growth behavior. to characterize crack growth behavior, both "short-term" laboratory specimen test type inputs and "long-term" operational flight type inputs were considered. Harmonic loading with a single overload revealed typical exponential crack growth behavior until the overload application, after which time the crack growth was retarded for a period of time depending on the overload strength. An optimum overload strength was identified which leads to maximum retardation of crack growth. Harmonic loading with a repeated overload of varying strength and frequency again revealed an optimum overload trait for maximizing growth retardation. The optimum

overload strength ratio lies near the range of 2 to 3 with dependency on frequency. Experimental data was found to correlate well with the analytical predictions.
Derived from text
Aircraft Structures; Structural Design; Prediction Analysis Techniques; Control Systems Design; Active Control; Crack Propagation; Fatigue (Materials); Aircraft Models

19990052759 NASA Lewis Research Center, Cleveland, OH USA
Probabilistic Evaluation of Fuselage-Type Composite Structures
Shiao, Michael C., Sverdrup Technology, Inc., USA; Chamis, Christos C., NASA Lewis Research Center, USA; Probabilistic Engineering Mechanics; 1998; ISSN 0266-8920; Volume 14, pp. 179-187; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A methodology is developed to simulate computationally the uncertain behavior of composite structures. The uncertain behavior includes buckling loads, natural frequencies, displacements, stress/strain, etc., which are the consequences of the random variation (scatter) of the primitive (independent random) variables in the constituent, plv. laminate and structural levels. This methodology is implemented in a computer code integrated probabilistic assessment of composite structures (IPACS). A fuselage-type composite structure is analyzed to demonstrate the code's capability . The probability distribution functions of the buckling loads, natural frequency, displacement, strain and stress are computed. The sensitivity of each primitive (independent random) variable to a given structural response is also identified from the analyses.
Author
Composite Structures; Computer Programs; Fuselages; Probability Distribution Functions; Finite Element Method; Structural Reliability

19990052866 NASA Langley Research Center, Hampton,VA USA
Aircraft and Ground Vehicle Winter Runway Friction Assessment
Yager, Thomas J., NASA Langley Research Center, USA; May 1999; 16p; In English; International Forum on Aeroelasticity and Structural Dynamics, 22-25 Jun. 1999, Williamsburg, VA, USA
Contract(s)/Grant(s): RTOP 522-18-11-04
Report No.(s): NASA/TM-1999-209142; L-17852; NAS 1.15:209142; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Some background information is given together with the scope and objectives of a 5-year, Joint Winter Runway Friction Measurement Program between the National Aeronautics & Space Administration (NASA), Transport Canada (TC), and the Federal Aviation Administration (FAA). The primary objective of this effort is to perform instrumented aircraft and ground vehicle tests aimed at identifying a common number that all the different ground vehicle devices would report. This number, denoted the International Runway Friction Index (IRFI), will be related to all types of aircraft stopping performance. The range of test equipment, the test sites, test results and accomplishments, the extent of the substantial friction database compiled, and future test plans will be described. Several related studies have also been implemented including the effects of contaminant type on aircraft impingement drag, and the effectiveness of various runway and aircraft de-icing chemical types, and application rates.
Author
Friction Measurement; Runway Conditions; Ground Tests; Contaminants; Ground Handling; Airfield Surface Movements

19990052997 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
High Intensity Radiated Field External Environments for Civil Aircraft Operating in the USA of America
Heather, Frederick W.; Dec. 1998; 138p; In English
Report No.(s): AD-A359458; NAWCADPAX-98-156-TM; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

NAWCAD Patuxent River, Maryland, was tasked by the FAA to determine the High Intensity Radiated Field (HIRF) levels for civil aircraft operating in the U.S. The electromagnetic field survey will apply to civil aircraft seeking FAA certification under Federal Aviation Regulations (FAR's) Parts 23, 25, 27, and 29. The HIRF survey determined the Rotorcraft Severe, Fixed Wing Severe, Certification, and Normal Environments that civil aircraft may be exposed to while operating in the continental U.S. and its territories. The HIRF survey was accomplished by accessing EME data bases, technical manuals, and phone contact with emitter operators to determine the HIRF drivers, analyze the severity, and provide a U.S. composite environment. These HIRF environments were subsequently provided to the EEHWG for harmonization with the European HIRF environment. The harmonized

environment is known as the International HIRF environments that are planned to be used in the FAR advisory material and other supporting documents. The International HIRF environments are also shown in this report for completeness.
DTIC
Electromagnetic Fields; Fixed Wings; Rotary Wing Aircraft

19990053144 Pennsylvania State Univ., Dept. of Aerospace Engineering, University Park, PA USA
Recent Development in the Analytical Investigation of Shipboard Rotorcraft Engage and Disengage Operations
Smith, Edward C., Pennsylvania State Univ., USA; Keller, Jonathan A., Pennsylvania State Univ., USA; Kang, Hao, Pennsylvania State Univ., USA; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 1-1 - 1-18; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents an overview of recent developments in an effort to predict transient aeroelastic rotor response during shipboard engage and disengage sequences. The blade is modeled as an elastic beam undergoing in flap, lag, extension and torsion. The blade equations of motion are formulated using Hamilton's principle and they are spatially discretized using the finite element method. The discretized blade equations of motion are integrated for a specified rotor speed run-up or run-down profile. Blade element theory is used to calculate quasi-steady or unsteady aerodynamic loads in linear and nonlinear regimes. The analysis is capable of simulating both articulated, hingeless, and gimballed rotor systems. Validation of the rotor code is discussed, including correlation with droop stop impact tests and wind tunnel experiments. Predictions of safe engagement and disengagement envelopes, limited by excessive blade tip deflections or hub moments, are presented. Future directions of study are also discussed.
Author
Aeroelasticity; Finite Element Method; Equations of Motion; Unsteady Aerodynamics; Transient Response; Rotors

19990053165 Krylov Shipbuilding Research Inst., Saint Petersburg, Russia
Conceptual Bases of WIG Craft Building: Ideas, Reality and Outlooks
Aframeev, E. A., Krylov Shipbuilding Research Inst., Russia; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 22-1 - 22-18; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Wing-in-Ground (WIG) craft (ekranoplans) building has sufficiently long history but till now there is not any established view on their technical appearance and place in the system of transport means. It was assumed that technical and economical characteristics of WIG craft wittingly exceeded those of competitive transport means: aircraft (and hydroaeroplanes) because of the high lift-to-drag ratio value (aerodynamic efficiency). However in reality they don't a priori provide the superiority over the aircraft (hydroaeroplanes). Now it is necessary to revise the conceptual base of WIG craft building. The idea of creation of second generation ekranoplans on the base of a the A-conception, suggested by the author in 1977, assumes that they are created as marine transport means with high ship features when sailing (air transport means, including hydroaeroplanes, doesn't possess such features), i.e. as two-mode vehicles. Realization of this conception puts the ekranoplans out of competition as compare with other classes of engineering in the cases when it is necessary to stay at sea for a long time. At the same time such ekranoplans have the incomparably high level of safety when using for the transportation of passengers and cargo. In the near-term future the sphere of WIG craft application can be significantly expanded and include not only the transportation but such important missions as the creation of global sea rescue system or sea launch of space vehicles. In the more remote future it may be possible to realize the trans-ocean transportation, however this mission requires the creation of superheavy ekranoplans what in turn requires the solution of some complicated technical problems.
Author
Air Transportation; Transport Aircraft; Aerospace Planes; Aerospace Engineering; Aircraft Design; Design Analysis; Ground Effect (Aerodynamics); Ground Effect Machines

19990053167 Joint Stock Co. Agency for Technologies and Transport, Nizhny Novgorod, Russia
The First Commercial Ekranoplan "Amphistar" and Prospects for the Development of Passenger Ekranoplans
Sinitsyn, D. N., Joint Stock Co. Agency for Technologies and Transport, Russia; Maskalik, A. I., Joint Stock Co. Agency for Technologies and Transport, Russia; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 24-1 - 24-18; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The background and evolution of ekranoplan development in Russia is described in the paper. The data are given on the developed ekranoplans including the first civilian ekranoplans "Amphistar". The whole range of marine passenger ekranoplans (MPE)

developed by the Russian ”Technologies and Transport” JSC is shown. The description of the Marine Passenger Ekranoplan MPE-200 is presented together with conclusions concerning prospects for the development of passenger ekranoplans.
Author
Commercial Aircraft; Air Transportation; Aircraft Design; Ground Effect Machines

19990053219 Georgia Inst. of Tech., Atlanta, GA USA
Integrated Diagnostics, *1 Jun. 1998 - 31 May 1999*
Cowan, Richard S.; Winer, Ward O.; May 31, 1999; 192p; In English
Contract(s)/Grant(s): N00014-95-1-0539
Report No.(s): AD-A363343; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This document summarizes activity concerning the performance of basic research being conducted in the area of Integrated Diagnostics, a term associated with the technologies and methodologies used to determine how mechanical failures occur, and how they can be detected, predicted, and diagnosed in real time. Objectives, set forth through a Department of Defense Multidisciplinary Research Program of the University Research Initiative (M-URI), are being addressed by faculty and staff from the Georgia Institute of Technology, Northwestern University, and the University of Minnesota. Fourth year accomplishments and plans are reported upon. During this reporting period, experiments based on material, load, and vibration information from critical rotorcraft components continued so as to collect data of relevance in understanding the mechanisms of small crack growth for use in developing fatigue failure models. Such models serve as a guide in the selection and development of sensors to detect faults and pending failures. Effort has been placed on sensor development, and achieving the means to analyze and correlate reliable sensor output for operator use. Organizationally, this activity is being accomplished through (11) projects, categorized by the thrust areas of (1) Mechanical System Health Monitoring, including microsensor development and the condition monitoring of rotordynamic elements; (2) Nondestructive Examination Technology; and (3) Material Failure Characterization and Prediction Methodology.
DTIC
Rotary Wing Aircraft; Prediction Analysis Techniques; Failure Analysis; Vibration; Failure

19990053230 Mitre Corp., Jason Program Office, McLean, VA USA
Nondestructive Evaluation and Self-Monitoring Materials
Williams, Ellen; Lewis, Nate; Abarbanel, Henry; Eardley, Doug; Happer, Will; Apr. 1999; 55p; In English
Report No.(s): AD-A363256; JSR-98-145; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report is a response to a request from DARPA for a JASON study to evaluate existing and novel approaches to condition-based maintenance. Our guidance was to avoid the area of ”smart materials”, which is by itself an active area of research with which DARPA is quite familiar. In addition, the JASON study was narrowed to exclude the research area devoted to developing self-healing materials, i.e., materials that not only detect a change and produce a signal when the change occurs, but which also deform or reorganize structurally at either the macroscopic or microscopic level to counteract any harmful operational effects due to such changes. Instead, the JASON study focused primarily on methods through which condition-based maintenance could be facilitated, improved, and/or enhanced.
DTIC
Aircraft Maintenance; Rotary Wings

19990053475 Electro Magnetic Applications, Inc., Denver, CO USA
Statistical Study of the Distance of Closest Approach of Aircraft to Ground-Based Emitters *Final Report*
Elliott, James R., Electro Magnetic Applications, Inc., USA; Perala, Rodney A., Electro Magnetic Applications, Inc., USA; Apr. 1999; 36p; In English
Contract(s)/Grant(s): DTFA03-96-00036
Report No.(s): AD-A363263; EMA-97-R-007; DOT/FAA/AR-98/75; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A Technical Program was initiated by the Federal Aviation Administration (FAA) William J. Hughes Technical Center to determine the closest distances that aircraft fly to high-intensity radiation emitters. This program was launched as the FAA and the High-Intensity Radiated Fields (HIRF) advisory committees were defining HIRF regulatory rulemaking requirements. This study was conducted at the Denver International Airport to determine the actual closest distances that aircraft fly in proximity to high-intensity radiation emitters. Information on emitter location, frequency, power, etc., was obtained from the Government Master File. Aircraft flight information was obtained from the SAR (System Analysis Recordings) tapes at the Denver En Route

Center. This program was used in conjunction with a research effort which located all high-powered emitters in the U.S. and Europe and established the actual HIRF environment.
DTIC
Electromagnetic Fields; Electromagnetic Radiation; Aircraft Safety; Air Traffic Control; Flight Safety; Beacon Collision Avoidance System; Flight Paths

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.

19990050999 Allison Engine Co., Indianapolis, IN USA
TADS: A CFD-Based Turbomachinery Analysis and Design System with GUI: Methods and Results, 2.0 ***Final Report, Feb. 1996 - Sep. 1998***
Koiro, M. J., Allison Engine Co., USA; Myers, R. A., Allison Engine Co., USA; Delaney, R. A., Allison Engine Co., USA; May 1999; 160p; In English
Contract(s)/Grant(s): NAS3-27394; RTOP 538-03-11
Report No.(s): NASA/CR-1999-206603; E-11116; NAS 1.26:206603; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The primary objective of this study was the development of a Computational Fluid Dynamics (CFD) based turbomachinery airfoil analysis and design system, controlled by a Graphical User Interface (GUI). The computer codes resulting from this effort are referred to as TADS (Turbomachinery Analysis and Design System). This document is the Final Report describing the theoretical basis and analytical results from the TADS system developed under Task 10 of NASA Contract NAS3-27394, ADPAC System Coupling to Blade Analysis & Design System GUI, Phase II-Loss, Design and. Multi-stage Analysis. TADS couples a throughflow solver (ADPAC) with a quasi-3D blade-to-blade solver (RVCQ3D) or a 3-D solver with slip condition on the end walls (B2BADPAC) in an interactive package. Throughflow analysis and design capability was developed in ADPAC through the addition of blade force and blockage terms to the governing equations. A GUI was developed to simplify user input and automate the many tasks required to perform turbomachinery analysis and design. The coupling of the various programs was done in such a way that alternative solvers or grid generators could be easily incorporated into the TADS framework. Results of aerodynamic calculations using the TADS system are presented for a multistage compressor, a multistage turbine, two highly loaded fans, and several single stage compressor and turbine example cases.
Author
Computational Fluid Dynamics; Turbomachinery; Graphical User Interface; Systems Analysis; Airfoils; Design Analysis

19990052582 NASA Glenn Research Center, Cleveland, OH USA
A Three-Dimensional Coupled Internal/External Simulation of a Film-Cooled Turbine Vane
Heidmann, James D., NASA Glenn Research Center, USA; Rigby, David L., DYNACS Engineering Co., Inc., USA; Ameri, Ali A., AYT Corp., USA; April 1999; 20p; In English; Gas Turbine and Aeroengine Congress, Exposition and Users' Symposium, 7-10 Jun. 1999, Indianapolis, IN, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): NAS3-98008; NAS3-27571; RTOP 523-26-13
Report No.(s): NASA/TM-1999-209078; NAS 1.15:209078; E-11638; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A three-dimensional Navier-Stokes simulation has been performed for a realistic film-cooled turbine vane using the LeRC-HT code. The simulation includes the flow regions inside the coolant plena and film cooling holes in addition to the external flow. The vane is the subject of an upcoming NASA Glenn Research Center experiment and has both circular cross-section and shaped film cooling holes. This complex geometry is modeled using a multi-block grid which accurately discretizes the actual vane geometry including shaped holes. The simulation matches operating conditions for the planned experiment and assumes periodicity in the spanwise direction on the scale of one pitch of the film cooling hole pattern. Two computations were performed for different isothermal wall temperatures, allowing independent determination of heat transfer coefficients and film effectiveness values. The results indicate separate localized regions of high heat transfer coefficient values, while the shaped holes provide a reduction in

heat flux through both parameters. Hole exit data indicate rather simple skewed profiles for the round holes, but complex profiles for the shaped holes with mass fluxes skewed strongly toward their leading edges.
Author
Three Dimensional Models; Turbines; Simulation; Navier-Stokes Equation; Vanes

19990052638 Advanced Structures Technology, Inc., Phoenix, AZ USA
Assessment of an Advanced Containment System *Final Report*
Presley, K. L.; Feb. 1999; 30p; In English
Report No.(s): PB99-143968; AST-R8008-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The objective of this program was to evaluate the potential benefit of adding ceramic liners to turbine containment structures. Military ballistic programs have shown that ceramics can alter the ballistic projectile and increase the effect of impact area to provide significant benefit. Turbine engine failures generate slower moving, odd-shaped debris. This effort added ceramic liners to metal and composite containment rings to evaluate the energy absorbed as a function of component weight.
NTIS
Containment; Turbines; Linings

19990052939 Naval Air Warfare Center, Weapons Div., China Lake, CA USA
Small-Engine Uncontained Debris Analysis *Final Report*
Frankenberger, C. E., III; Feb. 1999; 18p; In English
Contract(s)/Grant(s): DTFA03-95-X-90019
Report No.(s): AD-A362579; DOT/FAA/AR-99/7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Under Contract to the Federal Aviation Administration, the Naval Air Warfare Center has conducted an analysis to define the characteristics of small civil turbine engine uncontained debris. The objective of the analysis was to define the debris size, weight, exit velocity, and trajectory that can be used to update AC20-128A. The effort was conducted by gathering historical data from uncontained engine failures. These data included, when available, phase of flight, engine operating condition, the failed engine component, aircraft damage location, and damage size. With this basic information, debris size was correlated to damage size. A methodology developed in the ”Large-Engine Uncontained Debris Analysis” report number DOT/FAA/AR-99/11 was used to estimate debris exit velocity. Representative engine cases and cowls were defined, and existing ballistic penetration equations were used to calculate debris exit velocity. This analysis was conducted for disk and blade failures on fan, compressor and turbine components. Results of the analysis provided some interesting insight to these events. Looking at the debris trajectories, the analysis shows that the trajectories defined in AC20-128A are comparable to those seen in field events. Also the analysis highlights the fact that small engines produce fewer uncontained fragments than large engines (1 per event versus 11 per event on the average for large engines).
DTIC
Engine Design; Debris; Trajectory Analysis; Aircraft Engines

19990052943 General Electric Co., Aircraft Engines, Cincinnati, OH USA
Crack Growth-Based Predictive Methodology for the Maintenance of the Structural Integrity of Repaired and Non-repaired Aging Engine Stationary Components *Final Report*
Barron, M. L.; Apr. 1999; 112p; In English
Report No.(s): PB99-147381; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche
This report contains the description and results of work conducted by General Electric Aircraft Engines(GEAE) between October 1994 and April 1997 under the Federal Aviation Administration (FAA) contract to study aging engine issues relative to stationary components. GEAE’s project in support of this goal was to study specific components, combustion castings, and compressor rear frames in service on older GEAE engines to determine if periodic inspections are warranted and to develop the tools necessary to conduct effective inspections should the data support a proactive need. A detail description of the planned work scope along with results for that portion of the work that was completed are reported.
NTIS
Crack Propagation; Cracking (Fracturing); Structural Failure; Aircraft Engines; Engine Parts; Maintenance

19990053005 NASA Glenn Research Center, Cleveland, OH USA
NASA Glenn Research Center’s Hypersonic Propulsion Program
Palac, Donald T., NASA Glenn Research Center, USA; May 1999; 10p; In English; Airbreathing Engines, 5-10 Sep. 1999, Florence, Italy; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Meeting sponsored by AAF and ATI

Contract(s)/Grant(s): RTOP 523-61-13
Report No.(s): NASA/TM-1999-209185; E-11696; NAS 1.15:209185; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

NASA Glenn Research Center (GRC), as NASA's lead center for aeropropulsion, is responding to the challenge of reducing the cost of space transportation through the integration of air-breathing propulsion into launch vehicles. Air- breathing launch vehicle (ABLV) propulsion requires a marked departure from traditional propulsion applications. and stretches the technology of both rocket and air-breathing propulsion. In addition, the demands of the space launch mission require an unprecedented level of integration of propulsion and vehicle systems. GRC is responding with a program with rocket-based combined cycle (RBCC) propulsion technology as its main focus. RBCC offers the potential for simplicity, robustness, and performance that may enable low-cost single-stage-to-orbit (SSTO) transportation. Other technologies, notably turbine-based combined cycle (TBCC) propulsion, offer benefits such as increased robustness and greater mission flexibility, and are being advanced, at a slower pace, as part of GRC's program in hypersonics.
Author
Air Breathing Boosters; Air Breathing Engines; Launch Vehicles; Spacecraft Launching

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.

19990050914 NASA Dryden Flight Research Center, Edwards, CA USA
An H-Infinity Approach to Control Synthesis with Load Minimization for the F/A-18 Active Aeroelastic Wing
Lind, Rick, NASA Dryden Flight Research Center, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 23-32; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The F/A-18 Active Aeroelastic Wing research aircraft will demonstrate technologies related to aeroservoelastic effects such as wing twist and load minimization. This program presents several challenges for control design that are often not considered for traditional aircraft. This paper presents a control design based on H-infinity synthesis that simultaneously considers the multiple objectives associated with handling qualities, actuator limitations, and loads. A point design is presented to demonstrate a controller and the resulting closed-loop properties.
Author
Aeroservoelasticity; Controllability; Feedback Control; H-Infinity Control; Wing Loading; Controllers

19990050917 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Aeroelasticity, Goettingen, Germany
Simulation of Nonlinear Airfoil/Control-Surface Flutter at Subsonic Speeds using Classical Unsteady Aerodynamics and an Euler Method
Schulze, Silvio, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 53-70; In English; See also 19990050911; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A flutter simulation method for aeroelastic systems with discrete structural nonlinearities is presented and applied. The computational approach is based on the coupling of the discretized fluid and structural equations which are solved in the time domain. Embedded in an effective procedure to compute complete flutter boundaries (bifurcation diagrams), the method is employed to investigate the flutter stability of an airfoil/control-surface system for hardening and softening stiffness characteristics in the control mechanism. The aerodynamic forces are predicted under the assumption of subsonic inviscid flow by the classical linear airfoil theory as a basis of comparison and by a Euler method. The typical flutter behavior of the system is described and explained by comparing it with the flutter properties of a predefined linear reference model. The results presented here demonstrate the practicability of the method and provide a deeper insight into the nonlinear airfoil/control-surface flutter mechanisms.
Author
Unsteady Aerodynamics; Aeroelasticity; Flutter; Mathematical Models; Control Surfaces; Aerodynamic Stability; Euler Equations of Motion; Structural Analysis; Predictor-Corrector Methods; Finite Difference Time Domain Method

19990050922 National Aerospace Lab., Structures Div., Tokyo, Japan

Wind Tunnel Tests and Analysis on Flutter of Spacecraft Including Pitching Effects in its Launching Configuration

Kanda, Atsushi, National Aerospace Lab., Japan; Ueda, Tetsuhiko, National Aerospace Lab., Japan; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 115-120; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A project of experimental reentry winged space vehicle ”HOPE-X” is proceeding in Japan. An elastically supported pitching mode may be involved in the dynamic characteristics of this vehicle since it is attached to the H-II rocket in the launching configuration. It is of importance to take these kind of modes into consideration for flutter analysis because the flutter affected with this mode can be critical at the launching phase. A sting support system with controllable pitching rigidity was innovated and tested in a transonic wind tunnel. As the result, the flutter related to the pitching mode was observed. This type of flutter was also confirmed in the analysis using DPM (Doublet Point Method). Further, it was found that a different type of flutter occurred in anti-symmetric mode at relatively low dynamic pressure.

Author

Wind Tunnel Tests; Flutter Analysis; Dynamic Characteristics; Launch Vehicle Configurations; Vibration Tests; Pitch (Inclination); Transonic Flutter

19990050923 NASA Langley Research Center, Hampton, VA USA

Aeroelastic Tailoring for Stability Augmentation and Performance Enhancements of Tiltrotor Aircraft

Nixon, Mark W., Army Vehicle Technology Center, USA; Piatak, David J., NASA Langley Research Center, USA; Corso, Lawrence M., Bell Helicopter Co., USA; Popelka, David A., Bell Helicopter Co., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 121-138; In English; See also 19990050911; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The requirements for increased speed and productivity for tiltrotors has spawned several investigations associated with proprotor aeroelastic stability augmentation and aerodynamic performance enhancements. Included among these investigations is a focus on passive aeroelastic tailoring concepts which exploit the anisotropic capabilities of fiber composite materials. Researchers at Langley Research Center and Bell Helicopter have devoted considerable effort to assess the potential for using these materials to obtain aeroelastic responses which are beneficial to the important stability and performance considerations of tiltrotors. Both experimental and analytical studies have been completed to examine aeroelastic tailoring concepts for the tiltrotor, applied either to the wing or to the rotor blades. This paper reviews some of the results obtained in these aeroelastic tailoring investigations and discusses the relative merits associated with these approaches.

Author

Tilt Rotor Aircraft; Aeroelasticity; Stability Augmentation; Aerodynamic Characteristics; Rotor Aerodynamics

19990050925 Politecnico di Milano, Dept. of Aerospace Engineering, Milan, Italy

Multi-Body Analysis of an Active Control for a Tiltrotor

Ghiringhelli, G. L., Politecnico di Milano, Italy; Masarati, P., Politecnico di Milano, Italy; Mantegazza, P., Politecnico di Milano, Italy; Nixon, M. W., Army Research Lab., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 149-158; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The design of advanced rotorcrafts requires the ability to analyse sophisticated, interdisciplinary systems to a degree of refinement that only recently has become achievable at a low price, thanks to the improvements in computer power. Multi-body analysis allows the detailed modeling of the kinematics as well as of the structural properties of rather sophisticated mechanical systems, such as helicopter rotors. When integrated with aeroservoelastic analysis, it represents a powerful tool for both the analysis and the design of aircraft, with particular regard to rotorcrafts. An original multi-body formulation is presented, based on the direct writing of a system of differential-algebraic equations (DAE) that describe the equilibrium and the kinematic constraints of a structural system. The finite rotations, during the time-step integration of the initial value problem, are handled in an efficient manner by means of a technique called ”Updated-Updated Rotations”, an Updated Lagrangian approach that uses as reference the predicted configuration of the system. This allows to neglect the rotation perturbations in the computation of the Jacobian matrix with considerable computational savings, while preserving the accuracy by consistently computing the residual. Control equations and the related unknowns are added, to model the control system to the desired level of refinement, from idealised control input/output signals, to each servosystem component. The numerical analysis of a tiltrotor configuration is proposed, based on an analytical model of the WRATS wind tunnel model. This is a 1/5 scale model of the V-22 tiltrotor aircraft, currently tested in the Transonic Dynamic Tunnel (TDT) at NASA Langley. The control strategy is based on the Generalized Predictive Control (GPC) technique, with a Recursive Least Mean Squares (RLMS) on-line identification of an equivalent discrete linear system, that is used to design

the adaptive controller. The rotor pitch controls are used as actuators. Different combinations of strain gages and accelerometers are used as sensor devices.
Author
Active Control; Tilt Rotor Aircraft; Kinematics; Servomechanisms; Aeroservoelasticity; Adaptive Control; Mathematical Models; Recursive Functions

19990050927 Old Dominion Univ., Dept. of Aerospace Engineering, Norfolk, VA USA
Review of Nonlinear Panel Flutter at Supersonic and Hypersonic Speeds
Mei, Chuh, Old Dominion Univ., USA; Abdel-Motagaly, K., Old Dominion Univ., USA; Chen, R., Old Dominion Univ., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 171-188; In English; See also 19990050911; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A review of various analytical methods and experimental results of supersonic and hypersonic panel flutter is presented. The analytical methods are categorized into two main methods. The first category is the classical methods, which include Galerkin in conjunction with numerical integration, harmonic balance and perturbation methods. The second category is the finite element methods in either the frequency domain (eigen solution) or the time domain (numerical integration). A review of the experimental literature is given. The effects of different parameters on the flutter behavior are described. The parameters considered include inplane forces, thermal loading, flow direction, and initial curvature. Active control of composite panels at supersonic speeds and elevated temperatures is also presented.
Author
Panel Flutter; Nonlinearity; Supersonic Speed; Hypersonic Speed; Aeroelasticity; Supersonic Flutter; Temperature Effects

19990050932 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
An Unsteady Aerodynamics Identification Procedure for Flutter Prediction
Prudhomme, S., Office National d'Etudes et de Recherches Aerospatiales, France; Blondeau, C., Office National d'Etudes et de Recherches Aerospatiales, France; Humbert, M., Aerospatiale, France; Bucharles, A., Office National d'Etudes et de Recherches Aerospatiales, France; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 235-244; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This article introduces an identification procedure from flight-data, in the perspective of quasi real time flutter prediction models upgrading. Parameters are introduced to model uncertainties on the unsteady aerodynamics. While tests are performed for increasing velocity, identification algorithms use flight data to update the parameters and make flutter prediction more accurate for investigation towards higher velocity. Performance of identification is evaluated in terms of accuracy for unsteady aerodynamics estimation, and of flutter prediction capability, with and without turbulence.
Author
Flutter Analysis; Prediction Analysis Techniques; Unsteady Aerodynamics; Mathematical Models; Parameter Identification

19990050933 Alberta Univ., Dept. of Mathematical Sciences, Edmonton, Alberta Canada
Parameter Estimation in Flutter Analysis by Wavelet and Neural Network
Wong, Y. S., Alberta Univ., Canada; Lee, B. H. K., Institute for Aerospace Research, Canada; Wong, T. K. S., Alberta Univ., Canada; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 245-254; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Despite rapid advances in the development of computational aerodynamics and wind tunnel testing techniques, flight tests are still required to determine flutter boundaries of aircraft. Normally, modal frequencies and damping values are measured, but these quantities can be difficult to determine accurately when noise is present or when modal frequencies are close to each other. Various methods have been considered for parameter estimation in flutter tests, and these include curve fitting based on non-linear least squares, maximum likelihood estimation, Kalman filters and filter error method, to name but a few. Some of these techniques require considerable amount of computations, and hence real time evaluation of frequency and damping values may require efficient algorithms. Wavelet theory for signal processing has made great progress in recent years. Also, artificial neural networks capable of modeling complex characteristics in nonlinear systems have contributed to the development of more advanced methods in analyzing aeroelastic response signals. Unlike conventional methods, these approaches do not require explicit mathematical manipulations. Furthermore, the required parameters can be estimated in real time once the neural network has been properly trained. to achieve optimal computational efficiency, the required parameters can be determined by a group of neural networks using a parallel algorithm. This study is an extension of the approach suggested by Lee and Wong where only one neural network

was used to analyze a one-degree-of-freedom time signal represented by an exponentially decaying sine wave corrupted with noise.
Derived from text
Parameter Identification; Aeroelasticity; Flutter Analysis; Wavelet Analysis; Neural Nets; Mathematical Models

19990050934 Manchester Univ., Manchester School of Engineering, UK
Flutter Speed Prediction During Flight Flutter Testing Using Neural Networks
Cooper, J. E., Manchester Univ., UK; Crowther, W. J., Manchester Univ., UK; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 255-264; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Flight flutter testing is a crucial part in the certification of a prototype aircraft. The flight envelope must be expanded safely, however, there is always the pressure to complete the tests as quickly as possible. Although there will be an aeroelastic model of the system for comparison, the decision to proceed to the next test point is usually based upon the modal parameters estimated from the flutter test data. A number of different methods have been proposed to determine the speed at which flutter occurs, however, the most commonly used approach is simply to extrapolate the estimated damping ratios. In this paper, a method for the prediction of flutter speed from flutter test data is proposed based upon the use of Neural Networks. The method is demonstrated upon a simulated aeroelastic model.
Author
Flutter Analysis; Prediction Analysis Techniques; Neural Nets; Aeroelasticity; Dynamic Response; Flight Tests

19990050935 Northwestern Polytechnical Univ., Data Processing Center, Xian, China
Overview of Recent Flutter Boundary Prediction Techniques Based on Testing Data Analysis
Chengming, Pei, Northwestern Polytechnical Univ., China; Zhihua, Qiu, Northwestern Polytechnical Univ., China; Kun, Zhai, Northwestern Polytechnical Univ., China; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 265-274; In English; See also 19990050911; Sponsored in part by the K. C. Wong Education Foundation, Hong Kong, Chengdu Aircraft Industry Corp., and Xi'an Aircraft Industry Corp.; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

FBP (Flutter Boundary Prediction) due to subcritical signal analysis is becoming a significant research subject in the field of flutter testing. In this paper, traditional modal damping and modern system stability analysis are reviewed. The principle and specifics of the methods are also briefly discussed. Especially, a new hybrid prediction method based on NNES (Neural Network Expert System) is proposed and integrated into current FBP techniques and human experiences from experts.
Author
Flutter Analysis; Prediction Analysis Techniques; Expert Systems; Neural Nets; Vibration Damping

19990050937 California Univ., Mechanical and Aerospace Engineering Dept., Los Angeles, CA USA
Active Control of Flutter in Compressible Flow and its Aeroelastic Scaling
Presente, E., California Univ., USA; Friedman, P. P., California Univ., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 287-310; In English; See also 19990050911
Contract(s)/Grant(s): F49260-94-1-0400; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Active flutter suppression of a two dimensional wing section in subsonic flow is studied. Pitch and plunge dynamics, combined with a trailing-edge control surface is considered. Aerodynamic loads are expressed in time-domain using Roger's approximation. Augmented aerodynamic states are reconstructed using a Kalman filter, and linear optimal control is used to design a full-state feedback regulator for flutter suppression. Constraints on actuator deflection and rate limit the flutter envelope expansion. A new two-pronged approach to developing aeroelastic and aeroservoelastic scaling laws is presented and applied to a typical example. Flutter suppression for a typical cross-section with a conventional trailing edge control surface is compared with that obtained with piezoelectric actuation utilizing bend/twist coupling on a finite span composite wing. Power consumption and its scaling for these two cases is compared.
Author
Aeroelasticity; Aeroservoelasticity; Compressible Flow; Active Control; Subsonic Flutter; Vibration Damping; Scaling Laws; Aeroelastic Research Wings

19990050938 Naples Univ., Dept. of Aeronautical Engineering, Italy
New Experimental Stall Flutter Active Control of a Bridge Section
Lecce, L., Naples Univ., Italy; Selvaggi, E., Naples Univ., Italy; Nicolosi, F., Naples Univ., Italy; Baruffo, M., Naples Univ., Italy;

Abate, A., Naples Univ., Italy; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 311-324; In English; See also 19990050911; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this paper experimental activities on stall flutter phenomenon will be presented. Tests have been performed in the low speed wind tunnel at the Department of Aeronautical Engineering (DPA) of the University of Naples on a model using a typical single deck box girder bridge section. In the first part of the work, the stall flutter has been controlled using a leading edge (l.e.) movable surface (tab) deflecting downward. Application of a new active control system has been performed using the previous movable surface. The stall flutter in dynamic conditions has been controlled using an active system which automatically changes the tab position (from 0 to 10 deg) and is able to suppress the stall phenomenon. The control system consists of a mixed digital-analogue feedback circuit with an accelerometer as error sensor and two electromagnetic actuators to control the tab rotation. In the second part a new approach has been tested. The new methodology consists of a rotating cylinder placed at the section leading edge. Through the cylinder rotation it is possible to change the section aerodynamic behaviour and then to increase stall flutter critical speed up to 60% at certain angles of attack.

Author

Flutter Analysis; Aerodynamic Stalling; Tabs (Control Surfaces); Active Control; Bridges (Structures); Aerodynamic Stability

19990050943 NASA Langley Research Center, Hampton, VA USA

Transonic Flutter Suppression Control Law Design, Analysis and Wind Tunnel Results

Mukhopadhyay, Vivek, NASA Langley Research Center, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 381-392; In English; See also 19990050911; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The benchmark active controls technology and wind tunnel test program at NASA Langley Research Center was started with the objective to investigate the nonlinear, unsteady aerodynamics and active flutter suppression of wings in transonic flow. The paper will present the flutter suppression control law design process, numerical nonlinear simulation and wind tunnel test results for the NACA 0012 benchmark active control wing model. The flutter suppression control law design processes using (1) classical, (2) linear quadratic Gaussian (LQG), and (3) minimax techniques are described. A unified general formulation and solution for the LQG and minimax approaches, based on the steady state differential game theory is presented. Design considerations for improving the control law robustness and digital implementation are outlined. It was shown that simple control laws when properly designed based on physical principles, can suppress flutter with limited control power even in the presence of transonic shocks and flow separation. In wind tunnel tests in air and heavy gas medium, the closed-loop flutter dynamic pressure was increased to the tunnel upper limit of 200 psf The control law robustness and performance predictions were verified in highly nonlinear flow conditions, gain and phase perturbations, and spoiler deployment. A non-design plunge instability condition was also successfully suppressed.

Author

Transonic Flutter; Vibration Damping; Control Theory; Flutter Analysis; Wind Tunnel Tests; Unsteady Aerodynamics; Active Control; Nonlinearity; Computerized Simulation; Aeroelasticity

19990050944 NASA Dryden Flight Research Center, Edwards, CA USA

Wavelet Applications for Flight Flutter Testing

Lind, Rick, NASA Dryden Flight Research Center, USA; Brenner, Marty, NASA Dryden Flight Research Center, USA; Freudinger, Lawrence C., NASA Dryden Flight Research Center, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 393-402; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Wavelets present a method for signal processing that may be useful for analyzing responses of dynamical systems. This paper describes several wavelet-based tools that have been developed to improve the efficiency of flight flutter testing. One of the tools uses correlation filtering to identify properties of several modes throughout a flight test for envelope expansion. Another tool uses features in time-frequency representations of responses to characterize nonlinearities in the system dynamics. A third tool uses modulus and phase information from a wavelet transform to estimate modal parameters that can be used to update a linear model and reduce conservatism in robust stability margins.

Author

Flight Tests; Flutter Analysis; Wavelet Analysis; Dynamical Systems; Signal Processing; Flight Envelopes; Aeroelasticity

19990050948 ZONA Technology, Inc., Scottsdale, AZ USA

A Damping Perturbation Method for Flutter Solution: The g-Method

Chen, P. C., ZONA Technology, Inc., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 433-441; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

By utilizing a damping perturbation method the present g-method includes a first order damping term in the flutter equation that is rigorously derived from the Laplace-domain aerodynamics. The g-method generalizes the K-method and the P-K method for reliable damping prediction. It is valid in the entire reduced frequency domain and up to the first order of damping. The present work also provides a theoretical foundation for the g-method that can be used to estimate the truncation error for large values of damping. The solution algorithm of the g-method is proven to be robust and can obtain an unlimited number of aerodynamic lag roots; as demonstrated by the results of the selected test cases.

Author

Perturbation Theory; Vibration Damping; Flutter Analysis; Aeroelasticity; Frequency Domain Analysis

19990051006 Army Aviation and Missile Command, Aeroflightdynamics Directorate, Moffett Field, CA USA

The Development of the CONDUIT Advanced Control System Design and Evaluation Interface with a Case Study Application to an Advanced Fly by Wire Helicopter Design

Colbourne, Jason, California Polytechnic State Univ., USA; March 1999; 66p; In English

Contract(s)/Grant(s): NCC2-983; RTOP 581-30-22

Report No.(s): NASA/TM-1999-208763; NAS 1.15:208763; AFDD/TR-99-A-005; A-99V-001; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report details the development and use of CONDUIT (Control Designer's Unified Interface). CONDUIT is a design tool created at Ames Research Center for the purpose of evaluating and optimizing aircraft control systems against handling qualities. Three detailed design problems addressing the RASCAL UH-60A Black Hawk are included in this report to show the application of CONDUIT to helicopter control system design.

Author

Aircraft Control; Control Systems Design; Design Analysis; Computer Programs

19990052677 Alenia Marconi Systems, Missile Systems Div., Rome, Italy

Flutter Stability of Movable Control Surfaces for Aircraft Stores

Ponzi, Claudio, Alenia Marconi Systems, Italy; Schweiger, Johannes, DaimlerChrysler Aerospace A.G., Germany; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 457-468; In English; See also 19990052675; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Flutter stability of movable control surfaces for aircraft stores is a rather complex topic because a large variety of different store system conditions, aircraft configurations, store to aircraft functional conditions, aircraft maneuver and environmental conditions have to be covered by analysis as well as by ground and flight tests. For this purpose, the most critical or most sensitive flutter parameters of the stores must be known and covered by analysis and tests. For stores with only fixed aerodynamic stabilizers, the verification of their flutter stability is usually quite simple because these surfaces are small and stiff. For them, it is usually sufficient to include only their mass properties and attachment stiffnesses in the aircraft flutter analysis, where the store is considered only by its rigid body motions. Only in some cases it is required to include also effects from rigid aerodynamic surfaces on the store. But as soon as a surface is used to provide control forces, it usually needs to be larger and thus gets also more flexible. Additional flexibility is added by the drive system, and, in some cases by a free floating attachment mode for captive flight conditions. Detailed flutter investigations for the store itself are usually performed by the store manufacturer. On this side however, possible impacts from the different types of aircraft are not known and could also not be covered in their multitude during the development of a new store. For example, the aerodynamic flow field in the vicinity of the aircraft, especially under the fuselage, can be completely different from free flight conditions. This paper explains how to handle these aspects and depicts major advantages and drawbacks of the state of the art analysis and testing techniques. The different specifications for the development and certifications of aircraft and stores are also addressed briefly. Finally an approach will be described how the flutter stability of control surfaces can be enhanced by means of formal mathematical optimization methods.

Author

Aeroelasticity; Flutter; Flutter Analysis; Wing-Fuselage Stores; Unsteady Aerodynamics; Optimization; Body-Wing Configurations

19990052683 La Sapienza Univ., Dipt. Aerospaziale, Rome, Italy

Singular Perturbation Technique for Nonlinear Aeroelastic Analysis

Dessi, D., La Sapienza Univ., Italy; Mastroddi, F., La Sapienza Univ., Italy; Morino, L., Rome III Univ., Italy; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 523-532; In English; See also 19990052675; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In this paper we consider an aeroelastic section with cubic free-play nonlinearities, approximating Wagner's function in the expression of aerodynamic forces with exponentials in the time domain. The mathematical model is then recast in the standard first order ordinary differential form, with x the global state-space vector, to which nonlinear analysis tools apply. An extensive numerical study has been performed to show the dependence of Hopf bifurcation characteristics from the structural and geometric properties of the wing section. Bifurcation and frequency vs. dynamic pressure plots are presented. In such cases the onset of flutter might happen before the linear flutter speed for certain initial conditions.

Author

Flutter Analysis; Nonlinearity; Aeroelasticity; Mathematical Models; Dynamic Structural Analysis; Unsteady Aerodynamics

19990052685 Old Dominion Univ., Aerospace Engineering Dept., Norfolk, VA USA

Flutter Suppression and Vibration Control of Plate-Wing Structures using Self-Sensing Active Constrained Layer Damping

Ro, Jeng-Jong, Old Dominion Univ., USA; Elsaadawy, Ehab, Old Dominion Univ., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 543-552; In English; See also 19990052675

Contract(s)/Grant(s): DAAH-04-96-1-0317; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Active Constrained Layer Damping (ACLD) treatment has been used successfully for controlling the vibration of various flexible structures. The treatment provides an effective means for augmenting the simplicity and reliability of passive damping with the low weight and high efficiency of active controls to attain high damping characteristics over broad frequency bands. In this study, a self-sensing configuration of the ACLD treatment is utilized to simultaneously suppress the bending and torsional vibrations of plates and flutter control of a plate-wing structure. The treatment considered ensures collocation of the sensor/actuator pairs in order to guarantee stable operation. First part of this study, a three-layer network of the Self-sensing Active Constrained Layer Damping (SACLD) treatment is used to control multi-modes of vibration of a flexible aluminum plate (0.264m x 0.127m x 4.826E-4m) which is mounted in a cantilevered arrangement. Two ACLD patches (0.264m x 0.0635m) with self-sensing polyvinylidine fluoride (PVDF) actuators oriented by (14 deg/-14 deg) configuration are treated on one side of plate. The theoretical characteristics of the multi-layer treatment are presented in this paper and compared with the experimental performance. Secondly, the concept of vibration control using SACLD/plate is implemented to perform the flutter suppression experimentally. The experimental demonstration of flutter control of the SACLD/plate-wing structure is performed in the Low Speed wind Tunnel (LST) at Aerospace Department at ODU. Simple linear control with self-sensing strain and strain rate feedback is utilized to study the performance of the SACLD/plate in flutter control.

Author

Active Control; Flutter; Vibration Damping; Wings; Mathematical Models; Actuation; Piezoelectricity; Dynamic Characteristics; Rectangular Plates

19990052686 NASA Langley Research Center, Hampton, VA USA

An Examination of Applying Shunted Piezoelectrics to Reduce Aeroelastic Response

McGowan, Anna-Maria Rivas, NASA Langley Research Center, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 553-572; In English; See also 19990052675; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Several analytical and experimental studies clearly demonstrate that piezoelectric materials (piezoelectrics) can be used as actuators to actively control vibratory response, including aeroelastic response. However, two important issues in using piezoelectrics as actuators for active control are: 1) the potentially large amount of power required to operate the actuators, and 2) the complexities involved with active control (added hardware, control law design, and implementation). Active or passive damping augmentation using shunted piezoelectrics may provide a viable alternative. This approach requires only simple electrical circuitry and very little or no electrical power. The current study examines the feasibility of using shunted piezoelectrics to reduce aeroelastic response using a typical-section representation of a wing and piezoelectrics shunted with a parallel resistor and induc-

tor. The aeroelastic analysis shows that shunted piezoelectrics can effectively reduce aeroelastic response below flutter and may provide a simple, low-power method of subcritical aeroelastic control.
Author
Piezoelectricity; Bypasses; Circuits; Dynamic Response; Aeroelasticity; Active Control; Smart Structures; Vibration Damping

19990052687 Old Dominion Univ., Dept. of Aerospace Engineering, Norfolk, VA USA
A Comparison Study of the Performance of a Saturation Absorber and Classical Vibration Control Methods
Omar, Hanafy M., Old Dominion Univ., USA; Kunz, Donald, Old Dominion Univ., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 573-584; In English; See also 19990052675; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The saturation absorber is an application of the saturation phenomenon as a vibration suppression device. The saturation phenomenon occurs in autoparametric, multi-degree-of- freedom systems, if the natural frequencies of the absorbers and the plants are commensurable (omega(sub p) = 2(omega(sub c)),3(omega(sub c)),...). to control the vibratory response of a plant with a single degree of freedom, a second-order absorber is introduced and coupled to the plant with quadratically nonlinear terms. When the plant is forced at its resonant frequency and the magnitude of the response reaches its saturation level, the nonlinear coupling forms an energy bridge between the plant and the absorber. The objective of the research described in this paper is to quantify the performance of the saturation control (response, the required control authority, robustness to the plant parameter variation), as compared with the performance of classical controllers, such as velocity feedback, and nonlinear controllers like the Fuzzy Logic Controller (FLC). This comparison will serve to identify the advantages and the disadvantages of saturation control, especially regarding the control authority required to suppress the response of a vibrating system. In addition, a parametric study of the nonlinear coupling parameters will result in guidelines for obtaining the desired absorber performance is also given.
Derived from text
Vibration Damping; Controllers; Fuzzy Systems; Active Control

19990052689 National Inst. for Research and Development of Turbomachinery, Bucharest, Romania
Effects of Transient Hypersonic Flow Conditions on Failure Prediction of Panels
Udrescu, Radu, National Inst. for Research and Development of Turbomachinery, Romania; Surace, Giuseppe, Politecnico di Torino, Italy; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 595-604; In English; See also 19990052675; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A new approach of the transient flow conditions (simultaneous transitory behaviour of thermal load and fluid velocity) is proposed in the nonlinear panel flutter analysis. Applying proper aeroelastic theories (von Karman elasticity, piston aerodynamic theory) and fatigue life estimation (Heywood's approach) the results confirm differences in failure prediction compared with the classical approach (case of constant flow and kinetic heating parameters). This study demonstrates the sensitivity of the aerothermoelastic system to the transitory hypersonic flow conditions: the pattern of the motion changes in amplitude even when modifying the increasing slope of the thermal and flow parameters that govern the motion, but maintaining the same steady state values. The panel behaves like a chaotic system and needs to be carefully investigated for a reliable design.
Author
Hypersonic Flow; Transient Loads; Failure Analysis; Panel Flutter; Flutter Analysis; Aeroelasticity; Aerothermoelasticity; Finite Element Method; Dynamic Response

19990052690 Military Univ. of Technology, Warsaw, Poland
Nonlinear Regular and Chaotic Flutter of an Airfoil with a Trailing Edge Flap in Supersonic Flow
Dzygadlo, Z., Military Univ. of Technology, Poland; Nowotarski, I., Military Univ. of Technology, Poland; Olejnik, A., Military Univ. of Technology, Poland; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 605-614; In English; See also 19990052675; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

An airfoil in supersonic flow, having deformable nonlinear supports, is an aeroelastic system for which various types of instability, bifurcations and regular or chaotic motions can appear. The airfoil has three degrees of freedom - that is, plunge displacement, angle of pitch and angle of flap deflection. The stiffness force and moments for all those motions are assumed to be nonlinear ones. The airfoil is subjected to the pressure difference produced by its motion in supersonic flow. Stability and bifurcations occur-

ring in the system, limit cycles of self-excited vibrations and regions of regular or chaotic motions have been investigated. The effect of some parameters of the system on the course of linear and nonlinear vibrations has been studied.
Author
Aeroelasticity; Linear Vibration; Nonlinearity; Supersonic Flow; Trailing Edge Flaps; Random Vibration; Flutter Analysis; Aerodynamic Stability; Supersonic Airfoils

19990052691 NASA Langley Research Center, Hampton, VA USA
Correlation of Fin Buffet Pressures on an F/A-18 with Scaled Wind-Tunnel Measurements
Moses, Robert W., NASA Langley Research Center, USA; Shah, Gautam H., NASA Langley Research Center, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 615-626; In English; See also 19990052675; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Buffeting is an aeroelastic phenomenon occurring at high angles of attack that plagues high performance aircraft, especially those with twin vertical tails. Previous wind-tunnel and flight tests were conducted to characterize the buffet loads on the vertical tails by measuring surface pressures, bending moments, and accelerations. Following these tests, buffeting responses were computed using the measured buffet pressures and compared to the measured buffeting responses. The calculated results did not match the measured data because the assumed spatial correlation of the buffet pressures was not correct. A better understanding of the partial (spatial) correlation of the differential buffet pressures on the tail was necessary to improve the buffeting predictions. Several wind-tunnel investigations were conducted for this purpose. When compared, the results of these tests show that the partial correlation scales with flight conditions. One of the remaining questions is whether the wind-tunnel data is consistent with flight data. Presented herein, cross-spectra and coherence functions calculated from pressures that were measured on the High Alpha Research Vehicle indicate that the partial correlation of the buffet pressures in flight agrees with the partial correlation observed in the wind tunnel.
Author
Buffeting; Fins; Pressure Measurement; Wind Tunnel Tests; Aerodynamic Stability; F-18 Aircraft; Aeroelasticity; Dynamic Response; Vortices

19990052692 CFD Research Corp., Huntsville, AL USA
Twin-Tail Buffet Simulation using a Multi-Disciplinary Computing Environment (MDICE)
Sheta, Essam F., CFD Research Corp., USA; Siegel, John M., Jr., CFD Research Corp., USA; Golos, Freddy N., CFD Research Corp., USA; Harrand, Vincent J., CFD Research Corp., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 627-638; In English; See also 19990052675; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The current paper presents a state-of-the-art approach for performing efficient multi-disciplinary simulations. A Multi-Disciplinary Computing Environment (MDICE) is presented and validated with a twin-tail buffet simulation of a generic fighter aircraft. MDICE is an object-oriented computing environment which allows several analysis modules to run and communicate with each other over a distributed network of computers. In a buffet condition, the leading edge vortices of a delta wing break down producing an unsteady turbulent flow which empennages on the surfaces of the tails, causing severe premature structural fatigue. The application of MDICE to the twin-tail buffet problem involves four types of modular functionality: a fluid-dynamics module, a fluid-structure interfacing technique, a structural dynamics module, and grid motion technique. The configuration model is pitched at a wide range of angles of attack at Mach and Reynolds numbers of 0.4 and 1.25 million, respectively. The computational results are in very good agreement with the experimental data.
Author
Dynamic Structural Analysis; Multidisciplinary Design Optimization; Buffeting; Flight Simulation; Vortex Breakdown; Applications Programs (Computers); Dynamic Response; Computerized Simulation

19990052693 Old Dominion Univ., Aerospace Engineering Dept., Norfolk, VA USA
Adaptive Suction and Blowing for Twin-Tail Buffet Control
Kandil, Osama A., Old Dominion Univ., USA; Yang, Zhi, Old Dominion Univ., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 639-648; In English; See also 19990052675
Contract(s)/Grant(s): NAG1-648; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Adaptive active flow control for twin-tail buffet alleviation is investigated. The concept behind this technique is to place control ports on the tail outer and inner surfaces with flow suction or blowing applied through these ports in order to minimize the pressure difference across the tail. The suction or blowing volume flow rate from each port is proportional to the pressure differ-

ence across the tail at this location. A parametric study of the effects of the number and location of these ports on the buffet response is carried out. The computational model consists of a sharp-edged delta wing of aspect ratio one and swept-back flexible twin tail with taper ratio of 0.23. This complex multidisciplinary problem is solved sequentially using three sets of equations for the fluid flow, aeroelastic response and grid deformation, using a dynamic multi-block grid structure. The computational model is pitched at 30 deg angle of attack. The freestream Mach number and Reynolds number are 0.3 and 1.25 million, respectively. The model is investigated for the inboard position of the twin tails, which corresponds to a separation distance between the twin tails of 33% of the wing span. Comparison of the time history and power spectral density responses of the tails for various distributions of the control ports are presented and discussed.
Author
Adaptive Control; Aeroelasticity; Buffeting; Flow Velocity; Tail Surfaces; Active Control; Delta Wings; Fluid Flow; Vortex Breakdown; Multiblock Grids

19990052700 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA
Synergistic Interaction of Aeroelastic Tailoring and Boundary Moment Control on Aircraft Wing Flutter
Gern, Frank H., Virginia Polytechnic Inst. and State Univ., USA; Librescu, Liviu, Virginia Polytechnic Inst. and State Univ., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 719-734; In English; See also 19990052675; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The implications of active feedback control and aeroelastic tailoring on the flutter instability of straight/swept aircraft wings carrying external stores are discussed. The stabilizing feedback control is generated by a bending moment acting at the wing tip. Relating this bending moment with adequately selected kinematic response quantities, a complex eigenvalue problem is obtained. Its solution yields the closed-loop flutter speed and frequency of flutter. The beneficial interaction of active feedback control in conjunction with aeroelastic tailoring upon the flutter boundary of aircraft wings made-up from advanced composite materials is emphasized. In addition, the prospects of an extension of the operational envelope of flight vehicles carrying external stores without weight penalties are revealed.
Author
Active Control; Aeroelasticity; Bending Moments; Feedback Control; Flutter; Rectangular Wings; Wing Oscillations; Mathematical Models; Computerized Simulation; Wing Tips; Optimization

19990052752 Washington Univ., Dept. of Aeronautics and Astronautics, Seattle, WA USA
Panel Flutter Constraints: Analytic Sensitivities and Approximations Including Planform Shape Design Variables
Livne, Eli, Washington Univ., USA; Mineau, David, Washington Univ., USA; Journal of Aircraft; August 1997; Volume 34, No. 4, pp. 558-568; In English
Contract(s)/Grant(s): NAG2-723; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Analytical sensitivities of panel flutter constraints with respect to panel shape as well as thickness and material properties are derived and numerically tested. Cases of fixed in-plane loads and cases in which in-plane loads are variable (depending on panel and overall wing shape as well as material and sizing design variables) are considered. Accuracy of approximations and range of move limits required are studied in preparation for integration with nonlinear programming/approximation concept aeroelastic design synthesis methodology.
Author
Aeroelasticity; Nonlinear Programming; Planforms; Panel Flutter; Design Analysis

19990053154 Office National d'Etudes et de Recherches Aerospatiales, Dept. Commande des Syst mes et Dynamique, Toulouse, France
Piloting of a VTOL-UAV to Shipboard Recovery
Reboulet, C., Office National d'Etudes et de Recherches Aerospatiales, France; Mouyon, P., Office National d'Etudes et de Recherches Aerospatiales, France; deFerrier, Bernard, Bombardier Services Corp., USA; Langlois, Bernard, Bombardier, Inc., Canada; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 11-1 - 11-6; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A system of guidance and control ensuring the safe recovery of a VTOL type unmanned air vehicle is described. The key ideas of the proposed approach are the estimation of the velocity/position with respect to the ship in a quasi-inertial coordinate frame and the guidance/control of the air vehicle to a virtual target (predicted position of the landing grid). The advantage of this guidance and control approach is the complete decoupling of the UAV from ship motions. The various methods used in each module of the whole recovery system are presented, including: tracking, filtering, and landing deck position prediction. Model performances based on test results are discussed. Strategy chosen in the development of the whole automated recovery system is described.

Finally, an assessment of the proposed concept obtained by simulation is provided. These results show that this approach is more robust than conventional motion sensitive techniques. The system promises to dramatically increase UAV operational limits and recovery efficiency. This activity is sponsored by the Delegation Generale de l'Armement (DGA France) and was accomplished with the framework of a Franco- Canadian collaborative project between ONERA-DCSD and Bombardier, Inc (Canadair).
Author
Pilotless Aircraft; Remotely Piloted Vehicles; Vertical Takeoff Aircraft; Vatol Aircraft; Autonomous Navigation; Automatic Flight Control; Aircraft Control

19990053157 Delegation Generale de l'Armement, Surface Ship Dept., Paris, France
Heel Compensation for the Charles de Gaulle Aircraft Carrier: Principles and Control Structure
Kummer, S., Delegation Generale de l'Armement, France; Hardier, G., Office National d'Etudes et de Recherches Aerospatiales, France; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 14-1 - 14-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

To improve the sea keeping performances of the french nuclear aircraft carrier Charles de Gaulle, with respect to its predecessors Clemenceau and Foch, DCN has developed a platform motion control system, called SATRAP, which reduced the ship motions while ensuring navigation capability. This system involves a centralized computer which controls three subsystems: two pairs of stabilizing fins, a set of rudders and a moving-mass system (athwart ship) for heel compensation, the Cogite system. Originally conceived for situations where the stabilizing fins would be otherwise saturated (steady heel from wind or heavy weights displacements). Cogite has evolved into a system which also improves the operational capability of the ship by limiting the heel during sharp turns, permitting non-stop handling and preparation of aircrafts. This paper presents the results of the studies which led to the development of a performing mode of operation for SATRAP, where the helmsman has full control of the rudders while the fins and Cogite system automatically reduce the ship motions. The following points are discussed in this paper: operational requirements in terms of performances, SATRAP system architecture and principles chosen for the control laws (task allocation for the actuators, feedforward-feedback controllers).
Author
Aircraft Carriers; Control Theory; Control Systems Design; Feedback Control; Feedforward Control; Stabilization

19990053163 Academy of Sciences of the Ukraine, Inst. of Hydromechanics, Kiev, Ukraine
Longitudinal Stability of Ekranoplans and Hydrofoils Ships
Korolyov, V. I., Academy of Sciences of the Ukraine, Ukraine; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 20-1 - 20-8; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Longitudinal stability of ekranoplans and hydrofoil ships, that have two carrying hydrofoils separated by some distance along the length of hull, "tandem" system, is considered in the paper. Longitudinal stability is characterized by the value of metacentric height, which is used in the practice of ship-building. An expression is given for the definition of this value depending on the main geometric and aerodynamic parameters. A link is determined between the metacentric height and frequency of the free angular movements of ekranoplans. A parameter investigation is fulfilled and recommendations are obtained for the choice of combinations of the carrying system basic elements.
Author
Hydrofoils; Hydrofoil Craft; Hydroplanes (Vehicles); Longitudinal Stability; Hydrodynamics

19990053348 NASA Dryden Flight Research Center, Edwards, CA USA
An H-infinity Approach to Control Synthesis with Load Minimization for the F/A-18 Active Aeroelastic Wing
Lind, Rick, NASA Dryden Flight Research Center, USA; 1999; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The F/A-18 Active Aeroelastic Wing research aircraft will demonstrate technologies related to aeroservoelastic effects such as wing twist and load minimization. This program presents several challenges for control design that are often not considered for traditional aircraft. This paper presents a control design based on H(sub infinity) synthesis that simultaneously considers the multiple objectives associated with handling qualities, actuator limitations, and loads. A point design is presented to demonstrate a controller and the resulting closed-loop properties.
Author
Aeroelasticity; Wings; H-Infinity Control; F-18 Aircraft; Feedback Control; Actuators

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).

19990050926 Micro Craft, Inc., Hampton, VA USA
Rotary Wing Test Stand Capability for the Republic of Korea
Breaks, Jeffrey, Micro Craft, Inc., USA; Cooper, Michael, Micro Craft, Inc., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 159-170; In English; See also 19990050911; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Two agencies in the Republic of Korea have commissioned the design and fabrication of rotor test stands to provide performance and dynamic testing capability for helicopter rotor systems in newly constructed wind tunnel facilities near Taejon, Korea. These test stands, based on the proven design of the 2 Meter Rotor Test Stand (2MRTS) that has been operating in the NASA Langley Research Center, 14 x 22-Foot Low Speed Tunnel for some time, incorporate significant improvements in the drive power and in the control and instrumentation subsystems. Both rotor test systems are robust and utilize many off-the-shelf components for durability and ease of maintenance.
Author
Test Stands; Dynamic Tests; Rotary Wings; Low Speed Stability; Aerodynamic Stability

19990052696 NASA Langley Research Center, Hampton, VA USA
Aircraft and Ground Vehicle Winter Runway Friction Assessment
Yager, Thomas J., NASA Langley Research Center, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 679-690; In English; See also 19990052675; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Some background information is given together with the scope and objectives of a 5-year, Joint Winter Runway Friction Measurement Program between the National Aeronautics & Space Administration (NASA), Transport Canada (TC), and the Federal Aviation Administration (FAA). Participants recently completed the fourth winter season of testing. The primary objective of this effort is to perform instrumented aircraft and ground vehicle tests aimed at identifying a common number that all the different ground vehicle devices would report. This number, denoted the International Runway Friction Index (IRFI) will be related to all types of aircraft stopping performance. The range of test equipment, the test sites, test results and accomplishments, the extent of the substantial friction database compiled, and future test plans will be described. Several related studies have also been implemented including the effects of contaminant type on aircraft impingement drag and the effectiveness of various runway and aircraft de-icing chemical types and application rates. New equipment and techniques to measure surface frictional properties are also described. The status of an international friction index calibration device for use in ensuring accuracy of ground vehicle friction measurements will also be discussed. NASA considers the success of this joint program critical in terms of ensuring adequate ground handling capability in adverse weather conditions for future aircraft being designed and developed as well as improving the safety of current aircraft ground operations.
Author
Friction Measurement; Ground Handling; Runways; Winter; Ground Tests; Surface Properties; Runway Conditions; Airfield Surface Movements; Ice

19990052964 Defence Science and Technology Organisation, Melbourne, Australia
MicroVAX/Bus Communication Testing Software for the Low Speed Wind Tunnel Data Acquisition System
Edwards, Craig D.; Feb. 1999; 37p; In English
Report No.(s): AD-A362582; DSTO-TN-0189; DODA-AR-010-843; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Software has been developed to test the communication between the MicroVAX computer and the bi-directional parallel data bus in the Low Speed Wind Tunnel (LSWT) data acquisition system. It enables reading any combination of data parameters from the bus for a user-defined number of iterations. An output file is created which contains the final values, average bus communication times associated with the read process and a statistical analysis of the recorded data. This report describes the operation of the software and presents results of tests performed on the existing data acquisition configuration.
DTIC
Wind Tunnel Tests; Software Engineering; Data Acquisition

19990053242 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA
General Aviation Airports: Unauthorized Land Use Highlights Need for Improved Oversight and Enforcement
May 1999; 30p; In English; Report to Congressional Requesters.
Report No.(s): AD-A363173; GAO/RCED-99-109; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To increase the capacity of the nation's airport facilities and maintain the aviation infrastructure, the federal government has made financial grants or transferred federal land to about 2,000 of the almost 18,000 general aviation airports in the USA Since 1982, the Federal Aviation Administration (FAA) has provided about $4.7 billion in financial grants to general aviation airports. About 350 such airports have received land that is surplus to federal needs, while about 100 have received land that was not considered surplus but was transferred to support the airports' needs. to receive this federal assistance, airports must agree to abide by a number of requirements designed to ensure that the public interest is served. Among other things, airports must obtain approval from FAA before altering the use or ownership of airport land and must use airport revenues only for their operation, maintenance, or development FAA is responsible for monitoring airports' compliance with these requirements and, when requirements are not met, for enforcement. As requested in the House Transportation and Infrastructure Committee Report on the Airport Improvement Program Reauthorization Act of 1998 this report evaluates (1) FAA'S monitoring of general aviation airports' compliance with federal land-use requirements and (2) FAA's use of enforcement tools to resolve cases of noncompliance. to obtain information on FAA'S oversight of land at general aviation airports, we visited 14 and surveyed the remaining 9 FAA field offices responsible for overseeing airports' compliance.
DTIC
Land Use; Airports; General Aviation Aircraft

19990053469 Air Force Research Lab., Human Effectiveness Directorate, Brooks AFB, TX USA
Transfer of Training Effectiveness in Flight Simulation: 1986 - 1997 ***Final Report, Jan. - Dec. 1997***
Carretta, Thomas R., Air Force Research Lab., USA; Dunlap, Ronald D., Air Force Research Lab., USA; Sep. 1998; 16p; In English
Contract(s)/Grant(s): AF Proj-1123
Report No.(s): AD-A362818; AFRL-HE-AZ-TR-1998-0078; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this report was to review recent studies regarding the effectiveness of flight simulators as augmentation for "hands-on" flying training. Simulation-based training has been proposed to reduce costs, extend aircraft life, maintain flying proficiency, and provide more effective training, especially in areas difficult to train in operational aircraft. A review of the literature from 1986 to 1997 identified 67 articles, conference papers, and technical reports regarding simulator flying training and transfer. of these, only 13 were related directly to transfer of training from the simulator to the aircraft. Studies of simulator effectiveness for training landing skills constituted a majority of the transfer studies, although a few examined other flying skills such as radial bombing accuracy and instrument and flight control. Results indicate that simulators are useful for training landing skills, bombing accuracy, and instrument and flight control. Generally, as the number of simulated sorties increases, performance improves, but this gain levels off after approximately 25 missions. Further, several studies indicate that successful transfer may not require high-fidelity simulators or whole-task training, thus reducing simulator development costs. Evaluation of this literature is difficult for many reasons. Typically, researchers fail to report sufficient detail regarding research methods, training characteristics, and simulator fidelity. In addition to these methodological concerns, there is a lack of true simulator-to-aircraft transfer studies involving complex pilot skills. This may be due to problems such as inadequate simulator design, cost, and availability, and access to simulators in operational flying units. Future directions in simulator transfer of training are discussed.
DTIC
Flight Simulators; Transfer of Training; Control Simulation; Flight Control; Motion Simulators; Education; Pilot Training; Computerized Simulation

12
ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

19990052643 NASA Goddard Space Flight Center, Greenbelt, MD USA
Management of Guidance, Navigation, and Control Technologies for Spacecraft Formations Under the NASA Cross Enterprise Technology Development Program (CETDP)
Hartman, Kathy, NASA Goddard Space Flight Center, USA; Weidow, David, NASA Goddard Space Flight Center, USA;

Hadaegh, Fred, Jet Propulsion Lab., California Inst. of Tech., USA; May 1999; In English; FMET, 18-20 May 1999, Greenbelt, MD, USA
Contract(s)/Grant(s): RTOP 570-632-10; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Breakthrough technology development is critical to securing the future of our space industry. The National Aeronautics and Space Administration (NASA) Cross-Enterprise Technology Development Program (CETDP) is developing critical space technologies that enable innovative and less costly missions, and spawn new mission opportunities through revolutionary, long-term, high-risk, high-payoff technology advances. The CETDP is a NASA-wide activity managed by the Advanced Technology and Mission Studies Division (AT&MS) at Headquarters Office of Space Science. Program management for CETDP is distributed across the multiple NASA Centers and draws on expertise throughout the Agency. The technology research activities are organized along Project-level divisions called thrust areas that are directly linked to the Agency's goals and objectives of the Enterprises: Earth Science, Space Science, Human Exploration and Development of Space; and the Office of the Chief Technologist's (OCT) strategic technology areas. Cross-Enterprise technology is defined as long-range strategic technologies that have broad potential to span the needs of more than one Enterprise. Technology needs are identified and prioritized by each of the primary customers. The thrust area manager (TAM) for each division is responsible for the ultimate success of technologies within their area, and can draw from industry, academia, other government agencies, other CETDP thrust areas, and other NASA Centers to accomplish the goals of the thrust area. An overview of the CETDP and description of the future directions of the thrust area called Distributed Spacecraft are presented in this paper. Revolutionary technologies developed within this thrust area will enable the implementation of a spatially distributed network of individual vehicles, or assets, collaborating as a single collective unit, and exhibiting a common system-wide capability to accomplish a shared objective. With such a capability, new Earth and space science measurement concepts become a reality.
Author
Aerospace Engineering; Guidance (Motion); Project Management; Navigation; NASA Programs; Earth Sciences

19990052674 NASA Goddard Space Flight Center, Greenbelt, MD USA
Janus Trajectory Design
Marr, Gregory C., NASA Goddard Space Flight Center, USA; 1999; In English; 1999 Flight Mechanics, 1999, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The proposed Janus Discovery Class mission will pass over opposite illuminated hemispheres of the planet Mercury on two successive flybys and will pass over a crater near Mercury's South geographic pole on the third and Final flyby. Three probes will be released by the main spacecraft prior to the first Mercury flyby to pass over Mercury's geographic poles and over the anti-Sunward side. The science team wanted to complete the first Mercury flyby within approximately 110 days of launch and the second Mercury flyby within approximately 365 days of launch. A direct trajectory was chosen which met the basic constraints of the science team while meeting the Discovery launch vehicle constraints. The objective of this paper is to serve as an overview of the Janus trajectory design. The proposal submitted in June 1998 provides a comprehensive overview of the Janus mission.
Author
Flyby Missions; Janus; Trajectories; Mercury (Planet)

19990053337 NASA Ames Research Center, Moffett Field, CA USA
Mars Characterization for Future Missions
Bridger, Alison F. C., San Jose State Univ., USA; Haberle, Robert M., NASA Ames Research Center, USA; 1999; 6p; In English
Contract(s)/Grant(s): NCC2-5280; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Annual simulations of Mars' atmosphere made with the NASA Ames Mars General Circulation Model have been used to extract and generate products to provide statistical products that detail the variability of Mars' atmosphere on fairly short time scales. These products are needed for the creation of a new version of Mars-GRAM, due for completion in June, 1999. The updated Mars-Gram, in turn, will provide guidance for forthcoming aerobraking and aerocapture activities. We have created files containing zonally-averaged fields (temperatures, densities, pressures, and winds, all on z-surfaces), as well as zonally-averaged diurnal and semidiurnal tidal amplitudes and phases. All fields represent a time averaged state (over either 5 or 30 sols), and all fields are available at each of 12 seasons for a Mars year (the seasons being 30deg of Ls apart). Files for low and moderate dust loading cases are liable via anonymous ftp. Files for a high dust case will be in place shortly.
Derived from text
Mars Missions; Diurnal Variations; Atmospheric General Circulation Models; Simulation; Atmospheric Circulation

19990053343 NASA Ames Research Center, Moffett Field, CA USA

Mars Aerocapture Studies for the Design Reference Mission ***Final Report***

Lyne, James Evans, Tennessee Univ., USA; Wercinski, Paul, NASA Ames Research Center, USA; Walberg, Gerald, North Carolina State Univ., USA; Jits, Roman, North Carolina State Univ., USA; [1997]; 15p; In English

Contract(s)/Grant(s): NCC2-5198; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The recent discovery of possible fossilized microbes in a Martian meteorite sample and the spectacular success of the Mars Pathfinder mission have substantially increased public interest and support for future robotic and manned exploration of Mars. NASA is currently refining a plan known as the Design Reference Mission (DRM) in which the first human landing would occur in 2014 after a series of cargo launches which would place surface systems and an Earth return vehicle at Mars two years prior to the crew's arrival. At each subsequent launch opportunity (which occur approximately every twenty-six months), an additional Earth return vehicle, surface facility and crew would depart for Mars, with each crew employing the systems launched during the previous opportunity. The mission design calls for a long-duration surface stay, rapid crew transits, in-situ manufacture of the Mars ascent propellant, nuclear thermal propulsion for the trans-Mars injection burn, and the use of aerocapture for both the cargo and crew vehicles at Mars.

Derived from text

Aerocapture; Mars Atmosphere; Microorganisms; Fossils; Mission Planning

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.

19990050929 Centro Tecnico Aerospacial, Inst. de Aeronautica e Espaco, San Jose dos Campos, Brazil

Panel Flutter Analyses for the First Brazilian Satellite Launcher

Damilano, J. G., Centro Tecnico Aerospacial, Brazil; Said, Jamil C., Centro Tecnico Aerospacial, Brazil; Azevedo, Joao L. F., Centro Tecnico Aerospacial, Brazil; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 201-210; In English; See also 19990050911

Contract(s)/Grant(s): CNPq-522413/96-0; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The paper describes panel flutter analyses performed in the context of the development of the first Brazilian satellite launcher (VLS). The development of the structural-dynamic and aerodynamic formulations are presented, together with their coupling to obtain the aeroelastic equations. Two different approaches were used to describe the aerodynamic loading, namely formulations based on the quasi-steady, linearized, small perturbation potential equation and on 1st-order piston theory. Results are presented for the VLS main aerodynamic fairing panels, both at zero incidence and at angle of attack. The effect of the inclusion of the unsteady aerodynamic terms in the aeroelastic results was also investigated. The overall conclusion of the study indicates that the VLS payload shroud would be free from panel flutter even with a considerable reduction in the fairing panel thickness.

Author

Panel Flutter; Flutter Analysis; Unsteady Aerodynamics; Aeroelasticity; Aerodynamic Loads; Shrouds; Fairings

19990052705 Aerospace Corp., Los Angeles, CA USA

Stiffness and Damping Effects of Launch Vehicle Aeroelastic Coupling

Dotson, K. W., Aerospace Corp., USA; Baker, R. L., Aerospace Corp., USA; Sako, B. H., Aerospace Corp., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 811-820; In English; See also 19990052675; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The self-sustained coupling of structural responses with transonic flow state transitions at the nose of launch vehicle payload fairings can be analyzed by solving the nonlinear system equation of motion based on the force response relationship and the periodicity condition. The traditional analysis approach for this phenomenon, however, linearizes the equation of motion by converting the alternating flow forces into an aerodynamic damping term and defines a stability criterion as the response amplitude that yields zero net system damping. This work clarifies the relationship between the new and traditional methods, and compares results and conclusions. The feasibility of modifying a launch vehicle buffet analysis (of random fluctuations caused by turbulent flow) to include aeroelastic coupling effects is also explored. The aerodynamic stiffness and damping terms formulated are consis-

tent with trends observed in wind tunnel test data. It is shown, however, that the modified buffet analysis approach can be inaccurate, particularly when the aeroelastic coupling contribution does not dominate the system response.
Author
Aeroelasticity; Buffeting; Equations of Motion; Stiffness; Dynamic Structural Analysis; Vibration Damping; Launch Vehicles; Structural Stability

16
SPACE TRANSPORTATION

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

19990052631 NASA Marshall Space Flight Center, Huntsville, AL USA
Evaluation of MPLM Design and Mission 6A Coupled Loads Analyses
Bookout, Paul S., NASA Marshall Space Flight Center, USA; Ricks, Ed, NASA Marshall Space Flight Center, USA; February 1999; 5p; In English; International Modal Analysis, Feb. 1999, Kissimmee, FL, USA
Contract(s)/Grant(s): RTOP 477-72-62
Report No.(s): IMAC-1999-34; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Through the development of a space shuttle payload, there are usually several coupled loads analyses (CLA) performed: preliminary design, critical design, final design and verification loads analysis (VLA). A final design CLA is the last analysis conducted prior to model delivery to the shuttle program for the VLA. The finite element models used in the final design CLA and the VLA are test verified dynamic math models. Mission 6A is the first of many flights of the Multi-Purpose Logistics Module (MPLM). The MPLM was developed by Alenia Spazio S.p.A. (an Italian aerospace company) and houses the International Standard Payload Racks (ISPR) for transportation to the space station in the shuttle. Marshall Space Flight Center (MSFC), the payload integrator of the MPLM for Mission 6A, performed the final design CLA using the M6.OZC shuttle data for liftoff and landing conditions using the proper shuttle cargo manifest. Alenia performed the preliminary and critical design CLAs for the development of the MPLM. However, these CLAs did not use the current Mission 6A cargo manifest. An evaluation of the preliminary and critical design performed by Alenia and the final design performed by MSFC is presented.
Author
Loads (Forces); Logistics; Space Shuttle Payloads; Finite Element Method; Dynamic Models

19990052656 NASA Kennedy Space Center, Cocoa Beach, FL USA
Debris/Ice/TPS Assessment and Integrated Photographic Analysis of Shuttle Mission STS-95 ***Final Report, 28 Oct. - 10 Nov. 1998***
Katnik, Gregory N., NASA Kennedy Space Center, USA; February 1999; 85p; In English; Original contains color illustrations
Report No.(s): NASA/TM-1999-208541; NAS 1.15:208541; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A debris/ice/thermal protection system assessment and integrated photographic analysis was conducted for Shuttle mission STS-95. Debris inspections of the flight elements and launch pad were performed before and after launch. Icing conditions on the External Tank were assessed by the use of computer programs and infrared scanned data during cryogenic loading of the vehicle, followed by on-pad visual inspection. High speed photography of the launch was analyzed to identify ice/debris sources and evaluate potential vehicle damage and/or in-flight anomalies. This report documents the ice/debris/thermal protection system conditions and integrated photographic analysis of Space Shuttle mission STS-95 and the resulting effect on the Space Shuttle Program.
Author
Debris; High Speed Photography; Space Missions; Space Shuttles; Ice Prevention; Deicing; Cryogenics

19990053131 NASA Johnson Space Center, Houston, TX USA
STS-96 FD Highlights and Crew Activities Report: Flight Day 10
Jun. 05, 1999; In English; Videotape: 15 min. 57 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-1999074605; BRF-1418 J; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

On this tenth day of the STS-96 Discovery mission, the flight crew, Commander Kent V. Rominger, Pilot Rick D. Husband, and Mission Specialists Ellen Ochoa, Tamara E. Jernigan, Daniel T. Barry, Julie Payette, and Valery Ivanovich Tokarev are seen

making final preparation for their return to Earth. Rominger Husband, and Ochoa checkout the flight control systems, perform hot-fired tests and verify the performance of Discovery's small steering jets. Jernigan and Tokarev stow all the equipment used in the mission. Payette deploys a small student-built payload called STARSHINE. The crew also tests all the communications channels.
CASI
Discovery (Orbiter); Spacecrews; Manned Space Flight; Crew Procedures (Inflight); Return to Earth Space Flight

19990053264 NASA Johnson Space Center, Houston, TX USA
STS-96 FD Highlights and Crew Activities Report: Flight Day 09
Jun. 04, 1999; In English; Videotape: 14 min. 15 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-1999068288; BRF-1418I; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

On this ninth day of the STS-96 Discovery mission, the flight crew, Commander Kent V. Rominger, Pilot Rick D. Husband, and Mission Specialists Ellen Ochoa, Tamara E. Jernigan, Daniel T. Barry, Julie Payette, and Valery Ivanovich Tokarev are seen as they prepare to depart from the International Space Station. After the undocking of the spacecraft, Husband navigated the spacecraft around the International Space Station. Images of the crew removing centerline cameras, tracking the solar arrays and beautiful panoramic views of the Station above the Earth are seen.
CASI
Discovery (Orbiter); Spacecrews; Manned Space Flight; Return to Earth Space Flight; Crew Procedures (Inflight)

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.

19990049434 GenCorp Aerojet, Azusa, CA USA
Intergrated Advanced Microwave Sounding Unit-A (AMSU-A) Performance Verification Reports: Initial Comprehensive Performance Test Report, P/N: 1356006-1-IT, S/N: 202/A2
Platt, R., GenCorp Aerojet, USA; November 1998; 270p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1998-209217; NAS 1.26:209217; Rept-11334; CDRL-208; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This Performance Verification Report is for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A), Initial Comprehensive Performance Test Report, P/N 1356006- 1 -IT, S/N: 202/A2.
Author
Advanced Microwave Sounding Unit; Performance Tests; Procedures

19990049435 GenCorp Aerojet, Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Performance Verification Reports: Initial Comprehensive Performance Test Report, P/N: 1356008-1-IT, S/N: 202/A1
Haigh, R., GenCorp Aerojet, USA; November 1998; 470p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1998-209216; NAS 1.26:209216; Rept-11335; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

This is the Performance Verification Report, Initial Comprehensive Performance Test Report, P/N 1356008-1-IT, S/N 202/A1, for the Integrated Advanced Microwave Sounding Unit (AMSU-A).
Author
Advanced Microwave Sounding Unit; Performance Tests; Earth Observing System (EOS)

19990052584 NASA Glenn Research Center, Cleveland, OH USA
Electrical Breakdown of Anodized Structures in a Low Earth Orbital Environmental
Galofaro, J. T., NASA Glenn Research Center, USA; Doreswamy, C. V., Tuskegee Inst., USA; Vayner, B. V., Ohio Aerospace

Inst., USA; Snyder, D. B., NASA Glenn Research Center, USA; Ferguson, D. C., NASA Glenn Research Center, USA; April 1999; 14p; In English
Contract(s)/Grant(s): RTOP 632-1A-10
Report No.(s): NASA/TM-1999-209044; NAS 1.15:209044; E-11574; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A comprehensive set of investigations involving arcing on a negatively biased anodized aluminum plate immersed in a low density argon plasma at low pressures (P(sub O), 7.5 x 10(exp -5) Torr) have been performed. These arcing experiments were designed to simulate electrical breakdown of anodized coatings in a Low Earth Orbital (LEO) environment. When electrical breakdown of an anodized layer occurs, an arc strikes, and there is a sudden flux of electrons accelerated into the ambient plasma. This event is directly followed by ejection of a quasi-neutral plasma cloud consisting of ejected material blown out of the anodized layer. Statistical analysis of plasma cloud expansion velocities have yielded a mean propagation velocity, v = (19.4 +/- 3.5) km/s. As the plasma cloud expands into the ambient plasma, energy in the form of electrical noise is generated. The radiated electromagnetic noise is detected by means of an insulated antenna immersed in the ambient plasma. The purpose of the investigations is (1) to observe and record the electromagnetic radiation spectrum resulting from the arcing process. (2) Make estimates of the travel time of the quasi-neutral plasma cloud based on fluctuations to several Langmuir probes mounted in the ambient plasma. (3) to study induced arcing between two anodized aluminum structures in close proximity.
Author
Anodizing; Plasma Heating; Space Plasmas; Electromagnetic Noise; Electromagnetic Radiation; Earth Orbital Environments

19990052641 NASA Langley Research Center, Hampton, VA USA
Application of Least Mean Square Algorithms to Spacecraft Vibration Compensation
Woodard , Stanley E., NASA Langley Research Center, USA; Nagchaudhuri, Abhijit, Duke Univ., USA; Journal of the Astronautical Sciences; March 1998; Volume 46, No. 1, pp. 83-90; In English; Space Flight Mechanics, Feb. 1995, Albuquerque, NM, USA; Sponsored by American Astronautical Society, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper describes the application of the Least Mean Square (LMS) algorithm in tandem with the Filtered-X Least Mean Square algorithm for controlling a science instrument's line-of-sight pointing. Pointing error is caused by a periodic disturbance and spacecraft vibration. A least mean square algorithm is used on-orbit to produce the transfer function between the instrument's servo-mechanism and error sensor. The result is a set of adaptive transversal filter weights tuned to the transfer function. The Filtered-X LMS algorithm, which is an extension of the LMS, tunes a set of transversal filter weights to the transfer function between the disturbance source and the servo-mechanism's actuation signal. The servo-mechanism's resulting actuation counters the disturbance response and thus maintains accurate science instrumental pointing. A simulation model of the Upper Atmosphere Research Satellite is used to demonstrate the algorithms.
Author
Mean Square Values; Least Squares Method; Line of Sight; Algorithms; Servomechanisms

19990052720 NASA Goddard Space Flight Center, Greenbelt, MD USA
Attitude Determination Using Two Vector Measurements
Markley, F. Landis, NASA Goddard Space Flight Center, USA; 1998; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many spacecraft attitude determination methods use exactly two vector measurements. The two vectors are typically the unit vector to the Sun and the Earth's magnetic field vector for coarse "sun-mag" attitude determination or unit vectors to two stars tracked by two star trackers for fine attitude determination. TRIAD, the earliest published algorithm for determining spacecraft attitude from two vector measurements, has been widely used in both ground-based and onboard attitude determination. Later attitude determination methods have been based on Wahba's optimality criterion for n arbitrarily weighted observations. The solution of Wahba's problem is somewhat difficult in the general case, but there is a simple closed-form solution in the two-observation case. This solution reduces to the TRIAD solution for certain choices of measurement weights. This paper presents and compares these algorithms as well as sub-optimal algorithms proposed by Bar-Itzhack, Harman, and Reynolds. Some new results will be presented, but the paper is primarily a review and tutorial.
Author
Algorithms; Satellite Orientation; Three Axis Stabilization; Satellite Attitude Control; Optimization

19990052761 NASA Glenn Research Center, Cleveland, OH USA

Summary Report of Mission Acceleration Measurements for STS-89: Launched January 22, 1998

Hrovat, Kenneth, Tal-Cut Co., USA; McPherson, Kevin, NASA Glenn Research Center, USA; June 1999; 78p; In English; CD-ROM containing full text document

Contract(s)/Grant(s): NAS3-27254; RTOP 101-46-0A

Report No.(s): NASA/TM-1999-209084; NAS 1.15:209084; E-11667; NONP-NASA-CD-1999074852; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Support of microgravity research on the 89th flight of the Space Transportation System (STS-89) and a continued effort to characterize the acceleration environment of the Space Shuttle Orbiter and the Mir Space Station form the basis for this report. For the STS-89 mission, the Space Shuttle Endeavour was equipped with a Space Acceleration Measurement System (SAMS) unit, which collected more than a week's worth of data. During docked operations with Mir, a second SAMS unit collected approximately a day's worth of data yielding the only set of acceleration measurements recorded simultaneously on the two spacecraft. Based on the data acquired by these SAMS units, this report serves to characterize a number of acceleration events and quantify their impact on the local nature of the accelerations experienced at the Mechanics of Granular Materials (MGM) experiment location. Crew activity was shown to nearly double the median root-mean-square (RMS) acceleration level calculated below 10 Hz, while the Enhanced Orbiter Refrigerator/Freezer operating at about 22 Hz was a strong acceleration source in the vicinity of the MGM location. The MGM science requirement that the acceleration not exceed q I mg was violated numerous times during their experiment runs; however, no correlation with sample instability has been found to this point. Synchronization between the SAMS data from Endeavour and from Mir was shown to be close much of the time, but caution with respect to exact timing should be exercised when comparing these data. When orbiting as a separate vehicle prior to docking, Endeavour had prominent structural modes above 3 Hz, while Mir exhibited a cluster of modes around 1 Hz. When mated, a transition to common modes was apparent in the two SAMS data sets. This report is not a comprehensive analysis of the acceleration data, so those interested in further details should contact the Principal Investigator Microgravity Services team at the National Aeronautics and Space Administration's John H. Glenn Research Center.

Author

Microgravity; Acceleration Measurement; Refrigerators; Space Transportation System; Endeavour (Orbiter); NASA Programs

19990052855 NASA Johnson Space Center, Houston, TX USA

Phase 1 Program Joint Report

Nield, George C., Editor, NASA Johnson Space Center, USA; Vorobiev, Pavel Mikhailovich, Editor, Russian Space Agency, Russia; January 1999; 322p; In English; In Russian

Report No.(s): NASA/SP-1999-6108; S-845; NAS 1.21:6108; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

This report consists of inputs from each of the Phase I Program Joint Working Groups. The Working Groups were tasked to describe the organizational structure and work processes that they used during the program, joint accomplishments, lessons learned, and applications to the International Space Station Program. This report is a top-level joint reference document that contains information of interest to both countries.

Author

International Space Station; Space Shuttle Missions; Astronaut Performance; Mir Space Station; Spacecrews

19990053234 General Accounting Office, National Security and International Affairs Div., Washington, DC USA

Satellite Control Systems: Opportunity for DOD to Implement Space Policy and Integrate Capabilities

Thompson, Homer H.; Elgas, James A.; May 1999; 29p; In English

Report No.(s): AD-A363241; GAO/NSIAD-99-81; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As requested, we (1) reviewed the Department of Defense's (DOD) progress in integrating and improving its satellite control capabilities and in fostering integrated and interoperable satellite control within the government, as directed by the 1996 national space policy and (2) determined whether opportunities exist for DOD to standardize its satellite control capabilities by using commercial products and practices.

DTIC

Satellite Networks; Satellite Control

19
SPACECRAFT INSTRUMENTATION

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

19990052670 GenCorp Aerojet, Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Performance Verification Report METSAT AMSU-A2 Receiver Assembly: PN/1356441-1, S/N 106 ***Final Report***
Kapper, R., GenCorp Aerojet, USA; September 1998; 124p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1998-208627; NAS 1.26:208627; CDRL-208; AEROJET-11225; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This is the Performance Verification Report, METSAT AMSU-A2 Receiver Assembly, P/N 1356441-1, S/N 106 for the EOS/AMSU-A1 for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).
Author
Advanced Microwave Sounding Unit; Earth Observing System (EOS); Receivers

19990052764 NASA Goddard Space Flight Center, Greenbelt, MD USA
Autonomous Attitude Sensor Calibration (ASCAL)
Peterson, Chariya, Computer Sciences Corp., USA; Rowe, John, Computer Sciences Corp., USA; Mueller, Karl, NASA Goddard Space Flight Center, USA; Ziyad, Nigel, NASA Goddard Space Flight Center, USA; Dec. 10, 1998; In English; Flight Mechanics, 18-19 May 1999, Greenbelt, MD, USA
Contract(s)/Grant(s): NAS9-98100; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper, an approach to increase the degree of autonomy of flight software is proposed. We describe an enhancement of the Attitude Determination and Control System by augmenting it with self-calibration capability. Conventional attitude estimation and control algorithms are combined with higher level decision making and machine learning algorithms in order to deal with the uncertainty and complexity of the problem.
Author
Calibrating; Applications Programs (Computers); Attitude (Inclination); Flight Control; Autonomy; Augmentation

19990053411 Aerospace Corp., Technology Operations, El Segundo, CA USA
High-Resolution Ozone Imager (HIROIG) ***Final Report***
McKenzie, D. L.; Crawford, K. B.; Gutierrez, D. J.; Hecht, J. H.; Katz, N.; Jan. 10, 1998; 30p; In English
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A362746; TR-98(1306)-2; SMC-TR-99-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The High-Resolution Ozone Imager (HIROIG) is a hyperspectral UV imaging spectrograph/polarimeter designed for space flight with the specific purpose of searching for direct evidence of stratospheric ozone depletion caused by launch-vehicle exhaust. Solid-rocket motors deposit several tons of chlorine, primarily in the form of HCl, per kilometer in the stratosphere. Theoretical analysis and simulations have suggested that a significant amount of HCl may be converted into active chlorine, which can destroy ozone. HIROIG looks for stratospheric ozone depletion by measuring the spectrum of solar UV radiation backscattered by the atmosphere. HIROIG's primary mission places several unique demands on the instrument; it has 2 km spatial resolution, continuous spectral coverage of the 270-370 nm wavelength band, and, in order to distinguish scattering by launch-plume aerosols from atmospheric Rayleigh scattering, it can completely characterize the polarization of the incident light. A measurement sequence over a launch site requires collection of approximately 40 Mbytes of data in about 2 min. A prototype instrument has been built and deployed for ground-based field operations, and an engineering model of the full instrument, including flight-quality optics, has been designed and partially assembled.
DTIC
Space Missions; Ozone Depletion; Imaging Techniques; Polarized Light; Atmospheric Composition; Aerosols

20
SPACECRAFT PROPULSION AND POWER

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

19990049416 Pennsylvania State Univ., Dept. of Mechanical and Nuclear Engineering, University Park, PA USA
Main Chamber and Preburner Injector Technology
Santoro, Robert J., Pennsylvania State Univ., USA; Merkle, Charles L., Pennsylvania State Univ., USA; March 1999; 272p; In English; Original contains color illustrations
Contract(s)/Grant(s): NCC8-46; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This document reports the experimental and analytical research carried out at the Penn State Propulsion Engineering Research Center in support of NASA's plan to develop advanced technologies for future single stage to orbit (SSTO) propulsion systems. The focus of the work is on understanding specific technical issues related to bi-propellant and tri-propellant thrusters. The experiments concentrate on both cold flow demonstrations and hot-fire uni-element tests to demonstrate concepts that can be incorporated into hardware design and development. The analysis is CFD-based and is intended to support the design and interpretation of the experiments and to extrapolate findings to full-scale designs. The research is divided into five main categories that impact various SSTO development scenarios. The first category focuses on RP-1/gaseous hydrogen (GH2)/gaseous oxygen (GO2) tri-propellant combustion with specific emphasis on understanding the benefits of hydrogen addition to RP-1/oxygen combustion and in developing innovative injector technology. The second category investigates liquid oxygen (LOX)/GH2 combustion at main chamber near stoichiometric conditions to improve understanding of existing LOX/GH2 rocket systems. The third and fourth categories investigate the technical issues related with oxidizer-rich and fuel-rich propulsive concepts, issues that are necessary for developing the full-flow engine cycle. Here, injector technology issues for both LOX/GH2 and LOX/RP-1 propellants are examined. The last category, also related to the full-flow engine cycle, examines injector technology needs for GO2/GH2 propellant combustion at near-stoichiometric conditions for main chamber application.
Author
Injectors; Propulsion System Configurations; Liquid Rocket Propellants; Propellant Combustion; Propulsion System Performance; Combustion Chambers; Fuel Injection

19990051032 NASA Glenn Research Center, Cleveland, OH USA
High-Area-Ratio Rocket Nozzle at High Combustion Chamber Pressure: Experimental and Analytical Validation
Jankovsky, Robert S., NASA Glenn Research Center, USA; Smith, Timothy D., NASA Glenn Research Center, USA; Pavli, Albert J., NYMA, Inc., USA; June 1999; 56p; In English
Contract(s)/Grant(s): RTOP 632-1B-1B
Report No.(s): NASA/TP-1999-208522; NAS 1.60:208522; E-11265; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Experimental data were obtained on an optimally contoured nozzle with an area ratio of 1025:1 and on a truncated version of this nozzle with an area ratio of 440:1. The nozzles were tested with gaseous hydrogen and liquid oxygen propellants at combustion chamber pressures of 1800 to 2400 psia and mixture ratios of 3.89 to 6.15. This report compares the experimental performance, heat transfer, and boundary layer total pressure measurements with theoretical predictions of the current Joint Army, Navy, NASA, Air Force (JANNAF) developed methodology. This methodology makes use of the Two-Dimensional Kinetics (TDK) nozzle performance code. Comparisons of the TDK-predicted performance to experimentally attained thrust performance indicated that both the vacuum thrust coefficient and the vacuum specific impulse values were approximately 2.0-percent higher than the turbulent prediction for the 1025:1 configurations, and approximately 0.25-percent higher than the turbulent prediction for the 440:1 configuration. Nozzle wall temperatures were measured on the outside of a thin-walled heat sink nozzle during the test fittings. Nozzle heat fluxes were calculated front the time histories of these temperatures and compared with predictions made with the TDK code. The heat flux values were overpredicted for all cases. The results range from nearly 100 percent at an area ratio of 50 to only approximately 3 percent at an area ratio of 975. Values of the integral of the heat flux as a function of nozzle surface area were also calculated. Comparisons of the experiment with analyses of the heat flux and the heat rate per axial length also show that the experimental values were lower than the predicted value. Three boundary layer rakes mounted on the nozzle exit were used for boundary layer measurements. This arrangement allowed total pressure measurements to be obtained at 14 different distances from the nozzle wall. A comparison of boundary layer total pressure profiles and analytical predictions show good

agreement for the first 0.5 in. from the nozzle wall; but the further into the core flow that measurements were taken, the more that TDK overpredicted the boundary layer thickness.
Author
Boundary Layer Thickness; Rocket Nozzles; Combustion Chambers; Heat Transfer; Pressure Distribution; Pressure Measurement; Flux (Rate); Heat Flux; Turbulence

19990052737 National Aerospace Lab., Tokyo Japan
Suppression of Super-Synchronous Vibration of the LE-7 LOX Pump Inducer
Watanabe, M.; Hasegawa, S.; Watanabe, Y.; Hashimoto, T.; Yoshida, M.; Jul. 1998; 26p; In Japanese; Portions of this document are not fully legible
Report No.(s): PB99-141525; NAL-TR-1359; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
During development of the liquid oxygen turbopump of the LE-7 engine, super-synchronous shaft vibrations with a frequency of about 1.0 to about 1.2 times that of the turbopump shaft rotational speed were often observed as the pump inlet pressure decreased. From the investigations of the cavitating inducer, it was shown that those super-synchronous vibrations were caused by rotating cavitation and it deeply related with tip cavitation in the inducer.
NTIS
Liquid Oxygen; Cavitation Flow; Turbine Pumps

19990052765 NASA Glenn Research Center, Cleveland, OH USA
Preliminary Results of Solid Gas Generator Micropropulsion
deGroot, Wilhelmus A., DYNACS Engineering Co., Inc., USA; Reed, Brian D., NASA Glenn Research Center, USA; Brenizer, Marshall, Massachusetts Inst. of Tech., USA; April 1999; 12p; In English; Joint Propulsion, 13-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 632-1B-1B
Report No.(s): NASA/TM-1999-208842; NAS 1.15:208842; E-11455; AIAA Paper 98-3225; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A decomposing solid thruster concept, which creates a more benign thermal and chemical environment than solid propellant combustion, while maintaining, performance similar to solid combustion, is described. A Micro-Electro-Mechanical (MEMS) thruster concept with diode laser and fiber-optic initiation is proposed, and thruster components fabricated with MEMS technology are presented. A high nitrogen content solid gas generator compound is evaluated and tested in a conventional axisymmetric thrust chamber with nozzle throat area ratio of 100. Results show incomplete decomposition of this compound in both low pressure (1 kPa) and high pressure (1 MPa) environments, with decomposition of up to 80% of the original mass. Chamber pressures of 1.1 MPa were obtained, with maximum calculated thrust of approximately 2.7 N. Resistively heated wires and resistively heated walls were used to initiate decomposition. Initiation tests using available lasers were unsuccessful, but infrared spectra of the compound show that the laser initiation tests used inappropriate wavelengths for optimal propellant absorption. Optimal wavelengths for laser ignition were identified. Data presented are from tests currently in progress. Alternative solid gas generator compounds are being evaluated for future tests.
Author
Combustion; Decomposition; Gas Generators; Microthrust; Propellants; Spacecraft Propulsion; Thrust Chambers; Microelectromechanical Systems; Solidified Gases

19990052891 NASA Marshall Space Flight Center, Huntsville, AL USA
Antimatter Production for Near-Term Propulsion Applications
Schmidt, G. R., NASA Marshall Space Flight Center, USA; Gerrish, H. P., NASA Marshall Space Flight Center, USA; Martin, J. J., NASA Marshall Space Flight Center, USA; Smith, G. A., Pennsylvania State Univ., USA; Meyer, K. J., Pennsylvania State Univ., USA; 1999; 12p; In English; Joint Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-2691; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
The superior energy density of antimatter has often been pointed to as the source of energy for propulsion. However, the limited capacity and very low efficiency of present-day antiproton production methods suggest that antimatter may be too costly to consider for near-term propulsion applications. We address this issue by assessing the antimatter requirements for six different types of propulsion concepts, including two in which antiprotons are used to drive energy release from combined fission/fusion. These requirements are compared against the capacity of both the current antimatter production infrastructure and the improved capabilities which could exist within the early part of next century. Results show that although it may be impractical to consider

systems which rely on antimatter as the sole source of propulsive energy. The requirements for propulsion based on antimatter-assisted fission/fusion do fall within projected near-term production capabilities. In fact, such systems could feasibly support interstellar precursor missions and omniplanetary spaceflight with antimatter costs ranging up to $60 million per mission.
Author
Matter-Antimatter Propulsion; Antiprotons; Antimatter; Flux Density; Fission; Fusion

23
CHEMISTRY AND MATERIALS (GENERAL)

19990052639 Sandia National Labs., Albuquerque, NM USA
III-Nitride Dry Etching - Comparison of Inductively Coupled Plasma Chemistries; Journal of Vacuum Science and Technology
Abernathy, C. R.; Cho, H.; Donovan, S. M.; Hahn, Y. B.; Han, J.; Nov. 10, 1998; 1p; In English
Report No.(s): DE00-001942; SAND98-2514J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A systematic study of the etch characteristics of GaN, AlN and InN has been performed with boron halides- (BI3 and BBr3) and interhalogen- (ICl and IBr) based Inductively Coupled Plasmas. Maximum etch selectivities of 100:1 were achieved for InN over both GaN and AlN in the BI3 mixtures due to the relatively high volatility of the InN etch products and the lower bond strength of InN. Maximum selectivities of 14 for InN over GaN and is greater than 25 for InN over AlN were obtained with ICl and IBr chemistries. The etched surface morphologies of GaN in these four mixtures are similar or better than those of the control sample.
NTIS
Etching; Plasmas (Physics); Comparison; Aluminum Nitrides; Indium Compounds; Iodine Compounds; Gallium Nitrides

19990052640 Sandia National Labs., Albuquerque, NM USA
Rapid Melt and Resolidification of Surface Layers Using Intense Pulsed Ion Beams *Final Report*
Renk, T. J.; Oct. 02, 1998; 350p; In English
Report No.(s): DE00-000703; SAND98-2101; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The emerging technology of pulsed intense ion beams has been shown to lead to improvements in surface characteristics such as hardness and wear resistance, as well as mechanical smoothing. We report on the use of this technology to systematically study improvements to three types of metal alloys - aluminum, iron, and titanium. Ion beam treatment produces a rapid melt and resolidification (RMR) of the surface layer. In the case of a predeposited thin-film layer, the beam mixes this layer into the substrate, leading to improvements that can exceed those produced by treatment of the alloy alone, In either case, RMR results in both crystal refinement and metastable state formation in the treated surface layer not accessible by conventional alloy production.
NTIS
Ion Beams; Solidification; Surface Layers; Melting

19990052982 Hughes Associates, Inc., Baltimore, MD USA
An Evaluation of the International Maritime Organization's Gaseous Agents Test Protocol with Halocarbon Agents and an Inert Gas, 180 Deg Nozzles, and Low Temperature Conditioned Cylinders *Final Report*
Back, G. G.; Forssell, E. W.; Beyler, C. L.; DiNenno, P. J.; Hansen, R.; Dec. 1998; 318p; In English
Contract(s)/Grant(s): DTCG39-97-F-E00150
Report No.(s): AD-A360963; R/DC-25/98/UDI-103; USCG-D-02-99; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

This report provides an evaluation of four gaseous halon alternatives (CEA-308, NAF-SIII, FM-200, and Inergen) in full-scale machinery space applications. The primary objective of this investigation was to evaluate the IMO's test protocol for gaseous halon alternative fire extinguishing systems for use with an "inert" gaseous agent (Inergen), with discharge systems containing 180 deg (Sidewall) nozzles, and with agent discharge cylinders conditioned to low temperatures. The evaluation focused on whether the protocol requires modification to properly evaluate these systems.
DTIC
Fire Extinguishers; Alternatives; Halocarbons; Rare Gases; Inlet Nozzles

19990053352 Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan
The Reports of Institute of Advanced Material Study, Kyushu University, Volume 12
1998; ISSN 0914-3793; 99p; In English; In Japanese; See also 19990053353 through 19990053360; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

Contents include the following: Computation and comparison for heat and fluid flow using a QUICK and other different schemes. Physical properties of silicon estimated by molecular dynamics under a condition of constant temperature and pressure. Synthesis and complexation behavior of 2-[N, N-Bis(1-naphthylmethil)-aminomethyl]-18-crown-6. Step coverage simulation for non-linear surface reaction. Gravity effect on the compositional separation by thermal diffusion in a rectangular flow channel. Short-hot-wire method for measuring thermal conductivity of a fine fiber. Synthetic studies on dolabellane diterponoids. Synthesis of 10-EPI-clavudiol A, an epimer of marine dolabellanoid. Structure of carbon materials for an anode of lithium ion battery.
CASI
Electric Batteries; Fluid Flow; Gravitation; Surface Reactions; Thermal Conductivity

19990053355 Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan
Synthesis and Complexation Behavior of 2-[N,N-Bis(1 - Naphthylmethyl)- Aminomethyl]-18-Crown-6
Kubo, Kanji, Kyushu Univ., Japan; Sakaguchi, Seiji, Kanagawa Univ., Japan; Sakurai, Tadamitsu, Kanagawa Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 1998; Volume 12, No. 1, pp. 11-14; In English; See also 19990053352; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

2-[N,N-Bisf 1-naphthylmethyl)-aminomethyl]-18-crown-6 (3) gave intramolecular exciplex fluorescence, showing that the excited naphthalene chromophore was quenched by the nitrogen atom in the armed crown unit. The armed crown ether (3) was found to display unique photophysical properties in the presence of metal salts. Complexation of 3 with Zn(2+) increased the fluorescence intensity of the host by a factor of 2.4. H-1 and C-13 NMR analyses of this complexation behavior revealed that Zn(2+) strongly coordinates with the armed crown nitrogen to cause a dramatic decrease in an intramolecular charge-transfer character.
Author
Synthesis (Chemistry); Ethers; Naphthalene; Nitrogen Atoms; Fluorescence

24
COMPOSITE MATERIALS

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

19990052592 Federal Energy Technology Center, Morgantown, WV USA
Task 6.7.3 - Interfacial Mass Transport Effects in Composite Materials
Jan W. Nowok,; Feb. 01, 1998; 10p; In English
Report No.(s): DE00-001678; DE-FC21-93MC30097-52; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Advanced metal-matrix composites (MMC) consisting of titanium-based alloys possess some unique mechanical, physical, and chemical characteristics that make them highly desirable for aircraft and gas turbine engines. The main factors that affect materials processing and, further, the nature of a metal-ceramic interface, its structure, and morphological stability is liquid surface mass transport related to adhesional wetting (physical effect) and reactive wetting (chemical effect). Surfaces and interfaces dominate many of the technologically important processes in composite materials such as liquid-solid sintering and joining. The objective of this work is three fold: (1) to get insight into the role of the nonstoichiometry of chemical composition in ceramic materials used as reinforcement components in MMC processing, (2) to extend previous energetic analysis of mass transport phenomena to wetting behavior between liquid metal and the quasi-solidlike skin resulting from the presolidification of liquid on nonstoichiometric solids on a scale of interatomic distance, and (3) to provide experimental verification of our concept.
NTIS
Mass Transfer; Metal Matrix Composites

19990052646 NASA Glenn Research Center, Cleveland, OH USA

Effects of Fiber/Matrix Interface and its Composition on Mechanical Properties of Hi-Nicalon/Celsian Composites

Bansal, Narottam P., NASA Glenn Research Center, USA; Eldridge, Jeffrey I., NASA Glenn Research Center, USA; March 1999; 14p; In English; Composite Materials, 5-9 Jul. 1999, Paris, France; Sponsored by International Committee on Composite Materials, Unknown; Meeting sponsored in part by LGM and 3W

Contract(s)/Grant(s): RTOP 523-21-13

Report No.(s): NASA/TM-1999-209057; E-11593; NAS 1.15:209057; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To evaluate the effects of fiber coatings on composite mechanical properties. unidirectional celsian matrix composites reinforced with uncoated Hi-Nicalon fibers and those precoated with a dual BN/SiC layer in two separate batches (batch 1 and batch 2) were tested in three-point flexure. The uncoated-fiber reinforced composites showed catastrophic failure with strength of 210+/-35 MPa and a flat fracture surface. In contrast, composites reinforced with coated fibers exhibited graceful failure with extensive fiber pullout and showed significantly higher ultimate strengths, 904 and 759 MPa for the batch 1 and 2 coatings. respectively. Fiber push-in tests and microscopic examination indicated no chemical reaction at the uncoated or coated fiber-matrix interfaces that might be responsible for fiber strength degradation. Instead, the low strength of composite with uncoated fibers was due to degradation of the fiber strength from mechanical damage during composite processing. Despite identical processing, the first matrix cracking stresses (Sigma(sub mc)) of the composites reinforced with fibers coated in batch 1 and batch 2 were quite different, 436 and 122 MPa, respectively. The large difference in Sigma(sub mc) of the coated-fiber composites was attributed to differences in fiber sliding stresses (Tau(sub friction)), 121.2+/-48.7 and 10.4+/-3.1 MPa, respectively. for the two composites as determined by the fiber push-in method. Such a large difference in Tau(sub friction). for the two composites was found to be due to the difference in the compositions of the interface coatings. Scanning Auger microprobe analysis revealed the presence of carbon layers between the fiber and BN. and also between the BN and SiC coatings in the composite showing lower Tau(sub friction). This resulted in lower Sigma(sub mc) in agreement with the ACK theory. The ultimate strengths of the two composites depended mainly on the fiber volume fraction and were not significantly effected by Tau(sub friction) values, as expected. The poor reproducibility of the fiber coating composition between the two batches was judged to be the primary source of the large differences in performance of the two composites.

Author

Fiber-Matrix Interfaces; Chemical Reactions; Carbon Fibers; Silicon Carbides; Fiber Strength; Damage

19990052698 Bath Univ., Dept. of Mechanical Engineering, Bath, UK

Ply Angle Optimization of Non-Uniform Composite Beams Subject to Aeroelastic Constraints

Evrard, T., Bath Univ., UK; Butler, R., Bath Univ., UK; Hughes, S. W., Bath Univ., UK; Banerjee, J. R., City Univ., UK; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 699-708; In English; See also 19990052675; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper investigates the effect that varying the orientation alpha of a [90+alpha/O+alpha/+45+alpha/-45+alpha](sub s) lay-up has on the flutter and divergence behaviour of a uniform flat composite beam, in both swept and unswept configurations. Minimum-mass optimization of non-uniform flat composite beams, with varying orientation of the same lay-up, is also presented. Results show a reduction in mass of 23% for optimum alpha compared to the baseline alpha = 0 case. It is also found that the lay-up orientation giving maximum permissible airspeed for a uniform beam corresponds to the optimum orientation for a non-uniform beam. Hence, the wing designer may quickly and accurately determine the optimal lay-up orientation by performing flutter and divergence analyses at a range of values of alpha between +90 deg and -90 deg. The current limitations of the technique, concerning strength requirements and manufacturing considerations, are recognized. Furthermore, some of the designs are shown to be highly imperfection-sensitive.

Author

Aeroelasticity; Ply Orientation; Optimization; Beams (Supports); Composite Structures; Flutter Analysis; Free Vibration

19990052702 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

Divergence and Flutter of Adaptive Laminated Composite Aircraft Wings Featuring Damaged Bonding Interfaces

Librescu, L., Virginia Polytechnic Inst. and State Univ., USA; Icardi, U., Politecnico di Torino, Italy; DiSciuva, M., Politecnico di Torino, Italy; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 747-762; ffa; In English; See also 19990052675

Contract(s)/Grant(s): CTB97.00589.CT11; CTB97.00459.CT11; CRG960118; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A study of the aeroelastic divergence and flutter of swept-aircraft wings made-up from laminated composite materials featuring nonrigidly bonded interfaces is presented. Among the goals to be reached, those of capturing and revealing the effects played by interlaminar bonding imperfections on static and dynamic aeroelastic instabilities, and that of the incorporation of a feedback control methodology are investigated. Implementation of a feedback control methodology enabling one: a) to counteract the detrimental effects of bonding imperfections, and b) to enhance the overall aeroelastic response behavior, is also considered. In order to obtain results emphasizing the implications of bonding imperfections, the aeroelastic problem will be considered in a restricted sense, i.e. for the case when only the bending degree of freedom is involved. In this context, results addressing the problem of the influence of interfacial bonding imperfection, and feedback control on static and dynamic aeroelastic instabilities of swept-aircraft wings are presented, and pertinent conclusions are outlined.
Author
Divergence; Flutter; Swept Wings; Laminates; Composite Materials; Aerodynamic Stability; Dynamic Response; Aeroelasticity

19990052757 NASA Lewis Research Center, Cleveland, OH USA
Prediction of Composite Laminate Fracture: Micromechanics and Progressive Fracture
Gotsis, P. K., NASA Lewis Research Center, USA; Chamis, C. C., NASA Lewis Research Center, USA; Minnetyan, L., Clarkson Univ., USA; Composites Science and Technology; 1998; ISSN 0266-3538; Volume 58, pp. 1137-1149; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An investigation is described on the prediction of first-ply failure and fracture in selected composite laminates. The laminates are made from glass fibers and graphite fibers in epoxy matrices. Failure envelopes are generated for combined loading of these laminates on the basis of first-ply failure and laminate fracture. The evaluation is performed by a micromechanics-based theory and progressive fracture.
Author
Glass Fibers; Laminates; Matrix Materials; Micromechanics; Failure Analysis; Composite Materials; Thermal Stresses; Stress-Strain Relationships; Cracking (Fracturing)

19990052838 NASA Glenn Research Center, Cleveland, OH USA
Micromechanics Analysis Code Post-Processing (MACPOST) User Guide, 1.0
Goldberg, Robert K., NASA Glenn Research Center, USA; Comiskey, Michele D., Kent State Univ., USA; Bednarcyk, Brett A., Ohio Aerospace Inst., USA; May 1999; 62p; In English
Contract(s)/Grant(s): RTOP 523-21-13
Report No.(s): NASA/TM-1999-209062; E-11612; NAS 1.15:209062; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

As advanced composite materials have gained wider usage. the need for analytical models and computer codes to predict the thermomechanical deformation response of these materials has increased significantly. Recently, a micromechanics technique called the generalized method of cells (GMC) has been developed, which has the capability to fulfill this -oal. Tc provide a framework for GMC, the Micromechanics Analysis Code with Generalized Method of Cells (MAC/GMC) has been developed. As MAC/GMC has been updated, significant improvements have been made to the post-processing capabilities of the code. Through the MACPOST program, which operates directly within the MSC/PATRAN graphical pre- and post-processing package, a direct link between the analysis capabilities of MAC/GMC and the post-processing capabilities of MSC/PATRAN has been established. MACPOST has simplified the production, printing. and exportation of results for unit cells analyzed by MAC/GMC. MACPOST allows different micro-level quantities to be plotted quickly and easily in contour plots. In addition, meaningful data for X-Y plots can be examined. MACPOST thus serves as an important analysis and visualization tool for the macro- and micro-level data generated by MAC/GMC. This report serves as the user's manual for the MACPOST program.
Author
User Manuals (Computer Programs); Micromechanics; Composite Materials; Computer Programs; Mathematical Models

19990052895 NASA Marshall Space Flight Center, Huntsville, AL USA
Measurement of Damping of Composite Materials for Turbomachinery Applications ***Final Report***
Harris, D. L., NASA Marshall Space Flight Center, USA; March 1998; 16p; In English
Contract(s)/Grant(s): Proj. 94-05
Report No.(s): NASA/TM-1998-207685; M-861; NAS 1.15:207685; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The scientific community has felt that ceramic matrix composite (CMC) materials possess more material damping than the superalloys used in the production of rocket engine turbomachinery turbine-end components. The purpose of this NASA/MFSC

study is to quantify the damping in CMC's as compared to a typical super-alloy, Inconel 718. It was observed through testing of beam coupons and disk specimens that the CMC's do indeed possess more material damping than the baselined alloy Inconel 718. Author

Ceramic Matrix Composites; Heat Resistant Alloys; Nickel Alloys

19990053226 Aerospace Corp., Technology Operations, El Segundo, CA USA

Nondestructive Evaluation (NDE) Techniques Assessment for Graphite/Epoxy (Gr/Ep) Composite Overwrapped Pressure Vessels

Johnson, E. C.; Nokes, J. P.; Oct. 30, 1998; 27p; In English

Contract(s)/Grant(s): F04701-93-C-0094

Report No.(s): AD-A363261; TR-98(8504)-3; SMC-TR-99-16; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NDE methods evaluated included eddy current measurements, ultrasonics, radiography, acoustic emission monitoring, acoustic-ultrasonics, and interferometric (e.g., shearography) methods. The major interest was in the detection of damage to COPVs caused by impacts at energy levels that would leave no visible scar on the COPV surface. Each of the above-mentioned NDE methods was assessed with regards to its utility for the detection of impact damage to COPVs and its applicability in the field. Three COPVs were impacted at various energies and then inspected using each of the NDE methods. The results for each method are presented, followed by a summary comparing the advantages and disadvantages. Several NDE techniques were shown to be effective for detecting impact damage sites on graphite/epoxy overwrapped pressure vessels even if the impact energy was below the threshold for creating visible surface damage. These techniques (ultrasound, radiography, thermography, shearography, and eddy current testing) are sensitive because a small dent is left in the liner following the impact. The impact damage detection thresholds for the various NDE techniques employed depend on the size and shape of the vessel. The tup characteristics and the internal pressure of the vessel during impact also affect the degree of damage and, hence, the detectability of the impact site. The size of the indication associated with a flaw is also dependent on the technique used. Visual inspection can lead to an underestimate or lack of detection of the damage. For both thermography and shearography, consistent sizing could be accomplished through the use of calibration standards and a consistent test set-up. The ultrasonic and eddy current results are most likely accurate measures of how much of the liner was debonded.

DTIC

Graphite-Epoxy Composites; Composite Wrapping; Energy Levels; Thermography; Impact Damage

19990053301 North Carolina Agricultural and Technical State Univ., Greensboro, NC USA

Structural Integrity of Discontinuous Stiffened Integrally Braided and Woven Composite Panels ***Final Report***

Shivakumar, K. N., North Carolina Agricultural and Technical State Univ., USA; Sundaresan, M. J., North Carolina Agricultural and Technical State Univ., USA; Avva, V. S., North Carolina Agricultural and Technical State Univ., USA; Mar. 1999; 58p; In English

Contract(s)/Grant(s): FAA 95-G-013

Report No.(s): AD-A363127; DOT/FAA/AR-99/24; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The strength and failure modes of discontinuous blade stiffened panels made of textile preform composites (three-dimensional (3D) braided (0 deg +/- 17 deg) and 3D orthogonal woven (0 deg/90 deg/90 deg)) were evaluated through 3D finite element analysis and test. Tests were conducted under quasi-static tensile and tension-tension fatigue conditions. The peel and shear stresses at the notch root were as high as 40% and 80% of the axial stress, and they caused failure initiation. Final static fracture in both braided and woven composite panels were by net section tensile failure. The average strengths of the braided and the woven panels were 433.7 MPa and 581.8 MPa, respectively. However, the initial failure of the woven panels was stiffener separation but because the load carried by the blade stiffener was only about 10% of the total load, the panels were able to carry additional load until final failure occurred in tension. The stiffener separation occurred at about 28% of the final failure load (162.7 MPa). This load level is considered as the useful capability of the panel. Thus the behavior of the woven panels was similar to the conventional tape construction. The two specimens that were tested under fatigue (S(sub max) = 0.6 S(sub ult) and R = 0.1) survived one million cycles, but the woven panel lost its stiffener, and the residual strength of braided and woven composite specimens were 88.6% and 90.9% of their respective static strengths.

DTIC

Braided Composites; Three Dimensional Composites; Woven Composites; Composite Structures; Textiles

19990053462 Sandia National Labs., Albuquerque, NM USA

Processing and Characterizing Alumina/Aluminum Composites with Tailored Microstructures Formed by Reactive Metal Penetration

Corral, E.; Ellerby, D.; Ewsuk, K.; Fahrenholtz, B.; Loehman, R.; Jan. 28, 1999; 16p; In English; Mexican American Engineers and Scientists National Conference, 20-24 Jan. 1999, San Antonio, TX, USA

Report No.(s): DE00-003310; SAND99-0237C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In industry, the need to maximize energy efficiency depends on the availability of suitable advanced materials. Ceramic composites are exemplary materials for many advanced engineering applications because they exhibit good thermal stability, oxidation resistance and enhanced toughness. Presently, ceramic composite fabrication processes are costly, often requiring high temperatures and pressures to achieve reasonable densities. Our research is focused on developing a processing technique, that will allow production of alumina/aluminum composites using relatively low temperatures and without the application of an external force, thus reducing the processing costs. Our composites were formed using Reactive Metal Penetration (RMP), which is a process involving the reaction of molten Al with a dense ceramic preform. The result is a near net shape ceramic/metal composite with interpenetrating phases. The volume fraction of metal in the composites was varied by doping an aluminosilicate ceramic preform with silica. For this study we fabricated composites using pure mullite and mullite doped with 23 and 42 weight percent silica, yielding 18, 25, and 30 volume percent metal in the composites, respectively. Optical and Scanning Electron Microscopy were used to characterize the homogeneity and scale of the microstructure. The scale of the microstructure varied with preform composition, the reaction temperature and with secondary heat treatments. Four-point bend testing was used to evaluate the influence of microstructure on strength and reliability. During these studies a gradient in the microstructure was observed, which we further characterized using microhardness testing. Alumina/aluminum composites formed by RMP show higher toughness then monolithic alumina and have the potential for improved reliability when compared to monolithic ceramics.

NTIS

Aluminum Oxides; Ceramic Matrix Composites; Microstructure; Penetration; Metal Matrix Composites

25
INORGANIC AND PHYSICAL CHEMISTRY

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

19990050983 Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

Mixing and Radiation Properties of Buoyant Luminous Flame Environments, 1, Self-Preserving Plumes ***Final Report***

Dai, Z.; Sangras, R.; Tseng, L. K.; Faeth, G. M.; Oct. 1998; 138p; In English

Contract(s)/Grant(s): 60NANB4D1696

Report No.(s): PB99-140535; GDL/GMF-98-02; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

An investigation of the structure and optical properties of soot is described in this report. The findings of this research have applications to the development of noninstrusive methods for measuring soot properties and to estimating the continuum radiation properties of soot in flame environments.

NTIS

Buoyancy; Flames; Plumes; Optical Properties; Soot

19990050990 Sandia National Labs., Albuquerque, NM USA

Wetting of a Chemically Heterogeneous Surface; Journal of Chemical Physics

Frink, L. J. D.; Salinger, A. G.; Nov. 20, 1998; 1p; In English

Report No.(s): DE00-001959; SAND98-2593J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Theories for inhomogeneous fluids have focused in recent years on wetting, capillary condensation, and solvation forces for model systems where the surface(s) is(are) smooth homogeneous parallel plates, cylinders, or spherical drops. Unfortunately, natural systems are more likely to be heterogeneous both in surface shape and surface chemistry. In this paper, we discuss the consequences of chemical heterogeneity on wetting. Specifically, a 2-dimensional implementation of a nonlocal density functional theory is solved for a striped surface model. Both the strength and range of the heterogeneity are varied. Contact angles are calculated, and phase transitions (both the wetting transition and a local layering transition) are located. The wetting properties of the

surface are shown to be strongly dependent on the nature of the surface heterogeneity. In addition, highly ordered nanoscopic phases are found, and the operational limits for formation of ordered or crystalline phases of nanoscopic extent are discussed.
NTIS
Wetting; Heterogeneity; Surface Properties; Surface Reactions

19990052615 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA
Premixed Turbulent Flame Propagation in Microgravity ***Final Report, 25 Jun. 1994 - 24 Aug. 1998***
Menon, Suresh, Georgia Inst. of Tech., USA; June 1999; 137p; In English
Contract(s)/Grant(s): NAG3-1610; NAG3-2192; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

A combined numerical-experimental study has been carried out to investigate the structure and propagation characteristics of turbulent premixed flames with and without the influence of buoyancy. Experimentally, the premixed flame characteristics are studied in the wrinkled regime using a Couette flow facility and an isotropic flow facility in order to resolve the scale of flame wrinkling. Both facilities were chosen for their ability to achieve sustained turbulence at low Reynolds number. This implies that conventional diagnostics can be employed to resolve the smallest scales of wrinkling. The Couette facility was also built keeping in mind the constraints imposed by the drop tower requirements. Results showed that the flow in this Couette flow facility achieves full-developed turbulence at low Re and all turbulence statistics are in good agreement with past measurements on large-scale facilities. Premixed flame propagation studies were then carried out both using the isotropic box and the Couette facility. Flame imaging showed that fine scales of wrinkling occurs during flame propagation. Both cases in Ig showed significant buoyancy effect. To demonstrate that micro-g can remove this buoyancy effect, a small drop tower was built and drop experiments were conducted using the isotropic box. Results using the Couette facility confirmed the ability to carry out these unique reacting flow experiments at least in 1g. Drop experiments at NASA GRC were planned but were not completed due to termination of this project.
Derived from text
Flame Propagation; Couette Flow; Isotropy; Premixed Flames; Reacting Flow; Microgravity

19990052616 Colorado Univ., Center for Combustion Research, Boulder, CO USA
Ignition and Combustion of Bulk Metals in a Microgravity Environment
Branch, Melvyn C., Colorado Univ., USA; Daily, John W., Colorado Univ., USA; Abbud-Madrid, Angel, Colorado Univ., USA; Jun. 15, 1999; 13p; In English
Contract(s)/Grant(s): NAG3-1685; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Results of a study of heterogeneous and homogeneous combustion of metals in reduced gravity are presented. Cylindrical titanium and magnesium samples are radiatively ignited in pure-oxygen at 1 atm. Qualitative observations, propagation rates, and burning times are extracted from high-speed cinematography. Time-resolved emission spectra of gas-phase reactions are acquired with an imaging spectrograph. Lower propagation rates of the reacting mass on titanium and of ignition waves on magnesium are obtained at reduced gravity. These rates are compared to theoretical results from fire-spread analyses with a diffusion/convection controlled reaction. The close agreement found between experimental and theoretical propagation rates indicates the strong influence of natural-convection-enhanced oxygen transp6rt on burning rates. Lower oxygen flux and lack of condensed product removal appear to be responsible for longer burning times of magnesium gas-phase diffusion flames in reduced gravity. Spherically symmetric explosions in magnesium flames at reduced gravity (termed radiation-induced metal explosions, or RIME) may be driven by increased radiation heat transfer from accumulated condensed products to an evaporating metal core covered by a porous, flexible oxide coating. In titanium specimens, predominantly heterogeneous burning characterizes the initial steady propagation of the molten mass, while homogeneous gas-phase reactions are detected around particles ejected from the molten mixture. In magnesium specimens, band and line reversal of all the UV spectral systems of Mg and MgO are attributed to the interaction between small oxide particles and the principal gaseous emitters.
Author
Metal Combustion; Ignition; Microgravity; Radiative Heat Transfer; Burning Rate; Oxygen; Heterogeneity

19990052876 Purdue Univ., Joint Transportation Research Program, West Lafayette, IN USA
Methods of Corrosion Protection and Durability of Concrete Bridge Decks Reinforced with Epoxy-Coated Bars, Phase 1 ***Final Report***
Samples, L. M.; Ramirez, J. A.; Mar. 23, 1999; 278p; In English
Report No.(s): PB99-147746; FHWA/IN/JTRP-98/15; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

In this study, the results of an extensive field and laboratory investigation conducted to evaluate the corrosion performance of epoxy-coated reinforcement are reported. The results from the holiday testing showed that an average of 31 holidays per meter

(9 holidays per foot) were created during the concrete casting operation. Increasing the coating thickness by 101.6 micrograms (4 mils) and lowering the hose used when pumping concrete to the level of the top mat of reinforement reduced the holidays created to to 11.5 holidays per meter (3.5 holidays per foot) after casting. The results of 16 specimens subjected to cycles of exposure in the laboratory evaluation indicated that if the mat to mat resistance was greater than 5000 ohms, then over the 77-week period no corrosion activity was observed. No corrosion activity occurred even though the chloride levels at the reinforcement location were well above 0.79 kg/cu m(1.3 lb/yd(cubed)), the threshold level for initiation of corrosion. A possible way to achieve a high mat to mat resistance would be by limiting the damage to the epoxy coatings.
NTIS
Corrosion Prevention; Durability; Concretes; Epoxy Resins; Protective Coatings; Floors; Bridges (Structures)

19990053340 Old Dominion Univ., Dept. of Chemistry and Biochemistry, Norfolk, VA USA
In Site Analysis of a High Temperature Cure Reaction in Real Time Using Modulated Fiber-Optic FT-Raman Spectroscopy *Final Report, Period ending 5 Feb. 1999*
Cooper, John, Old Dominion Univ., USA; Aust, Jeffrey F., Old Dominion Univ., USA; Wise, Kent L., Old Dominion Univ., USA; Jensen, Brian J., Old Dominion Univ., USA; June 1999; 17p; In English
Contract(s)/Grant(s): NAG1-1989; NGT-52124
Report No.(s): ODURF-181290; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The vibrational spectrum of a high temperature (330 C) polymerization reaction was successfully monitored in real time using a modulated fiber-optic FT-Raman spectrometer. A phenylethynyl terminated monomer was cured, and spectral evidence for two different reaction products was acquired. The products are a conjugated polyene chain and a cyclized trimer. This is the first report describing the use of FT-Raman spectroscopy to monitor a high temperature (greater than 250 C) reaction in real time.
Author
Fiber Optics; Real Time Operation; Raman Spectroscopy; High Temperature; Vibrational Spectra; Polymerization; Reaction Time

19990053354 Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan
Physical Properties of Silicon Estimated by Molecular Dynamics Under a Condition of Constant Temperature and Pressure
Kakimoto, Koichi, Kyushu Univ., Japan; Suenaga, Hidetoshi, Kyushu Univ., Japan; Ozoe, Hiroyuki, Kyushu Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 1998; Volume 12, No. 1, pp. 7-10; In Japanese; See also 19990053352; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Molecular dynamics simulation was carried out to estimate volume expansion coefficients and compressibility of solid and liquid silicon. The numerical simulation employed constant temperature and pressure algorithms based on Andersen's method. Stillinger-Weber potential was used as a model potential. Calculated result shows no anomaly of density in the melt near the melting point. Estimated thermal-expansion coefficients of the solid and the melt are 1.4 x 10(exp -5)/K and 0.4 x 10(exp -4)/ K, respectively. Calculated compressibility of the solid and the melt is almost identical to experimental data.
Author
Physical Properties; Silicon; Simulation; Molecular Dynamics

19990053356 Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan
Step Coverage Simulation for Non-Liner Surface Reaction
Kim, Byunghoon, Kyushu Univ., Japan; Akiyama, Yasunobu, Kyushu Univ., Japan; Imaishi, Nobuyuki, Kyushu Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 1998; Volume 12, No. 1, pp. 15-19; In Japanese; See also 19990053352; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Step coverage simulation code was newly developed. This code, which is a kind of test particle Monte Carlo method, can simulate the step coverage with non-liner surface reaction, for example Tungsten (W) thermal Chemical Vapor Deposition (CVD) using hydrogen (H2) and hexafluoro Tungsten (WF6). The availability of this code was examined by the comparison of the experimental obtained step coverage and simulated one through W-CVD. The simulation results well explained the WF6 concentration dependency of step coverage of W film grown on the silicon substrate. The step coverage of film grown at 773 K and in low WF6 concentration becomes poor coverage, however the film grown in high WF6 concentration shows good coverage. Under high WF6 concentration, the growth rate reaches the ceiling, namely the growth rate have the same value on the any position in the trench, and consequently the step coverage became good.
Author
Surface Reactions; Simulation; Computerized Simulation; Nonlinearity; Tungsten Fluorides

19990053358 Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan

Short-Hot-Wire Method for Measuring Thermal Conductivity of a Fine Fiber, 1, Theoretical Analysis of Measurement Method

Zhang, Xing, Kyushu Univ., Japan; Fujiwara, Seiji, Kyushu Univ., Japan; Fujii, Motoo, Kyushu Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 1998; Volume 12, No. 1, pp. 29-36; In Japanese; See also 19990053352; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

In this paper, a new short-hot-wire method for measuring thermal conductivity of a fine fiber is proposed. This method is based on the theoretical solution of one dimensional steady heat conduction along the hot-were and fiber. The hot-wire generates an uniform heat flux by supplying constant electric current, and both ends of were are maintained initial temperature. Fiber is attached to the center area of hot-wire. by using short-hot-wire technique,the fiber temperature at the attached point and heat rate to the fiber can be accurately obtained when the average temperature and heat rate of the hot wire are measured. therefore, the thermal conductivity of fiber can be easily estimated. According to the theoretical analysis, this method can obtain thermal conductivity in the range up to 1000W/mK within an error of +- 1% for the fiber of 10 approx. 30 microns in diameter.

Author

Hot-Wire Anemometers; Thermal Conductivity; Heat Flux; Procedures; Technology Assessment; Heat Measurement

19990053466 Naval Research Lab., Center for Safety and Survivability, Washington, DC USA

An Experimental and Numerical Study of the Effects of Design Parameters on Water Mist Suppression of Liquid Pool Fires*, Oct. 1996 - Oct. 1998*

Ndubizu, Chuka C., Naval Research Lab., USA; Ananth, Ramagopal, Naval Research Lab., USA; Tatem, Patricia A., Naval Research Lab., USA; Prasad, Kuldeep, Science Applications International Corp., USA; Li, Chiping, Naval Research Lab., USA; Apr. 30, 1999; 32p; In English; Prepared in collaboration with GEO Centers, Inc., Rockville, MD, and Science Applications International Corp., Arlington, VA.

Report No.(s): AD-A362806; NRL/MR/6180-99-8372; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents the results of an experimental and numerical parametric study of water mist suppression of liquid pool fires. The numerical part was conducted with small 2-D methanol pool fire, while the experiments were conducted with a 50 cm diameter pan heptane and JP8 pool fires. Analyses of results of the experimental and numerical parts lead to similar conclusions. First, the results show that base injection of droplets enhanced their suppression effectiveness by as much as two times compared to top injection. This is because the droplets evaporated within the lower region of the fire where a greater effect of oxygen dilution and water vapor higher heat capacity is fully realized. Secondly, the experimental results show that smaller droplets are more effective than larger droplets in both top and base injections. The similarity between the model predictions and the experimental data indicates that the results of the parametric study conducted with a small scale laminar pool fire can be useful in the design of water mist suppression systems for large scale fires. Finally, the experimental results show that water mist is more effective in suppressing JP8 fires than heptane fires. It is concluded that the difference in effectiveness is largely due to the additional effects of surface cooling.

DTIC

Fires; Fire Extinguishers; Fire Prevention; Fire Fighting; Water; Mist

19990053470 Pennsylvania Univ., Dept. of Materials Science and Engineering, Philadelphia, PA USA

Twinning Mechanisms in Complex High Tm Intermetallic Compounds *Final Report, 1 Jan. 1990 - 30 Jun. 1997*

Pope, David P.; Luzzi, David E.; May 05, 1999; 6p; In English

Contract(s)/Grant(s): N00014-91-J-1165

Report No.(s): AD-A362826; 525361-FINAL; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This program was divided into two sections involving two separate kinds of experiments: The first involved an investigation into the possibility of twinning in complex structures by inhomogeneous shears (without shuffles) possibly involving synchroshear, as we found to be important in HfV2. The second was an experimental investigation into the (low) temperature-stress regime within which twins nucleate. We were able to show using high resolution TEM, that the shear is inhomogeneous, since the plane of mirror symmetry is a particular set of planes in the structure. Second we were able to show that shuffles are not involved since shuffling should be a diffusion-like process and should become very sluggish at low temperatures. We did flow stress measurements down to 4K and found that the twinning process is active all the way down to at least 77K, strongly suggesting that shuffles are not part of the process. As a result, we were able to demonstrate for the first time that the synchroshear process actually appears to be the mechanism by which twinning occurs in this material.

DTIC

Twinning; Complex Compounds; Intermetallics

19990053489 Utah Univ., Dept. of Chemistry, Salt Lake City, UT USA
Computer for AB Initio Molecular Dynamics Simulations ***Final Report, 1 Feb. - 31 Dec. 1998***
Voth, Gregory A.; Apr. 29, 1999; 2p; In English
Contract(s)/Grant(s): N00014-98-1-0323
Report No.(s): AD-A363044; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This DURIP funding was used to contribute to the expansion of an IBM SP parallel computer and its support hardware. This computer resource is being utilized for the computationally demanding ab initio molecular dynamics simulations that are part of the P.I.'s ONR funded research program. The goal of this program is to compute realistic rates for electrochemical reactions. The simulations are extraordinarily demanding in CPU time and memory requirements and have begun to yield very important new results for the water/metal electrode interface.
DTIC
Electrochemistry; Molecular Dynamics; Computers

26
METALLIC MATERIALS

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

19990049381 Sandia National Labs., Albuquerque, NM USA
Generation of Chloride Active Defects at the Aluminum Oxide Surface for the Study of Localized Corrosion Initiation
Barbour, J. C.; Missert, N.; Son, K.; Wall, F. D.; Zavadil, K. R.; Dec. 07, 1998; 34p; In English, 2-6 Nov. 1998, Boston, MA, USA; Sponsored by Electrochemical Society, Inc., USA
Report No.(s): DE00-002186; SAND98-2738C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The generation of surface defects on electron cyclotron resonance (ECR) plasma derived aluminum oxide films has been studied. We find that Cl active O vacancies can be generated using electron and ion irradiation yielding surface concentrations of 3 x l 013 to 1 X 1014 sites'cm-2. These values correspond to surface defect concentrations of 3 to 10% when compared to ordered, crystalline u-alumina. The vacancies appear to be responsible for increased surface O concentrations when immersed in water. Anodic polarization of irradiated films yields a decrease in the stable pitting potential which correlates with electron dose.
NTIS
Chlorides; Aluminum Oxides; Surface Defects; Corrosion

19990049382 Sandia National Labs., Albuquerque, NM USA
Microstructures and Mechanical Properties of Two-Phase Alloys Based on NbCr2
Cady, C. M.; Chen, K. C.; Kotula, P. G.; Mauro, M. E.; Thoma, D. J.; Dec. 07, 1998; 34p; In English, 30 Nov. - 4 Dec. 1998, Boston, MA, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE00-002185; SAND98-2735C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A two-phase, Nb-Cr-Ti alloy has been developed using several alloy design methodologies. In effort to understand processing- microstructure-property relationships, different processing routes were employed. The resulting microstructure and mechanical properties are discussed and compared. Plasma arc-melted samples served to establish baseline, . . . as- cast properties. In addition, a novel processing technique, involving decomposition of a supersaturated and metastable precursor phase during hot isostatic pressing (HIP), was used to produce a refined, equilibrium two-phase microstructure. Quasi-static compression tests as a ; function of temperature were performed on both alloy types. Different deformation mechanisms were encountered based upon temperature and microstructure.
NTIS
Microstructure; Mechanical Properties; Niobium Alloys; Chromium Alloys; Titanium Alloys

19990050984 Sandia National Labs., Albuquerque, NM USA
Variations in the Nature of Metal Adsorption on Ultrathin Al2O3 Films; Physical Review Letters
Bogicevic, A.; Jennison, D. R.; Nov. 24, 1998; 1p; In English
Report No.(s): DE00-002003; SAND98-2634J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

First-principles density-functional calculations are used to study metal adsorption (Li, K, Y, Nb, Ru, Pd, Pt, Cu, Ag, Au, and Al at 1/3-4 monolayer coverages) atop 5; A1203 films on Al(Ill). The oxide-metal bond is ionic at low coverages but, with interesting exceptions, caused by polari received at high coverages where the overlayer is metallic. Binding trends are explained in terms

of simple concepts. Increasing overlayer thickness can cause the adsorbate-oxide interface structure to than . %lEc o; 1998 and while some metals wet, most do not.
NTIS
Adsorption; Aluminum Oxides; Thin Films; Variations

19990052594 Federal Energy Technology Center, Morgantown, WV USA
Task 6.7.2 - Improved Corrosion Resistance of Alumina Refractories
John P. Hurley,; Patricia L. Kleven,; Feb. 01, 1998; 10p; In English
Report No.(s): DE00-001674; DE-FC21-93MC30097-51; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In order to develop methods of reducing corrosion, the microstructure that is attacked must be identified along with the mechanism and rates of the attack. Once identified, methods for reducing corrosion rates can be developed. In order to determine the reactivity of a refractory to a slag, several tests have been developed. The most common are the cup slag test, drip slag test American Society for Testing and Materials ((ASTM) C768), gradient slag test, rotary slag test (ASTM C874), and the dip-and-spin test. Among these tests, the cup slag test is the only static test method and the most commonly used. Previous static testing at the University of North Dakota Energy and Environmental Research Center (EERC) has shown that alumina-based castable refractories are among the least expensive and most corrosion-resistant materials for the highest-temperature coal-fired power system applications.
NTIS
Corrosion Resistance; Refractories; Aluminum Oxides

19990052877 National Inst. of Standards and Technology, Center for Neutron Research, Gaithersburg, MD USA
Neutron Diffraction Investigation of Residual Stresses in Transverse/Oblique Rail Slices Subjected to Different Grinding Strategies
Gnaeupel-Herold, T.; Brand, P. C.; Prask, H. J.; May 1999; 34p; In English
Report No.(s): PB99-147704; NISTIR-6305; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Using the Double Axis system for Residual stress, Texture, and Single crystal analysis (DARTS) at NIST, neutron diffraction residual stress measurements were carried out in the head region of five pairs of transverse and oblique cut slices of railroad track, each having a thickness of 6.35 mm. The slices were taken from a 300 HB rail of CFI 136 RE size. All slices except one unworn reference piece had the same accumulated tonnage but were ground in different intervals. The measurements confirm the results previously found which indicated the existence of high sub-surface residual tensile stresses, while the regional close to the wheel-rail contact line shows high residual compressive stresses.
NTIS
Neutron Diffraction; Residual Stress; Rail Transportation; Rails; Stress Measurement; Grinding (Material Removal)

19990053125 Ocean City Research Corp., NJ USA
Adhesion Criteria between Water-Based Inorganic Zinc Coatings and Their Topcoats for Steel ***Final Report, Oct. 1995 - Mar. 1998***
Ault, J. P.; Farschon, C. L.; Mar. 1999; 74p; In English
Report No.(s): PB99-149007; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report presents the results of a test program designed to investigate, in the laboratory, possible causes for failure of water-based inorganic zinc (WBIOZ) coatings. Failures observed in the field have consisted of either topcoat delamination or the appearance of 'freckle rusting' in the cured WBIOZ primer. There are many hypotheses regarding the cause of these failures, but no sufficient explanation exists. Furthermore, there are no proven means to ensure that failures do not occur.
NTIS
Zinc Coatings; Corrosion Resistance; Adhesion; Inorganic Coatings

19990053305 Sandia National Labs., Albuquerque, NM USA
Production of Gas-Solid Structures in Aluminum and Nickel Alloys by Gasar Processing
Apprill, J. M.; Baldwin, M. D.; Maguire, M. C.; Miszkiel, M. E.; Shapovalov, V. I.; Jan. 06, 1999; 16p; In English; Liquid Metal Processing and Casting, 21-24 Feb. 1999, Santa Fe, NM, USA; Sponsored by American Vacuum Society, USA
Report No.(s): DE00-003242; SAND99-0026C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Experimental data on directional and bulk solidification of hydrogen- charged samples of aluminum alloy A356 and nickel alloy Inconel 718 are discussed. The solidification structure of the porous zone is shown to be dependent on many process vari-

ables. of these variables, hydrogen content in the melt prior to solidification, and furnace atmospheric pressure during solidification play the decisive role. Also important are the furnace atmosphere composition, the solidification velocity, and the temperature distribution of the liquid metal inside the mold.
NTIS
Solidification; Aluminum Alloys; Heat Resistant Alloys

19990053312 Oak Ridge National Lab., TN USA
Technical Basis for the Master Curve Concept of Fracture Toughness Evaluations in the Transition Range
McCabe, D. E.; Merkle, J. G.; Wallin, K.; Jun. 23, 1998; 16p; In English; Fatigue and Fracture Mechanics, 23-25 Jun. 1998, St. Louis, MO, USA
Report No.(s): DE00-002980; ORNL/CP-100583; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
An American Society for Testing and Materials (ASTM) standard method (E 1921-97) has been developed that exclusively uses fracture mechanics test practices and advanced statistical methods to establish the ductile-to-brittle transition range of fracture toughness for structural steels. The development of suitably accurate analyses had been slowed in the past due to an incomplete understanding of the operational mechanisms that control the fracture toughness behavior of structural steels. New perspectives taken are (1) that dominant linear-elastic conditions need not be rigidly enforced in test specimens and (2) that the effect of weakest-link behavior is defined from local cleavage crack initiators such as precipitates, inclusions, and grain boundary embrittlement; namely, all microstructural features in steel. Statistical models can be built upon such mechanisms that result in defined fracture probability levels and, when coupled to a master curve concept, can more accurately define the true loctition of the ductile-to-brittle transition temperature. An integral part of the ASTM test standard development work has been the production of a supporting technical basis document. This document presents substantial background data and supporting theoretical aspects that have been used to justify the method development. The paper will include some of the salient features presented.
NTIS
Fracture Strength; Transition Points

19990053408 Sandia National Labs., Albuquerque, NM USA
Fabrication of MEMS Devices by Powder-Filling into DXRL-Formed Molds
Christenson, T.; Garino, T. J.; Venturini, E.; Jan. 07, 1999; 16p; In English, 29 Nov. - 4 Dec. 1998, Boston, MA, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE00-003272; SAND99-0107C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
We have developed a variety of processes for fabricating components for micro devices based on deep x-ray lithography (DXRL). Although the techniques are applicable to many materials, we have demonstrated them using hard (Nd2Fe14B) and soft (Ni-Zn ferrite) magnetic materials because of the importance of these materials in magnetic micro-actuators and other devices and because of the difficulty fabricating them by other means. The simplest technique involves pressing a mixture of magnetic powder and a binder into a DXRL-formed mold. In the second technique, powder is pressed into the mold and then sintered to density. The other two processes involve pressing at high temperature either powder or a dense bulk material into a ceramic mold that was previously made using a DXRL mold. These techniques allow arbitrary 2-dimensional shapes to be made 10 to 1000 micrometers thick with in-plane dimensions as small as 50 micrometers and dimensional tolerances in the micron range. Bonded isotropic Nd2Fe14B micromagnets made by these processes had an energy product of 7 MGOe.
NTIS
Fabrication; Microelectromechanical Systems; Powder (Particles); Molds

19990053500 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA
Heat Treatment of Al 7075 for Ejection Seat Shear Wire
Wong, Catherine R.; Mastroianni, Lee S.; Mar. 1999; 15p; In English
Report No.(s): AD-A362873; NSWCCD-61-TR-1999/04; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Shear pins in ejection seats are required to have double shear breaking load values in the range of 46-51 lbs. over the life of the equipment. Aluminum 6061-T6 that was cold worked to increase the shear strength was initially used and performed well for many years. Current lots of Al 6061 could not duplicate the double shear breaking load values and so it was attempted to achieve the required double shear breaking load in the Al 7075 alloy with a stable microstructure. A variety of heat treatments were performed and tested for hardness and double shear breaking load. This report presents the resulting heat treatment curves and the correlation between hardness and double shear breaking load. The proper heat treatment for this application is identified as a solu-

tion treatment between 870 and 900 deg F for 32 hours, aging at 225 deg F for 8 hours and then further aging at 350 deg F for 144 hours. This heat treatment was found to produce a double shear breaking load in the required range that is stable over time.
DTIC
Aluminum Alloys; Ejection Seats; Shear Strength; Microstructure

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.

19990049406 Sandia National Labs., Albuquerque, NM USA
SPHINX Measurements of Radiation Induced Conductivity of Foam
Ballard, W. P.; Beutler, D. E.; Burt, M.; Dudley, K. J.; Stringer, T. A.; Dec. 14, 1998; 34p; In English; Government Microcircuit Applications, 8-12 Mar. 1999, Monterey, CA, USA
Report No.(s): DE00-002340; SAND98-2287C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Experiments on the SPHINX accelerator studying radiation-induced conductivity (RIC) in foam indicate that a field-exclusion boundary layer model better describes foam than a Maxwell-Garnett model that treats the conducting gas bubbles in the foam as modifying the dielectric constant. In both cases, wall attachment effects could be important but were neglected.
NTIS
Sphinx; Foams; Electrical Resistivity

19990049407 Sandia National Labs., Albuquerque, NM USA
Molecular-Scale Lubricants for Micromachine Applications ***Final Report***
Burns, A. R.; Dugger, M. T.; Houston, J. E.; Lopez, G. P.; Mayer, T. M.; Dec. 01, 1998; 34p; In English
Report No.(s): DE00-002303; SAND98-2607; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The nature of this work was to develop the physics and chemistry base for understanding molecular-scale lubricants used to reduce of friction- and adhesion-induced failure in silicon micromachines (MEMS). We acquired this new knowledge by tailoring the molecular properties of the lubricants, applying local probes that can directly monitor the response of lubricants in contact conditions, and evaluating the performance of model lubricants MEMS devices. Model lubricants under investigation were the silane coupling agents that form monolayer films on native oxide silicon surfaces, which is the substrate in MEMS. These molecules bind via strong surface bonds and produce a layer of hydro- or fluoro-carbon chains normal to the substrate. 'Tailoring' the lubricants entails modifying the chain length, the chain chemical reactivity (H or F), and the density of chain structures. Thus much effort went into understanding the surface chemistry of silane-silicon oxide coupling. With proximal probes such as atomic force microscopy (AFM), interracial force microscopy (FM), and shear force microscopy in combination with IFM, we examined the frictional and adhesive properties of the silane films with very high spatial resolution (< 100 nm) and sensitivity. MEMS structures are treated with silanes under identical conditions, and examined for friction and adhesion under operating conditions. Proper assessment of the lubricants required quantitative analysis of MEMS performance at high speeds and long operating times. Our proximal probe measurements and WS performance analyses form a very important link for future molecular dynamics simulations, that, in turn, should be able to predict MEMS performance under all conditions.
NTIS
Lubricants; Molecular Structure; Molecular Dynamics; Machinery

19990050994 Sandia National Labs., Albuquerque, NM USA
Ultra High Temperature Rapid Thermal Annealing of GaN; Materials Issues in Semiconductor Process
Cao, X. A.; Fu, M.; Han, J.; Pearton, S. J.; Rieger, D. J.; Nov. 20, 1998; 1p; In English
Report No.(s): DE00-001958; SAND98-2592J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
All of the major acceptor (Mg, C, Be) and donor (Si, S, Se and Te) dopants have been implanted into GaN films grown on Al2O3 substrates. Annealing was performed at 1100-1500 C, using AIN encapsulation. Activation percentages of > 90% were obtained for Si(+) implantation annealed at 1400 C, while higher temperatures led to a decrease in both carrier concentration and electron mobility. No measurable redistribution of any of the implanted dopants was observed at 1450 C.
NTIS
Annealing; Gallium Nitrides; Thermal Energy; Acceptor Materials

19990052583 NASA Glenn Research Center, Cleveland, OH USA

Sliding Wear and Fretting Wear of DLC-Based, Functionally Graded Nanocomposite Coatings

Miyoshi, K., NASA Glenn Research Center, USA; Pohlchuck, B., NASA Glenn Research Center, USA; Street, Kenneth W., NASA Glenn Research Center, USA; Zabinski, J. S., Air Force Research Lab., USA; Sanders, J. H., Air Force Research Lab., USA; Voevodin, A. a., Air Force Research Lab., USA; Wu, R. L. C., K Systems Corp., USA; May 1999; 18p; In English

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

Report No.(s): NASA/TM-1999-209076; NAS 1.15:209076; E-11250-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Improving the tribological functionality of diamondlike carbon (DLC) films--developing, good wear resistance, low friction, and high load-carrying capacity-was the aim of this investigation. Nanocomposite coatings consisting of an amorphous DLC (a-DLC) top layer and a functionally graded titanium-titanium carbon-diamondlike carbon (Ti-Ti(sub x) C(sub y)-DLC) underlayer were produced on AISI 440C stainless steel substrates by the hybrid technique of magnetron sputtering and pulsed-laser deposition. The resultant DLC films were characterized by Raman spectroscopy, scanning electron microscopy, and surface profilometry. Two types of wear experiment were conducted in this investioation: sliding friction experiments and fretting wear experiments. Unidirectional ball-on-disk sliding friction experiments were conducted to examine the wear behavior of an a-DLC/Ti-Ti(sub x) C(sub y)-DLC-coated AISI 440C stainless steel disk in sliding contact with a 6-mm-diameter AISI 440C stainless steel ball in ultrahigh vacuum, dry nitrogen, and humid air. Although the wear rates for both the coating and ball were low in all three environments, the humid air and dry nitrogen caused mild wear with burnishing, in the a-DLC top layer, and the ultrahigh vacuum caused relatively severe wear with brittle fracture in both the a-DLC top layer and the Ti-Ti(sub x) C(sub y)-DLC underlayer. For reference, amorphous hydrogenated carbon (H-DLC) films produced on a-DLC/Ti-Ti(sub x) C(sub y)-DLC nanocomposite coatings by using an ion beam were also examined in the same manner. The H-DLC films markedly reduced friction even in ultrahigh vacuum without sacrificing wear resistance. The H-DLC films behaved much like the a-DLC/Ti-Ti(sub x) C(sub y)-DLC nanocomposite coating in dry nitrogen and humid air, presenting low friction and low wear. Fretting wear experiments were conducted in humid air (approximately 50% relative humidity) at a frequency of 80 Hz and an amplitude of 75 micron on an a-DLC/Ti-Ti(sub x) C(sub y)-DLC-coated AISI 440C disk and on a titanium-6 wt % aluminum-4 wt% vanadium (Ti-6Al-4V) flat, both in contact with a 9.4-mm-diameter, hemispherical Ti-6Al-4V pin. The resistance to fretting wear and damage of the a-DLC/Ti-6Al-4V materials pair was superior to that of the Ti-6Al-4V/Ti-6AI-4V materials pair.

Author

Brittleness; Coatings; Amorphous Materials; Fretting; Sliding Friction; Load Carrying Capacity; Steels; Titanium Alloys; Aluminum Alloys; Tribology; Wear Resistance; Lubrication; Diamond Films

19990052726 NASA Glenn Research Center, Cleveland, OH USA

Investigation of Atomic Oxygen Erosion of Polyimide Kapton H Exposed to a Plasma Asher Environment

Snyder, Aaron, NASA Glenn Research Center, USA; May 1999; 20p; In English, 23-27 May 1999, Long Beach, CA, USA; Sponsored by Society for the Advancement of Materials and Process Engineering, USA

Contract(s)/Grant(s): RTOP 632-1A-1E

Report No.(s): NASA/TM-1999-209178; E-11687; NAS 1.15:209178; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experimental results are presented on the erosion characteristics of the polyimide Kapton H, which serves as a blanket material in solar arrays. This polymer has a number of characteristics that make it a suitable choice for both terrestrial and space applications. In this paper attention is focused on the durability of protected Kapton when exposed to atomic oxygen (AO) in a plasma asher. A strip of 0.025-mm thick Kapton film, coated on both sides with SiO2, was studied during a 1306 hour exposure. The erosion, located at defect sites in the protective coating and measured optically, is described in terms of volume loss as a function of AO fluence. Three simple geometric profiles are used to generate a useful array of cavity shapes to model erosion evolution. These models connect the volume erosion rate to the observed lateral expansion of the developing cavities via their diameters, measured adviacent to the upper and lower protective film, and fitted by least-squares regression to simple power law functions of fluence. The rationale for the choice of models is discussed. It was found that lateral growth in cavity size evolves less than linearly with fluence.

Author

Oxygen Atoms; Research; Experimentation; Data Acquisition; Erosion; Kapton (Trademark); Polyimides; Technology Utilization

19990052881 Search for Extraterrestrial Intelligence Inst., Mountain View, CA USA

Synthesis and Development of Porous Polymeric Column Packing and Microchip Detectors for GC Analysis of Extraterrestrial Atmospheres ***Final Report, 1 Oct. 1989 - 30 Sep. 1998***

Shen, Thomas C., Search for Extraterrestrial Intelligence Inst., USA; Apr. 30, 1999; 72p; In English

Contract(s)/Grant(s): NCC2-650; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report summarizes the last nine years research accomplishments under Cooperative Agreement NCC2-650 between NASA, Ames Research Center and SETI Institute. Four Major research tasks are conducted: 1. Gas chromatography column development. 2. Pyrosensor development. 3. Micro-machining gas chromatography instrument development. 4. Amino acid analysis and high molecular weight polyamino acid synthesis under prebiotic conditions. The following describes these results.

Derived from text

Synthesis (Chemistry); Product Development; Amino Acids; Chips (Electronics); Polymers; Detection; Research; Molecular Weight; Flight Instruments

19990052981 Alabama Univ., Lab. of Molecular Physics, Birmingham, AL USA

Development of Elastomeric Polypeptide BIomaterials ***Final Report, 6 Jan. 1989 - 30 Sep. 1997***

Urry, Dan W.; Jan. 01, 1998; 16p; In English

Contract(s)/Grant(s): N00014-89-J-1970

Report No.(s): AD-A360942; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To design elastic polypeptide biomaterials in order to achieve diverse forms of free energy transduction by these water-miscible hydrophobic folding and assembling macromolecules, thereby to elucidate the underlying mechanisms and principles, and therefrom to make possible new materials and applications.

DTIC

Macromolecules; Polypeptides; Elastomers

19990053325 Naval Postgraduate School, Monterey, CA USA

A Feasibility Study of Liquid Phase Sinter Forming of a Model Ceramic System

Roeder, Roland C.; Mar. 1999; 85p; In English

Report No.(s): AD-A362946; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The feasibility of a new manufacturing process of ceramic materials in which net shaped products are produced via sintering and simultaneously deforming is studied. A suitable model system of SiO2-B2O3 is chosen due to its desirable properties for liquid phase sintering and its ability to be tested under atmospheric conditions. Samples of compacted powder are prepared and characterized via x-ray diffraction and scanning electron microscopy. Tests to determine the ability of the system to undergo Liquid Phase Sintering are studied. Deformation of samples in compression with concomitant Liquid Phase Sintering at nominally constant true strain rates is performed, and the effects of the amount of liquid phase are investigated. Problems associated with the Liquid Phase Sinter Forming process are identified, and recommendations are suggested for future studies.

DTIC

Feasibility; Liquid Phase Sintering; Ceramics

19990053342 NASA Kennedy Space Center, Cocoa Beach, FL USA

Cryogenic Insulation Systems

Augustynowicz, S. D., Dynacs Engineering Co., Inc., USA; Fesmire, J. E., NASA Kennedy Space Center, USA; Wikstrom, J. P., NASA Kennedy Space Center, USA; 1999; 7p; In English; International Congress of Refrigeration, 19-24 Sep. 1999, Sydney, Australia; Meeting sponsored by the International Institute of Refrigeration; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The results of a comparative study of cryogenic insulation systems performed are presented. The key aspects of thermal insulation relative to cryogenic system design, testing, manufacturing, and maintenance are discussed. An overview of insulation development from an energy conservation perspective is given. Conventional insulation materials for cryogenic applications provide three levels of thermal conductivity. Actual thermal performance of standard multilayer insulation (MLI) is several times less than laboratory performance and often 10 times worse than ideal performance. The cost-effectiveness of the insulation system depends on thermal performance; flexibility and durability; ease of use in handling, installation, and maintenance; and overall cost including operations, maintenance, and life cycle. Results of comprehensive testing of both conventional and novel materials

such as aerogel composites using cryostat boil-off methods are given. The development of efficient, robust cryogenic insulation systems that operate at a soft vacuum level is the primary focus of this paper.
Author
Cryogenics; Multilayer Insulation; Energy Conservation; Temperature Effects; Thermal Insulation

19990053410 Texas Univ., Austin, TX USA
Solid Freeform Fabrication Proceedings (9th) Held in Austin, Texas on August 10-12 1998
Marcus, Harris L.; Beaman, Joseph J.; Bourell, David L.; Barlow, Joel W.; Crawford, Richard H.; Aug. 1998; 778p; In English
Contract(s)/Grant(s): N00014-96-1-0441
Report No.(s): AD-A362745; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

-The Ninth Solid Freeform Fabrication (SFF) Symposium, held at The University of Texas in Austin on August 10-12, 1998, was attended by over 150 national and international researchers. Papers addressed SFF issues in computer software, machine design, materials synthesis and processing, and integrated manufacturing. New sessions on ceramic materials and multiple materials SFF were added to this year's program. The diverse domestic and foreign attendees included industrial users, SFF machine manufacturers, university researchers and representatives from the government. We are pleased once again with the strong showing of university students. The excitement generated at the Symposium reflects the participants' total involvement in SFF and the future technical health of this growing technology. The Symposium organizers look forward to its being a continuing forum for technical exchange among the expanding body of researchers involved in SFF. The Symposium was again organized in a manner to allow the multi-disciplinary nature of the SFF research to be presented coherently, with various sessions emphasizing computer issues, machine topics, and the variety of materials aspects of SFF. We believe that documenting the changing state of SFF art as represented by these Proceedings will serve both the people presently involved in this fruitful technical area as well as new researchers and users entering the field.
DTIC
Software Engineering; Ceramics; Fabrication; Composite Materials

19990053427 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Abteilung Operative Planung, Cologne, Germany
Application of Pressure Sensitive Paint (PSP) for Determination of the Instantaneous Pressure Field of Models in a Windtunnel ***Einsatz Einer Druckempfindlichen Beschichtung (PSP) zur Bestimmung des Momentanen Druckfeldes von Modellen im Windkanal***
Klein, Christian, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; 1997; ISSN 1434-8454; 98p; In German
Report No.(s): DLR-FB-97-55; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

In the following report, a two-dimensional and non-intrusive operating optical pressure measurement system (Pressure Sensitive Paint, PSP) is described. This system was tested under real conditions in the Transonic Windtunnel of the German Aerospace Center in G6ttingen. The oxygen-quenching process used by the optical pressure measurement system is examined in detail with spectroscopic methods. The results serve for the development of an appropriate data-acquisition and image-processing system for tests carried out in the windtunnel. Instantaneous pressure distributions are recorded in almost real time on a three-dimensional double delta model so that recognition and analysis of the vortex dynamics above the model is possible. The recorded pressure images, which can be interpreted as the ,footprints" of the vortex field near the wall, lead to the inference of vortex merging and vortex breakdown. Even fine structures such as Kelvin-Helmholtz instabilities in the vortex shear layer and secondary vortex structures can be detected by this optical pressure measurement system.
Author
Data Acquisition; Image Processing; Nonintrusive Measurement; Optical Measurement; Pressure Distribution; Vortex Breakdown

19990053461 Sandia National Labs., Albuquerque, NM USA
Effect of Humidity on the Reliability of a Surface Micromachined Microengine
Dugger, M. T.; Eaton, W. P.; Irwin, L. W.; Miller, S. L.; Miller, W. M.; Feb. 02, 1999; 16p; In English; Reliability Physics, 22-25 Mar. 1999, San Diego, CA, USA
Report No.(s): DE00-003325; SAND98-2061C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Humidity is shown to be a strong factor in the wear of rubbing surfaces in polysilicon micromachines. We demonstrate that very low humidity can lead to very high wear without a significant change in reliability. We show that the volume of wear debris generated is a function of the humidity in an air environment. As the humidity decreases, the wear debris generated increases. For the higher humidity levels, the formation of surface hydroxides may act as a lubricant. The dominant failure mechanism has been identified as wear. The wear debris has been identified as amorphous oxidized silicon. Large slivers (approximately 1 micron in

length) of debris observed at the low humidity level were also amorphous oxidized silicon. Using transmission electron microscopy, we observed that the wear debris forms spherical and rod-like shapes. We compared two surface treatment processes: a fluorinated silane chain, (FITl) and supercritical C02 dried (SCC02). The microengines using the SCC02 process were found to be less reliable than those released with the FIX process under two humidity levels.
NTIS
Humidity; Reliability; Surface Treatment; Micromachining

19990053492 Army Tank-Automotive Research and Development Command, Warren, MI USA
A Ceramic Armor Material Database ***Interim Report***
Holmquist, T. J.; Rajendran, a. M.; Templeton, D. W.; Bishnoi, K. D.; Jan. 1999; 240p; In English
Report No.(s): AD-A362926; TARDEC-TR-13754; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This report compiles and documents a Ceramic Armor Material Database. Experimental data obtained from numerous journals and conference proceedings, by researchers of various disciplines, covering over thirty years are documented in this report. The data include nine different ceramic materials. The ceramics are Silicon Carbide, Boron Carbide, Titanium Diboride, Aluminum Nitride, Silicon Nitride, Aluminum Oxide (85% pure), Aluminum Oxide (high purity), Tungsten Carbide and Glass. For each ceramic material, experimental data are tabulated for the following experiment types; (1) mechanical tests, (2) hydrostatic tests, (3) plate impact tests, (4) semi-infinite penetration tests, (5) depth of penetration (DOP) tests, (6) perforation tests and (7) other tests. The data are documented in tabular form in metric units. A schematic of the experimental configuration, and graphs of the data, are also provided when appropriate. Information about each of the materials tested is also provided including such information as elastic wave velocities, density, grain size, porosity, material processing, elastic modulus, Hugoniot Elastic Limit (HEL) and chemical composition. Although this report was not intended to be an exhaustive search of the literature, an attempt has been made to compile as much data as possible.
DTIC
Data Bases; Data Acquisition; Ceramics; Chemical Composition

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.

19990049414 Mainstream Engineering Corp., Rockledge, FL USA
Demonstration of the Use of Hydrogen Fuel for Food Service ***Final Report, Oct. 1992 - Sep. 1993***
Back, Dwight D.; Mar. 1999; 54p; In English
Contract(s)/Grant(s): DAAK60-93-C-0017
Report No.(s): AD-A361597; NATICK-TR-99/020; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This Phase 1 effort demonstrated the use of hydrogen-gas fuel for use in food service applications. Energy efficiencies of 40-50 percent were achieved with Mainstream Engineering's hydrogen burner, with usable energy supply rates of 15,000 BTU/hr, fulfilling the requirements of the U.S. Army. It was demonstrated that hydrogen-fuel could be used for food service using compressed cylinders of hydrogen or by using metal-hydride derived hydrogen.
DTIC
Hydrogen; Metal Hydrides; Burners; Hydrogen Fuels

19990053235 Army Aviation and Missile Command, Redstone Arsenal, AL USA
Elimination of Toxic Materials and Solvents from Solid Propellant Components (PP1058) ***Annual Report, FY 19n 1998***
Stanley, Robert; Hagler, Diane; Dec. 17, 1998; 11p; In English
Report No.(s): AD-A363240; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Solid rocket motor (srm) propellant used in military tactical and strategic missile weapon systems contain hazardous and toxic materials. Lead is used as a ballistic catalyst in minimum signature propellants. It's use results in approximately 161,000 pounds of lead compound usage per year. In some "smoky" propellant formulations, hydrogen chloride (HCl) is a combustion product which contributes to stratospheric ozone depletion. It is estimated that seven million pounds of HCL is emitted from military rocket motors per year. Lastly, processing of energetic oxidizer materials used in SRMs requires the use of solvents which are toxic, considered ozone depleting substances and also release volatile organic compounds (VOCs). Approximately four million pounds of oxidizer solvents are utilized in propellant production per year. Due to the human health hazards associated with these

toxic compounds, several regulations have been and are being promulgated to curtail or eliminate the use of these substances and their associated emissions. Therefore, alternatives are required to permit future propellant production and maintain weapon system readiness.
DTIC
Solvents; Solid Propellant Rocket Engines; Hazardous Materials; Elimination; Combustion Products

19990053298 Thrace Univ., School of Engineering, Xanthe, Greece
Prediction of Crack Initiation and Growth in Solid Propellants ***Final Report***
Gdoulos, E. E., Thrace Univ., Greece; Apr. 1999; 229p; In English
Contract(s)/Grant(s): F61708-98-W-0033
Report No.(s): AD-A363081; EOARD-SPC98-4003; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche
This report results from a contract tasking Democritus University of Thrace as follows: The contractor will investigate crack initiation and growth in solid propellant grains. Solid propellants are critical to missile, launch vehicle and satellite upper stage performance. Cracks in solid propellant can cause catastrophic failures leading to loss of valuable USAF assets and even lives. Understanding these phenomena is important to their future applications.
DTIC
Crack Initiation; Crack Propagation; Propellant Grains; Solid Propellants

29
MATERIALS PROCESSING

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

19990051002 NASA Marshall Space Flight Center, Huntsville, AL USA
NASA's Microgravity Technology Report: Summary of Activities 1997
Woodard, Dan, NASA Marshall Space Flight Center, USA; July 1998; 78p; In English
Report No.(s): NASA/TM-1998-208532; NAS 1.15:208532; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The purpose of the 1997 NASA Microgravity Technology Report is to update the Microgravity Research Program's technology development policy and to present and assess current technology related activities and requirements identified within its research and technology disciplines.
Author
Policies; Microgravity; Technologies

19990053336 Wisconsin Univ., Dept. of Zoology, Madison, WI USA
Microgravity Effecs During Fertilization, Cell Division, Development, and Calcium Metabolism in Sea Urchins
Schatten, Heide, Wisconsin Univ., USA; [1999]; 7p; In English
Contract(s)/Grant(s): NAG10-183; NAG10-224; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Calcium loss and muscle atrophy are two of the main metabolic changes experienced by astronauts and crew members during exposure to microgravity in space. For long-term exposure to space it is crucial to understand the underlying mechanisms for altered physiological functions. Fundamental occurrences in cell biology which are likely to depend on gravity include cytoskeletal dynamics, chromatin and centrosome cycling, and ion immobilization. These events can be studied during fertilization and embryogenesis within invertebrate systems. We have chosen the sea urchin system to study the effects of microgravity on cytoskeletal processes and calcium metabolism during fertilization, cell division, development, and embryogenesis. Experiments during an aircraft parabolic flight (KC-135) demonstrated: (1) the viability of sea urchin eggs prior to fertilization, (2) the suitability of our specimen containment system, (3) the feasibility of fertilization in a reduced gravity environment (which was achieved during 25 seconds of reduced gravity under parabolic flight conditions). Two newly developed pieces of spaceflight hardware made further investigations possible on a spaceflight (STS-77); (1) the Aquatic Research Facility (ARF), and (2) the Fertilization Syringe Unit (FSU). The Canadian Space Agency developed ARF to conduct aquatic spaceflight experiments requiring controlled conditions of temperature, humidity, illumination, and fixation at predetermined time points. It contained a control centrifuge which simulated the 1 g environment of earth during spaceflight. The FSU was developed at the Kennedy Space Center (KSC) by the Bionetics Corporation specifically to enable the crew to perform sea urchin fertilization operations in space.
Derived from text
Microgravity; Calcium; Muscles; Fertilization; Cell Division; Calcium Metabolism; Sea Urchins

19990053357 Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan

Gravity Effect on the Compositional Separation by Thermal Diffusion in a Rectangular Flow Channel

Arimo, Hirofumi, Kyushu Univ., Japan; Moriyama, Shinya, Kyushu Univ., Japan; Sato, Tsuneyuki, Kyushu Univ., Japan; Imaishi, Nobuyuki, Kyushu Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 1998; Volume 12, No. 1, pp. 21-27; In Japanese; See also 19990053352; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

A compositional separation by thermal diffusion phenomena (Soret effect) in a locally heated rectangular flow channel under 1G and microgravity condition was investigated experimentally and theoretically. Parabolic flight experiments on thermal diffusion were conducted using binary gas mixture systems of He-SF6 and Ne-SF6. Under the conditions of various G-levels, the local gas mixture was sampled through a fused quartz tube (75(central dot)m I.D. and 90 cm in length) inserted into the flow channel, and analyzed by means of a quadrupole mass spectrometer evacuated by a turbo molecular pump and diaphragm type dry vacuum pump. Gas flow, heat and mass transfer in a rectangular flow channel under 1G and (central dot)C were also predicted numerically using a steady state three-dimensional simulation code. The calculated results of the concentration distribution in the channel agreed well with the experimental ones under almost all conditions except for the microgravity NeSF6 system.

Author

Gravitation; Thermal Diffusion; Rectangles; Channel Flow; Microgravity; Computerized Simulation

31
ENGINEERING (GENERAL)

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

19990049419 Sandia National Labs., Albuquerque, NM USA

Impact of Hight Velocity Cold Spray Particles; Journal of Thermal Spray Technology

Dykhuizen, R. C.; Gilmore, D. L.; Jiang, X.; Neiser, R. A.; Sampath, S.; Dec. 01, 1998; 1p; In English

Report No.(s): DE00-002031; SAND98-2682J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper presents experimental data and an computational model of the cold spray solid particle impact process. Copper particles impacting onto a polished stainless steel substrate are examined. The high velocity impact causes significant plastic deformation of both the particle and the substrate, but no melting is observed. The plastic deformation exposes clean surfaces that, under the high impact pressures, result in significant bond strengths between the particle and substrate. Experimental measurements of the splat and crater sizes compare well with the numerical calculations. It is shown that the crater depth is significant and increases with impact velocity. However, the splat diameter is much less sensitive to the impact velocity. It is also shown that the geometric lengths of the splat and crater scale linearly with the diameter of the impacting particle. It is hoped that the results presented will allow better understanding of the bonding process during cold spray.

NTIS

Sprayers; Metal Particles; Impact Velocity

19990052591 Oak Ridge Y-12 Plant, TN USA

Reduction of Nitrogen Oxide Emissions for Lean Burn Engine Technology

McGill, R. N.; Aug. 04, 1998; 1p; In English

Report No.(s): DE00-001832; Y/AMT-608; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Lean-burn engines offer the potential for significant fuel economy improvements in cars and trucks, perhaps the next great breakthrough in automotive technology that will enable greater savings in imported petroleum. The purpose of this cooperative effort is to develop advanced catalyst systems, materials, and necessary engine control algorithms for reducing NOx emissions in oxygen-rich automotive exhaust (as with lean-burn engine technology) to meet current and near-future mandated Clean Air Act standards. These developments represent a breakthrough in both emission control technology and automobile efficiency. The role of Lockheed-Martin Energy Systems in the total project is two fold: characterization of catalyst performance through laboratory evaluations from bench-scale flow reactor tests to engine laboratory tests of full-scale prototype catalysts, and microstructural characterization of catalyst material before and after test stand and/or engine testing.

NTIS

Reduction (Chemistry); Nitrogen Oxides; Exhaust Emission; Engine Control; Exhaust Gases

19990052636 Nichols Consulting Engineers, Reno, NV USA

Concrete Pavement Maintenance Treatment Performance Review: SPS-4 5-Year Data Analysis ***Final Report, 1990 - 1995***

Morian, D. A.; Gibson, S. D.; Epps, J. A.; Jul. 1998; 182p; In English

Report No.(s): PB99-142689; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Strategic Highway Research Program developed and coordinated construction of test sections for rigid pavement maintenance throughout the USA and Canada. Test sites included specific test sections for evaluation of the performance of under sealing and joint sealing as maintenance treatments. Each site also included an unsealed control section.

NTIS

Concretes; Maintenance; Pavements; Data Processing; Concrete Structures

19990053127 National Inst. of Standards and Technology, Building and Fire Research Lab., Gaithersburg, MD USA

Screening Methods for Agent Compatibility with People, Materials, and the Environment

Nyden, M. R.; Skaggs, S. R.; 1999; 74p; In English; Report on a workshop held in Gaithersburg, Maryland on November 14-15, 1997. See also PB91-107110. Prepared in cooperation with Universal Technical Services, Inc., Albuquerque, NM

Report No.(s): PB99-147621; NISTIR-6323; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A workshop on fire suppressant agent compatibility with people, materials and the environment was held at the National Institute of Standards and Technology on November 14 and 15, 1997. The participants were asked to assess currently used screening methods for each of the following properties of candidate fire suppressants: environmental impact (including ozone depletion potential, global warming potential, and atmospheric lifetime); materials compatibility (including long-term storage stability, the interaction of the agent with metals, gaskets and lubricants, and the compatibility of the agent and its combustion by-products with potentially exposed weapons systems); and toxicity (including acute, genetic, subchronic, developmental, and cardiac sensitization). For each property, the workshop participants compared currently used measurement methods and identified the best method for future use in screening candidates for the next generation of fire suppressants. Each of these 'best current' methods was evaluated and given one of the following designations: acceptable as is, acceptable with modifications, or unacceptable. At the conclusion of the workshop, a consensus screening method was advanced for each property.

NTIS

Compatibility; Environmental Surveys; Toxicity; Fires

19990053143 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France

Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface *Problemes de Dynamique des Fluides des Vehicules Evoluant dans ou Pres de l'Interface Air-Mer*

Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999; 380p; In English, 5-8 Oct. 1998, Amsterdam, Netherlands; Sponsored by Research and Technology Organization, France; See also 19990053144 through 19990053173; Original contains color illustrations

Report No.(s): RTO-MP-15; AC/323(AVT)TP/9; ISBN 92-837-0004-X; Copyright Waived; Avail: CASI; A17, Hardcopy; A03, Microfiche

The papers prepared for the RTO Applied Vehicle Technology (AVT) Symposium on "Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface" which was held 5-8 October 1998 in Amsterdam, The Netherlands, 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. In addition to presentations from the NATO Countries, this Symposium included several presentations by Russian and Ukrainian authors. In total, 30 papers were presented during sessions on the following subjects: (1) Aerodynamics and Flight Dynamics around Ships; (2) Stabilization and Control Techniques for Ships; and (3) Non-Classical Aircraft Flying Near the Air-Sea Interface.

Author

Fluid Dynamics; Aerodynamics; Ships; Air Water Interactions; Conferences

19990053158 Delegation Generale de l'Armement, Saint-Cloud, France

New Advances in Sailing Hydrofoils

Lefaudeux, Francois, Delegation Generale de l'Armement, France; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 15-1 - 15-14; In English; See also 19990053143; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Two sailing hydrofoils projects are currently in progress in France. The objective of the first one, Techniques Avancees, is to establish a new all categories world speed record (now belonging to Yellow Pages Endeavour with more than 46 knots). The objective of the second, L'Hydroptere, is even more ambitious; it is a new record for the eastward crossing of the Atlantic Ocean. The two boats have been built and they sail regularly, a lot have been learn from those experiments and they are quite successful. Techniques Avancees holds the world speed record in its size category, L'Hydroptere sails regularly at 35-37 knots and it has been recorded at 39 knots. This paper presents, first, a brief history of hydrofoil sailing, starting with Monitor, a very successful project

dating from the end of the fifties. After this introduction to hydrofoil sailing, it concentrates on the two main design advances which explain the success of those two ships. The first deals with the lateral stability of hydrofoils sailing ships which have to counter the strong lateral force and heeling moment due to the action of the wind on the sails. The second deals with the problem of the general longitudinal stability of an ocean-going first generation hydrofoil in strong seas: how to avoid the dangers of fast changes in the flow angle of incidence on the main foils with the risks of negative lift and subsequent ”hard landing”.
Author
Hydrofoils; Hydrofoil Craft; Hydroplanes (Vehicles); Ships; Structural Design; Gas Turbine Engines; Engine Design

19990053320 Pacific Northwest National Lab., Richland, WA USA
National NGV Infrastructure *Final Report*
GM Sverdrup,; JG DeSteese,; ND Malcosky,; Jan. 07, 1999; 148p; In English
Report No.(s): DE00-002654; PNNL-12076; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This report summarizes work funded jointly by the US Department of Energy (DOE) and by the Gas Research Institute (GRI) to (1) barriers to establishing sustainable natural gas vehicle (NGV) infrastructure and (2) develop planning information that can help to promote a NGV infrastructure. The need for this work is driven by the realization that demand for NGVS has not yet developed to a level that provides sufficient incentives for investment by the commercial sector in all necessary elements of a supportive infrastructure. The two major objectives of this project were: (1) to identify and prioritize the technical barriers that may be impeding growth of a national NGV infrastructure and (2) to develop input that can assist industry in overcoming these barriers. The approach used in this project incorporated and built upon the accumulated insights of the NGV industry. The project was conducted in three basic phases: (1) review of the current situation, (2) prioritization of technical infrastructure barriers, and (3) development of plans to overcome key barriers. An extensive and diverse list of barriers was obtained from direct meetings and telephone conferences with sixteen industry NGV leaders and seven Clean Cities/Clean Corridors coordinators. This information is fully documented in the appendix. A distillation of insights gained in the interview process suggests that persistent barriers to developing an NGV market and supporting infrastructure can be grouped into four major categories: 1. Fuel station economics 2. Value of NGVs from the owner/operator perspective 3. Cooperation necessary for critical mass 4. Commitment by investors. A principal conclusion is that an efficient and effective approach for overcoming technical barriers to developing an NGV infrastructure can be provided by building upon and consolidating the relevant efforts of the NGV industry and government. The major recommendation of this project is the establishment of an ad hoc NGV Infrastructure Working Group (NGV-I WG) to address the most critical technical barriers to NGV infrastructure development. This recommendation has been considered and approved by both the DOE and GRI and is the basis of continued collaboration in this area.
NTIS
Natural Gas; Vehicles

32
COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications. For related information see also 04 Aircraft Communications and Navigation and 17 Space Communications, Spacecraft Communications, Command and Tracking. For search and rescue see 03 Air Transportation and Safety, and 16 Space Transportation.

19990049385 Sandia National Labs., Albuquerque, NM USA
Local Electrostatic Moments and Periodic Boundary Condition, Physical Riew B
Schultz, P. A.; Dec. 04, 1998; 1p; In English
Report No.(s): DE00-002128; SAND98-2721J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Electronic structure calculations frequently invoke periodic boundary conditions to solve for electrostatic potentials. For systems that are electronically charged, or contain dipole (or higher) moments, this artifice introduces spurious potentials due to the interactions between the system and multipole moments of its periodic images in aperiodic directions. I describe a method to properly handle the multipole moments of the electron density in electronic structure calculations using periodic boundary conditions. The density for which an electrostatic potential is to be evaluated is divided into two pieces. A local density is constructed that matches the desired moments of the full density, and its potential computed treating this density as isolated. With the density of this local moment countercharge removed from the full density, the remainder density lacks the troublesome moments and its electrostatic potential can be evaluated accurately using periodic boundary conditions.
NTIS
Electrostatics; Dipole Moments; Boundary Conditions

19990049386 Sandia National Labs., Albuquerque, NM USA
Elastic Wave Radiation from a Line Source of Finite Length
Aldridge, D. F.; Nov. 04, 1998; 1p; In English
Report No.(s): DE00-002087; SAND98-2474; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Straightforward algebraic expressions describing the elastic wavefield produced by a line source of finite length are derived in circular cylindrical coordinates. The surrounding elastic medium is assumed to be both homogeneous and isotropic, and the source stress distribution is considered axisymmetric. The time- and space-domain formulae are accurate at all distances and directions from the source; no fa-field or long-wavelength assumptions are adopted for the derivation. The mathematics yield a unified treatment of three different types of sources: an axial torque, an axial force, and a radial pressure. The torque source radiates only azimuthally polarized shear waves, whereas force and pressure sources generate simultaneous compressional and shear radiation polarized in planes containing the line source. The formulae reduce to more familiar expressions in the two limiting cases where the length of the line source approaches zero and infinity.
NTIS
Elastic Waves; Electromagnetic Radiation; Wavelengths

19990050993 National Telecommunications and Information Administration, Inst. for Telecommunication Sciences, Boulder, CO USA
Search Engine for Federal Standard 1037C
Ingram, W. J.; Gray, E. M.; Mar. 1999; 48p; In English
Report No.(s): PB99-144149; NTIA-99-365; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Federal Standard 1037C, Glossary of Telecommunication Terms, contains more than 5800 entries defining the components of several disciplines in telecommunications technology. Use of this large glossary is enhanced with the search engine designed specifically for the two HTML versions of the glossary: the online version and the CD-ROM version. The search engine provides speedy access to the entire text of the definitions containing the specified character string used in the search. This report discusses the need for the search engine, its design criteria, functions, enhancements, and benefits. The computer code for the search engine, which was developed using Perl scripts, is listed in the appendix.
NTIS
Telecommunication; Document Markup Languages

19990052673 GenCorp Aerojet, Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Test Report, Electromagnetic Interference (EMI)/Electromagnetic Radiation(EMR) and Electromagnetic Capability (EMC) for the EOS/AMSU-A1 ***Final Report***
Paliwoda, L., GenCorp Aerojet, USA; September 1998; 378p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1998-208623; NAS 1.26:208623; CDRL-207; AEROJET-11214; No Copyright; Avail: CASI; A17, Hardcopy; A03, Microfiche

This document contains the procedure and the test results of the Advanced Microwave Sounding Unit-A (AMSU-A) Earth Observing System (EOS) Project, assembly part number 1356008-1, serial number 202, Electromagnetic Interference (EMI) and Electromagnetic Susceptibility (EMC) qualification test. The test was conducted in accordance with the approved EMI/EMC Test Plan/Procedure, Specification number AE-26151/8B, dated 10 September 1998. Aerojet intends that the presentation and submittal of this document, prepared in accordance with the objectives established by the aforementioned Test Plan/Procedure, document number AE-26151/8B, will satisfy the data requirement with respect to the AMSU-A/EOS instrument operational compliance of the EMI/EMC test requirement. Test for the AMSU-A/EOS instrument have been completed and all the requirements per General Interface Requirement Document (GIRD), GSFC 422-11-12-01, for EOS Common Spacecraft/Instruments, paragraph 10.11, were met with the exceptions of the test methods CE03, RE01, and RE02, as described in this document.
Derived from text
Advanced Microwave Sounding Unit; Earth Observing System (EOS); Performance Tests; Electromagnetic Compatibility

19990052709 La Sapienza Univ., Aerospace Dept., Rome, Italy
Nonlinear Aeroelastic System Identification Via Wavelet Analysis in the Neighbourhood of a Limit Cycle
Mastroddi, F., La Sapienza Univ., Italy; Bettoli, A., La Sapienza Univ., Italy; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 857-866; In English; See also 19990052675; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A wavelet analysis on the output signal of a nonlinear system in the neighbourhood.of a Hopf bifurcation (i.e., a limit-cycle oscillation) has been performed to point out the linear and nonlinear signatures of the system. Indeed, this kind of nonlinear behaviour is characterised not only by a simple harmonic oscillation in developed steady-state condition, but also by an initial transitory phase with a complex time evolution of the spectral signal content. Both of issues could be described in an analytical way via a singular perturbation analysis but they could be also directly analyzed by a signal-processing tool via wavelet analysis (Continuous Wavelet Transform, CWT): this is obtained using the wavelet capability in describing efficiently the time evolution of the spectrum of the signal (i.e., a nonlinear ”signature” of a Hopf bifurcation). The novelty of the paper consists of applying the wavelet theoretical tool in the behavior description of a wing experiencing a limit cycle.
Author
Aeroelasticity; Nonlinear Systems; Oscillations; Signal Processing; System Identification; Wavelet Analysis; Wings

19990052874 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Multiple Weight Enumerators of Codes
Vardi, I.; Feb. 1999; 44p
Report No.(s): PB99-148678; IHES/M/99/09; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper is an exposition of the computations done for the paper On codes and Siegel modular forms, of W. Duke (8). Further results are given, in particular, the third and fourth weight enumerators of the Golay code are computed. This is achieved by showing that M24 is transitive on intersections of codewords of the Golay code, in particular, M24/M12 is a two point homogeneous space.
NTIS
Coding; Transmission Lines

19990052995 Northrop Grumman Corp., Melbourne, FL USA
A Real-Time Stochastic MTI Radar Simulation for DIS Application
Floto, Richard; Jan. 1998; 7p; In English
Report No.(s): AD-A359453; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Modeling the stochastic nature of an air-to-ground radar imposes stringent demands on the processor required to implement the simulation. These demands are intensified when the simulation environment must fit the timeline of a real-time radar system. This paper examines a method to model the stochastic nature of the radar system in a Moving Target Indicator (MTI) mode using ground moving DIS targets as input. A prototype of this MTI simulation technique is being developed for incorporation of the Joint STARS radar into a Joint Advanced Distributed Simulation (JADS) environment. One of the most important performance criteria of an MTI mode is the Probability of Detection (Pd) of ground moving targets in the presence of clutter assuming a constant false alarm rate. Pd is primarily influenced by the target returns signal-to-noise (S/N) ratio. Another important performance feature influenced by target S/N is the location accuracy of the target. This paper develops a method of characterizing target Pd and location accuracy as a function of key radar system variables that can be implemented in the real-time target detection stream of the MTI radar system.
DTIC
Stochastic Processes; Moving Target Indicators; Real Time Operation; Computerized Simulation; Target Acquisition; Distributed Interactive Simulation; Radar

19990053008 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia
A Technique for Measuring the Gain of HF Antennas
Ayliffe, J. K., Defence Science and Technology Organisation, Australia; Coleman, C. J., Defence Science and Technology Organisation, Australia; Frazer, G., Defence Science and Technology Organisation, Australia; Gooley, K. W., Defence Science and Technology Organisation, Australia; Hattam, P., Defence Science and Technology Organisation, Australia; Lane, J., Defence Science and Technology Organisation, Australia; Pincombe, A., Defence Science and Technology Organisation, Australia; Sweetman, E., Defence Science and Technology Organisation, Australia; September 1998; In English; Original contains color illustrations
Report No.(s): DSTO-TR-0654; AR-010-510; Copyright; Avail: Issuing Activity (DSTO Electronics and Surveillance Research Lab., PO Box 1500, Salisbury, South Australia 5108, Australia), Hardcopy, Microfiche

A technique for characterizing large HF antennas is considered. The approach achieves this by comparing radar returns from a target illuminated by the unknown antenna with returns from the same target illuminated by a well characterized antenna. Results from a trial confirm that the method is effective.
Author
Antenna Gain; High Frequencies; Large Space Structures; Antennas

19990053227 Naval War Coll., Joint Military Operations Dept., Newport, RI USA
Command and Control in Joint Vision 2010: Flexible, Adaptive and Networked ***Final Report***
Olmo, Frank J.; Feb. 05, 1999; 25p; In English
Report No.(s): AD-A363260; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
One of the most daunting tasks the U.S. military will face in the 21 century is the issue of implementing effective command and control (C2) of joint and coalition military operations. As new technologies are implemented to support Joint Vision 2010 (JV2010), successful C2 must give the commander the flexibility to use faster and more accurate information technologies in order to increase battlespace knowledge and situational awareness. The dynamics of new technologies is linked to the Information Age and is commonly referred to as a Revolution in Military Affairs (RMA), which is leveraged through the enabling concepts of ”Information Superiority” and ”Network-Centric Warfare.” The challenge for the future commander is to exploit the RMA by applying a flexible C2 process to control the battlespace. Thus, as networked forces bring faster and more accurate information across all levels of war, the operational commander will exert his influence by maintaining a flexible networked architecture through a continuum based on his intent and the tempo of operations. A more focused understanding of networked C2 is the key to the evolution of new and existing joint architectures in order to keep pace with information technologies. The military must embrace an aggressive transition to a more flexible organization that is linked to a networked hierarchy to meet the challenges of the 21st Century.
DTIC
Command and Control; Military Operations; Warfare

19990053228 Naval War Coll., Joint Military Operations Dept., Newport, RI USA
C2 in the Information Age: Will Operational Command Echelons Become Unnecessary? ***Final Report***
Dolan, Kriten J.; Feb. 05, 1999; 28p; In English
Report No.(s): AD-A363259; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
C2 is at the very heart of debates about the U.S. military’s future. The current wide-ranging dialogue has brought a number of compelling issues to the fore. Amid discussions of the ”way forward,” advocates of Network-Centric Warfare have suggested that U.S. military forces must adapt to a business-based ”flat” organizational model because the traditional hierarchical structure will not keep pace with the tempo of future warfare. The utility of this concept in the military context remains to be seen. Current discussions of the benefits of a networked system are decidedly oriented toward the tactical level where the emphasis is on action and rapid decision-making. This does not do justice to the responsibilities of an operational commander. Even more disconcerting, the desire to export network-based organizational concepts beyond the tactical level may prompt decision-makers to consider flattening the U.S. military C2 structure by eliminating operational command echelons. This option is untenable. Preserving these intermediate echelons is vital to maintaining the organizational balance and flexible command style needed to deal with the complexity of future challenges.
DTIC
Command and Control; International Trade; Warfare

19990053347 Mississippi State Univ., Dept. of Computer Science, Mississippi State, MS USA
A Study of Quality of Service Communication for High-Speed Packet-Switching Computer Sub-Networks
Cui, Zhenqian, Mississippi State Univ., USA; May 1999; 89p; In English
Contract(s)/Grant(s): F30602-95-I-0036; F30602-96-I-0329; NAG2-1211; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
In this thesis, we analyze various factors that affect quality of service (QoS) communication in high-speed, packet-switching sub-networks. We hypothesize that sub-network-wide bandwidth reservation and guaranteed CPU processing power at endpoint systems for handling data traffic are indispensable to achieving hard end-to-end quality of service. Different bandwidth reservation strategies, traffic characterization schemes, and scheduling algorithms affect the network resources and CPU usage as well as the extent that QoS can be achieved. In order to analyze those factors, we design and implement a communication layer. Our experimental analysis supports our research hypothesis. The Resource ReSerVation Protocol (RSVP) is designed to realize

resource reservation. Our analysis of RSVP shows that using RSVP solely is insufficient to provide hard end-to-end quality of service in a high-speed sub-network. Analysis of the IEEE 802.lp protocol also supports the research hypothesis.
Author
Computer Networks; High Speed; Packet Switching; Algorithms

19990053420 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
A Comparative Analysis of the Iridium and Globalstar Satellite Transmission Paths
Crowe, Kenneth e.; Mar. 01, 1999; 220p; In English
Report No.(s): AD-A361712; AFIT/GSO/ENG/99M-01; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
Globalstar and Iridium will provide valuable global communications assets for business, humanitarian aid and military operations. However, the level of coverage and the quality of the transmission path of these systems are strongly dependent on the latitude of the user and, due to their orbital characteristics, both systems provide reduced levels of coverage at low latitudes. Additionally, the L- and S-Band frequencies utilized by these systems are prone to ionospheric interference at low latitudes. The results of extensive simulation analysis indicate that the Globalstar constellation architecture provides a considerably better transmission path than Iridium's in several important areas, including path elevation angles, satellite visibility and susceptibility to ionospheric effects. to assist future study, a unique set of equations has been developed which describe the distribution of Iridium and Globalstar path elevation angles entirely as a function of the user's latitude. In addition to the differences in path elevation angles, modeling indicates that ionospheric scintillation is a potentially serious problem for both systems. However, Globalstar is expected to suffer lower fade levels than Iridium due to its higher downlink frequency and multiple path availability. The research concludes that, within the scope of the analysis, Globalstar provides a higher quality transmission path for low to mid-latitude users.
DTIC
Transmission Lines; Transmittance; Satellite Communication

33
ELECTRONICS AND ELECTRICAL ENGINEERING

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

19990049426 Sandia National Labs., Albuquerque, NM USA
Direct-Write Precision Resistors for Ceramic Packages
Dai, S.; Dimos, D.; Huang, R. F.; Rodriguez, M. A.; Wilcox, D.; Nov. 30, 1998; 1p; In English, 30 Nov. - 4 Dec. 1998, Boston, MA, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE00-002063; SAND98-1560C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
A direct-write approach to fabricate high precision resistors is reported. Special attention is paid to the effect of print thickness on the resistance value of buried resistors after a low temperature co-firing process. The results show that the direct-write approach provides a superior line definition and thickness control over a traditional screen printing process. Microstructural analysis indicates that there is an interdiffused layer developed between the resistor material and the low temperature co-fired ceramic substrate.
NTIS
Ceramics; Printed Resistors

19990052834 National Inst. of Standards and Technology, Office of Microelectronics Programs, Gaithersburg, MD USA
National Semiconductor Metrology Program, Project Portfolio, FY 1999
Knight, S.; Settle-Raskin, A.; May 1999; 86p; In English
Report No.(s): PB99-142606; NISTIR-5851; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This booklet was prepared to help you to learn more about the 38 projects currently being conducted through the NSMP.
NTIS
Semiconductors (Materials); Metrology

19990052854 National Information Display Lab., Princeton, NJ USA
Evaluation of the Electrohome 9501LC CRT Projector
Jun. 19, 1998; 81p; In English
Report No.(s): AD-A361071; NIDL-PN-021298-063; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The present study evaluates a production unit of the Electrohome 9501LC high-resolution color CRT projector and Stewart Studiotek 130 projection screen. Only photometric measurements were performed on this system. The primary emphasis of the measurements is the determination of the contrast modulation of the display for on/off grille patterns. In turn, the contrast modulation measurements provide an estimate of the number of resolvable pixels that are displayed on the projection screen. The number of resolvable pixels is typically less than the addressability of the display, which is the number of positions that are electronically addressed. We provide below a description of the display that was evaluated and the details of the setup procedures used to prepare the display for measurement. Section II presents the data and results of the photometric measurements. Section III completes the report with analyses of the measurements and final conclusions.
DTIC
Display Devices; Projectors

19990052894 Aerojet-General Corp., Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Engineering Test Report: METSAT A2 Signal Processor (P/N 1331120-2, S/N F05) ***Final Report***
Lund, D., Aerojet-General Corp., USA; Oct. 26, 1998; 48p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1998-208626; NAS 1.26:208626; AEROJET-11296; CDRL-207; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the Engineering Test Report, METSAT A2 Signal Processor (P/N 1331120-2, S/N F05), S/N 109, for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).
Author
Advanced Microwave Sounding Unit; Signal Analyzers; Signal Processing

19990053240 Arkansas Univ., Dept. of Electrical Engineering, Fayetteville, AR USA
Design of a Switched-Reluctance Motor Drive for Electric Propulsion ***Annual Report, 1 May 1998 - 30 Apr. 01***
Carlos, Juan; Martin, Terry W.; May 1999; 8p; In English
Report No.(s): AD-A363184; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This First Annual Report summarizes the activities performed on this grant from August 1, 1998, until April 30, 1999. Detailed technical reports will be written once that a specific topic or task has been completed. We were informed by late March 1998 that the Office of Naval Research decided to fund our grant with a starting date of May 1, 1998. We assembled the research team by August 1998 since we were able to hire all graduate students by the fall 1998 semester. Graduate students normally start their graduate studies in the fall semester (that normally begins around mid August) or in the spring semester (that normally begins around mid January). Also, it normally takes 2 to 3 months to find graduate students qualified for a specific research project. We are expecting to speed up our efforts so we can finish this research project by its ending date (i.e., April 30, 2001). The remainder of this report addresses the assembled research team, the main activities performed during the period covered by this report, the activities in progress, and the expenses incurred from August 1, 1998, to May 15, 1999.
DTIC
Electric Propulsion; Electric Motors; Reluctance

19990053324 Naval Postgraduate School, Monterey, CA USA
Frequency-Based Load Sharing in Current-Mode-Controlled Buck Converters
Moore, Jonathan E.; Mar. 1999; 116p; In English
Report No.(s): AD-A362884; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Modular DC Zonal Electrical Distribution (DC ZEDS) offers advantages in both cost and weight over traditional radial shipboard distribution. In order to equip the next class of surface combatant with DC ZEDS, preparative research includes the design of autonomous dc-to-dc power converter modules having robust load sharing capability. This thesis examines the combined utility of current-mode switch control and frequency-based load sharing to promote equal load sharing among parallel dc-to-dc converter modules. Current-mode control with frequency-based load sharing is analyzed primarily with digital simulation. To that end, a state-space representation for a system of two converters and an Advanced Continuous Simulation Language (ACSL) simulation for a system of three converters are developed. Various studies were conducted to evaluate the performance of a proposed system

for load sharing performance between dissimilar converters, for step changes in load, and for bringing a converter off-line. Additionally, a sub-circuit of frequency-based control-the rms frequency estimation circuit-was built, and its static performance evaluated. Finally, recommendations are made for further simulations which will better test the dynamic performance of this rms estimation circuit and the system of parallel converters employing frequency-based load sharing as a whole.
DTIC
Voltage Converters (DC to DC); Electric Power Transmission; Electric Power; Frequency Assignment; Loads (Forces)

19990053335 General Electric Co., GE Corporate Research and Development, Schenectady, NY USA
Ultracapacitor/battery electronic interface development ***Final Report***
King, R. D.; Salasoo, L.; Schwartz, J.; Cardinal, M.; Jun. 30, 1998; 74p; In English
Report No.(s): DE99-001305; DOE/ID/13406-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A flexible, highly efficient laboratory proof-of-concept Ultracapacitor/ Battery Interface power electronic circuit with associated controls was developed on a cost-shared contract funded by the US Department of Energy (DOE), the New York State Energy Research and Development Authority (NYSERDA), and the General Electric Company (GE). This power electronic interface translates the varying DC voltage on an ultracapacitor with bi-directional power flow to the DC bus of an inverter-supplied ac propulsion system in an electric vehicle application. In a related application, the electronic interface can also be utilized to interface a low-voltage battery to a DC bus of an inverter supplied ac propulsion system. Variations in voltage for these two intended applications occur (1) while extracting energy (discharge) or supplying energy (charge) to an ultracapacitor, and (2) while extracting energy (discharge) or supplying energy (charge) to a low-voltage battery. The control electronics of this interface is designed to be operated as a stand-alone unit acting in response to an external power command. However, the interface unit's control is not configured to provide any of the vehicle system control functions associated with load leveling or power splitting between the propulsion battery and the ultracapacitor in an electric or hybrid vehicle application. A system study/preliminary design effort established the functional specification of the interface unit, including voltage, current, and power ratings, to meet the program objectives and technical goals for the development of a highly efficient ultracapacitor/battery electronic interface unit; and performed a system/application study of a hybrid-electric transit bus including an ultracapacitor and appropriate electronic interface. The maximum power capability of the ultracapacitor/battery electronic interface unit is 25 kW.
NTIS
Systems Engineering; Electric Batteries; Capacitors; Interfaces

19990053360 Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan
Structure of Carbon Materials for an Anode of Lithium Ion Battery
Mochida, Isao, Kyushu Univ., Japan; Ku, Cha-Hun, Kyushu Univ., Japan; Korai, Yozo, Kyushu Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 1998; Volume 12, No. 1, pp. 45-57; In Japanese; See also 19990053352; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Lithium insertion mechanism into anodic carbon of lithium ion battery and the performances of lithium ion battery such as charge/discharge capacity and potential, cycle stability were measured and correlated to the structure of carbon. Lithium ion intercalates into the graphene layers of graphite, reversible capacity being as high as 372 mAh/g theoretically. However, non-graphitized carbon showed very different performances from that of graphite. Based on the charge / discharge performances of several kinds of carbon, Li insertion models for carbons heat-treated at low temperature are proposed in this review. The microstructure and sub-micro voids in carbon heat-treated at lower temperature play a very important role to store Li in carbon. Such approaches will be very helpful to design new carbon for high performance Li ion battery.
Author
Carbon; Lithium; Electric Batteries; Stability; Metal Ions

34
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.

19990050936 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
Aeroelasticity Simulations in Turbulent Flows
Grisval, Jean-Pierre, Office National d'Etudes et de Recherches Aerospatiales, France; Liauzin, Cedric, Office National d'Etudes et de Recherches Aerospatiales, France; Zdenek, Johan, Centric Engineering Systems, Inc., USA; CEAS/AIAA/ICASE/NASA

Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 275-286; In English; See also 19990050911; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Unsteady turbulent flow calculations involving moving boundaries and fluid-structure interaction problems are solved using a finite element method and Spalart-Allmaras and k-epsilon turbulence models. These models are tested on buffeting problems with 2D airfoils. Wall functions have been implemented for both turbulence models in order to perform 3D simulations with the Dyvas wing.

Author

Aeroelasticity; Airfoils; Buffeting; Finite Element Method; Turbulence Models; Turbulent Flow; Mathematical Models; Computerized Simulation

19990050997 Old Dominion Univ., Inst. for Computational and Applied Mechanics, Norfolk, VA USA

Numerical Investigation of Flow Around Rectangular Cylinders with and Without Jets, *Period ending 31 Dec. 1998*

Tiwari, S. N ., Old Dominion Univ., USA; Pidugu, S. B., Old Dominion Univ., USA; March 1999; 70p; In English

Contract(s)/Grant(s): NCC1-232

Report No.(s): ODU/ICAM-99-101; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The problem of flow past bluff bodies was studied extensively in the past. The problem of drag reduction is very important in many high speed flow applications. Considerable work has been done in this subject area in case of circular cylinders. The present study attempts to investigate the feasibility of drag reduction on a rectangular cylinder by flow injection by flow injection from the rear stagnation region. The physical problem is modeled as two-dimensional body and numerical analysis is carried out with and without trailing jets. A commercial code is used for this purpose. Unsteady computation is performed in case of rectangular cylinders with no trailing jets where as steady state computation is performed when jet is introduced. It is found that drag can be reduced by introducing jets with small intensity in rear stagnation region of the rectangular cylinders.

Author

Numerical Analysis; Drag Reduction; High Speed; Bluff Bodies; Jet Flow

19990051027 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

On the Stability of Three-Dimensional Boundary Layers, Part 1, Linear and Nonlinear Stability *Final Report*

Janke, Erik, Institute for Computer Applications in Science and Engineering, USA; Balakumar, Ponnampalam, Institute for Computer Applications in Science and Engineering, USA; May 1999; 24p; In English

Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-1999-209330; NAS 1.26:209330; ICASE-99-16; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The primary stability of incompressible three-dimensional boundary layers is investigated using the Parabolized Stability Equations (PSE). We compute the evolution of stationary and traveling disturbances in the linear and nonlinear region prior to transition. As model problems, we choose Swept Hiemenz Flow and the DLR Transition Experiment. The primary stability results for Swept Hiemenz Flow agree very well with computations by Malik et al. For the DLR Experiment, the mean flow profiles are obtained by solving the boundary layer equations for the measured pressure distribution. Both linear and nonlinear results show very good agreement with the experiment.

Author

Incompressible Boundary Layer; Three Dimensional Boundary Layer; Stability; Nonlinearity

19990051031 Stanford Univ., Stanford, CA USA

Summary of Work for Joint Research Interchanges with DARWIN Integrated Product Team, *1998*

Hesselink, Lambertus, Stanford Univ., USA; March 1999; 13p; In English

Contract(s)/Grant(s): NCC2-5211; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The intent of Stanford University's SciVis group is to develop technologies that enabled comparative analysis and visualization techniques for simulated and experimental flow fields. These techniques would then be made available un- der the Joint Research Interchange for potential injection into the DARWIN Workspace Environment (DWE). In the past, we have focused on techniques that exploited feature based comparisons such as shock and vortex extractions. Our current research effort focuses on finding a quantitative comparison of general vector fields based on topological features. Since the method relies on topological information, grid matching an@ vector alignment is not needed in the comparison. This is often a problem with many data comparison techniques. In addition, since only topology based information is stored and compared for each field, there is a significant compression of information that enables large databases to be quickly searched. This report will briefly (1) describe current

technologies in the area of comparison techniques, (2) will describe the theory of our new method and finally (3) summarize a few of the results.
DFRC
Data Bases; Computer Programs; Software Engineering; Flow Distribution; Extraction

19990052614 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia
Receptivity of Flat-Plate Boundary Layer in a Non-Uniform Free Stream (Vorticity Normal to the Plate) ***Final Report***
Kogan, M. N., Tsentralni Aerogidrodinamicheskii Inst., Russia; Shumilkin, V. G., Tsentralni Aerogidrodinamicheskii Inst., Russia; Ustinov, M. V., Tsentralni Aerogidrodinamicheskii Inst., Russia; Zhigulev, S. V., Tsentralni Aerogidrodinamicheskii Inst., Russia; June 1999; 80p; In English
Contract(s)/Grant(s): NCC1-241; RTOP 282-10-01-01
Report No.(s): NASA/CR-1999-209334; NAS 1.26:209334; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
Experimental and theoretical studies of low speed leading edge boundary layer receptivity to free-stream vorticity produced by upstream wires normal to the leading edge are discussed. Data include parametric variations in leading edge configuration and details of the incident disturbance field including single and multiple wakes. The induced disturbance amplitude increases with increases in the leading edge diameter and wake interactions. Measurements agree with the theory of M. E. Goldstein.
Author
Vorticity; Free Flow; Flat Plates; Boundary Layers; Leading Edges; Wakes

19990052701 Air Force Research Lab., Aeronautical Sciences Div., Wright-Patterson AFB, OH USA
Non-Linear Fluid and Structures Interaction Simulation
Melville, Reid B., Air Force Research Lab., USA; Gordnier, Raymond E., Air Force Research Lab., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 735-746; In English; See also 19990052675; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche
A dynamic aeroelastic solver is used to simulate several fluid-structure interactions with highly non-linear flowfields. A Beam-Warming, approximate factored algorithm, coupled with a linear, second-order structural model via subiteration, becomes a fully implicit, second-order accurate aeroelastic solver. Key issues for accurate aeroelastic simulation are discussed and highlighted by examples. These include geometric conservation, temporal synchronization of the fluid and structural state, full coupling and feedback between the solvers, and non-linear flow features that drive aeroelastic stability and require high levels of spatial discretization.
Author
Aeroelasticity; Dynamic Structural Analysis; Fluid-Solid Interactions; Mathematical Models; Computerized Simulation

19990052729 NASA Langley Research Center, Hampton, VA USA
Efficient Multi-Stage Time Marching for Viscous Flows via Local Preconditioning
Kleb, William L., NASA Langley Research Center, USA; Wood, William A., NASA Langley Research Center, USA; vanLeer, Bram, Michigan Univ., USA; 1999; In English; CFD, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-3267; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
A new method has been developed to accelerate the convergence of explicit time-marching, laminar, Navier-Stokes codes through the combination of local preconditioning and multi-stage time marching optimization. Local preconditioning is a technique to modify the time-dependent equations so that all information moves or decays at nearly the same rate, thus relieving the stiffness for a system of equations. Multi-stage time marching can be optimized by modifying its coefficients to account for the presence of viscous terms, allowing larger time steps. We show it is possible to optimize the time marching scheme for a wide range of cell Reynolds numbers for the scalar advection-diffusion equation, and local preconditioning allows this optimization to be applied to the Navier-Stokes equations. Convergence acceleration of the new method is demonstrated through numerical experiments with circular advection and laminar boundary-layer flow over a flat plate.
Author
Time Marching; Viscous Flow; Navier-Stokes Equation; Laminar Boundary Layer; Boundary Layer Flow

19990052763 NASA Goddard Space Flight Center, Greenbelt, MD USA
Flight Testing of a Cryogenic Capillary Pumped Loop
Ku, Jentung, NASA Goddard Space Flight Center, USA; Kobel, Mark, NASA Goddard Space Flight Center, USA; Bugby, David, Swales Aerospace, USA; Kroliczek, Edward, Swales Aerospace, USA; Baumann, Jane, C and R Technologies, Inc., USA; Culli-

more, Brent, C and R Technologies, Inc., USA; 1999; In English; Intersociety Energy Conversion Engineering, 1-5 Aug. 1999, Vancouver, British Columbia, Canada
Report No.(s): IECEC-99-042; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper describes the flight test results of the fifth generation cryogenic capillary pumped loop (CCPL-5) which flew on the Space Shuttle STS-95 in October of 1998 as part of the CRYOTSU Flight Experiment. This flight was the first in-space demonstration of the CCPL, a lightweight heat transport and thermal switching device for future integrated cryogenic bus systems. The CCPL-5 utilized nitrogen as the working fluid and operated between 80K and 110K. Flight results indicated excellent performance of the CCPL-5 under zero-G environment. The CCPL could start from a supercritical condition in all tests, and the loop operating temperature could be tightly controlled regardless of changes in the heat load and/or the sink temperature. In addition, the loop demonstrated successful operation with a heat load of 0.5 W as well as with parasitic heat loads alone.
Author
Flight Tests; Cryogenics; Space Shuttles; Heat Transfer

19990052784 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
Modelization and Numerical Computation of Droplets Collisions in Laminar and Turbulent Flows ***Modelisation et Calcul Numerique des Collisions de Gouttes en Ecoulements Laminaires et Turbulents***
Pigeonneau, Franck, Office National d'Etudes et de Recherches Aerospatiales, France; 1998; ISSN 0078-3780; 244p; In French
Report No.(s): ONERA-NT-1998-13; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This report is devoted to a calculation of drop collisions in laminar and turbulent flows. In a frame of Stokes flow, hydrodynamic forces between two drops are obtained by exact solution with the help of bispherical coordinates. The forces allow the determination of the collision rate for simple shear flow and pure straining motion. The sections of collision are obtained by trajectory method. The results show the increasing of the collision efficiency with inertia of the drops. The expression of the collision rate in turbulent flow is similar to this of kinetic theory of gas. The pair distribution function of velocities is determined in a case of isotropic and homogeneous turbulence and with conditional probabilities. The collision rates are calculated without and with gravity. The size evolution of drop cloud is described by Smoluchowski kinetic equation. The latter is resolved by means of original numeric method. Two cases are considered. For small drops in isotropic homogeneous turbulent flow, the broadening of drop spectrum requires a time greater if the hydrodynamic interactions are taken into account. For large drops with gravity, the formation by collision of drops for which the diameter is greater than 200 micrometers depends strongly on the turbulence. These results corroborate in situ observations in stratus cloud.
Author
Drops (Liquids); Laminar Flow; Turbulent Flow; Coordinates; Collisions; Shear Flow; Isotropic Turbulence

19990052841 NASA Glenn Research Center, Cleveland, OH USA
A Comparison of Three Navier-Stokes Solvers for Exhaust Nozzle Flowfields
Georgiadis, Nicholas J., NASA Glenn Research Center, USA; Yoder, Dennis A., NASA Glenn Research Center, USA; Debonis, James R., NASA Glenn Research Center, USA; May 1999; 16p; In English; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 537-0F-21
Report No.(s): NASA/TM-1999-209184; E-11693; NAS 1.15:209184; AIAA Paper 99-0748; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A comparison of the NPARC, PAB, and WIND (previously known as NASTD) Navier-Stokes solvers is made for two flow cases with turbulent mixing as the dominant flow characteristic, a two-dimensional ejector nozzle and a Mach 1.5 elliptic jet. The objective of the work is to determine if comparable predictions of nozzle flows can be obtained from different Navier-Stokes codes employed in a multiple site research program. A single computational grid was constructed for each of the two flows and used for all of the Navier-Stokes solvers. In addition, similar k-e based turbulence models were employed in each code, and boundary conditions were specified as similarly as possible across the codes. Comparisons of mass flow rates, velocity profiles, and turbulence model quantities are made between the computations and experimental data. The computational cost of obtaining converged solutions with each of the codes is also documented. Results indicate that all of the codes provided similar predictions for the two nozzle flows. Agreement of the Navier-Stokes calculations with experimental data was good for the ejector nozzle. However, for the Mach 1.5 elliptic jet, the calculations were unable to accurately capture the development of the three dimensional elliptic mixing layer.
Author
Computational Grids; Ejectors; Exhaust Nozzles; Flow Characteristics; Navier-Stokes Equation; Nozzle Flow; Turbulent Mixing

19990053145 Southampton Univ., UK

CFD Predictions of the Influence of External Airflow on Helicopter Operations When Operating From Ship Flight Decks

Wakefield, N. H., Southampton Univ., UK; Newman, S. J., Southampton Univ., UK; Wilson, P. A., Southampton Univ., UK; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 2-1 - 2-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A CFD model of a hovering helicopter main rotor is developed to examine airflow in the presence of ship structures and side winds. The rotor is modelled by modifying the governing Navier-Stokes equations in the region of the disc. The extra terms added to the governing equations apply a downforce to the fluid; these forces are independent of the flow around the rotor and equal to the helicopter weight. The boundaries of the computational domain are also modified in order to generate a physically correct solution. Flow solutions in both two and three dimensions are achieved using the commercial flow solver CFX 4.1. The flow solutions exhibit very good correlation with established momentum and power principles. In order to model helicopter operations from a ship's flight deck, typically a frigate, the rotor is modelled at several positions above a ship profile. Cross winds are applied to the computational domain. The thrust of the rotor is held constant and the resulting flow solutions are calculated. The power exerted at the rotor is obtained and compared to the ideal hover condition and computational flow solution. The flow solutions show that the airflow accelerates over the flight deck and a helicopter operating in this region encounters large cross winds and velocity gradients. The results also show that the helicopter control margins are more likely to limit the safe operating limit than the power margin. Using the modified boundary conditions, this method demonstrates the viability of CFD for predicting the ship airwake and the reduced power margins a helicopter experiences whilst operating in the vicinity of the ship. This study has been exploratory and limited by computing resources, but future models will include helicopter fuselage, tail rotor, time dependent boundary conditions and dynamic flight.

Author

Helicopter Control; Computational Fluid Dynamics; Navier-Stokes Equation; Mathematical Models; Loads (Forces); Boundary Conditions; Predictions; Rotary Wings

19990053146 Pennsylvania State Univ., Dept. of Aerospace Engineering, University Park, PA USA

Higher Order Accurate Solutions of Ship Airwake Flow Fields Using Parallel Computers

Long, Lyle N., Pennsylvania State Univ., USA; Liu, Jingmei, Pennsylvania State Univ., USA; Modi, Anirudh, Pennsylvania State Univ., USA; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 3-1 - 3-14; In English; See also 19990053143

Contract(s)/Grant(s): N00014-97-1-0530; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents a new method for simulating ship airwake flow fields. These flows are inherently unsteady, and very difficult to predict. The method presented (NLDE) is fourth-order accurate in space and time. In this method we first solve for the steady state flow field, then we solve for the unsteady fluctuations. Steady and unsteady results are presented for a generic frigate shape. Considering the complex geometry of real ship. the unstructured grid approach is most useful. The mean flow results are compared with oil flow visualization photographs. Parallel computational methods are a necessity for ship air wake problems and MPI is used in the NLDE solver. The parallel performance on various computers is presented also.

Author

Ships; Unsteady Flow; Flow Visualization; Wakes; Flow Distribution; Computerized Simulation; Parallel Processing (Computers)

19990053147 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA

Simulation and Analysis of LHD Ship Airwake by Navier-Stokes Method

Tai, Tsze C., Naval Surface Warfare Center, USA; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 4-1 - 4-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A multi-zone, thin-layer Navier-Stokes method is utilized to investigate the airwake about an LHD ship configuration. This ship's superstructure is modelled with blocked structures that closely represent the actual geometry. The freestream has a wind speed of 12.87 m/s (25 knots) at a direction of zero, 10 and 20 degrees. The flow is fully turbulent with a Reynolds number of 221 million based on ship length. In general, the flow is largely separated behind the superstructure. Major flow features including viscous-vortex interactions observed experimentally are captured in the simulation. Typical results in the form of particle traces and the velocity field over and aft of the ship are presented.

Author

Navier-Stokes Equation; Ships; Wind Velocity; Velocity Distribution; Free Flow; Computerized Simulation; Flow Visualization

19990053148 Defence Evaluation Research Agency, Aero/Structures Dept., Farnborough, UK

Prediction of Ship Air Wakes Over Flight Decks Using CFD

Tattersall, P., Defence Evaluation Research Agency, UK; Albone, C. M., Defence Evaluation Research Agency, UK; Soliman, M. M., Defence Evaluation Research Agency, UK; Allen, C. B., Bristol Univ., UK; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 5-1 - 5-12; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A Computational Fluid Dynamics (CFD) method is presented for calculating the airflow over a ship superstructure, with emphasis on the flow over aft-located helicopter decks on conventional naval ships. The non-aligned grid generation and flow solution methods are described, including discussion of the modelling of time-accuracy and rotor downwash effects. Work on the coupling of the CFD results with a rotor performance code (CRFM) is also described. Example solutions are shown to illustrate the current capabilities of the method.

Author

Computational Fluid Dynamics; Ships; Wakes; Air Flow; Rotors

19990053150 Institute for Aerospace Research, Aerodynamics Lab., Ottawa, Ontario Canada

Analysis of Patrol Frigate Air Wakes

Zan, S. J., Institute for Aerospace Research, Canada; Syms, G. F., Institute for Aerospace Research, Canada; Cheney, B. T., Institute for Aerospace Research, Canada; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 7-1 - 7-14; In English; See also 19990053143; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The operation of helicopters from a ship-based platform is a challenging procedure from a pilot's perspective. In addition to maneuvering near a moving platform, the pilot must respond to the complex, unsteady flow field which exists over the flight deck. The flow over the ship superstructure generates an air wake which contains significant spatial gradients in the mean wind velocities as well as increased turbulence levels; both may significantly alter the performance of an immersed helicopter rotor. to address this issue completely, one must deal with a fully-coupled problem including both the helicopter rotor and the ship air wake. However, as a first step, the ship air wake can be mapped out to estimate what inflow the rotor might experience. A program is under way in the National Research Council of Canada Aerodynamics Laboratory (NRC/AL) to analyze the air wake formed behind the Halifax-Class Patrol Frigate (CPF). It contains an experimental component and a computational one. Using hot-film anemometers and the AL 5m Vertical Wind Tunnel, the experimental element maps out the flow field (14x13x16 matrix) in the vicinity of the flight deck of a 1:50 scale CPF model at 0 deg yaw and 12 deg yaw. The region measured included the boundaries of the recirculation zone that exists behind the hangar. An atmospheric boundary layer profile was created by placing a set of horizontal rods upstream of the model, which generated a properly scaled variation of mean velocity with height. to complement this work the flow field around a modified CPF was computed using a Navier-Stokes flow solver. This modification exists for these experiments only. No such modifications exists on the real ships. In order to facilitate grid generation, simplifications were made to the bridge and several of the smaller structures around the flight deck were removed. A structured, multi-block, pressure-based Navier-Stokes flow solver was used to compute the steady-state flow field. The atmospheric boundary layer was included in the numerical simulation. This modified ship geometry was also placed in the wind tunnel for validation of the numerical solutions. The results of the wind tunnel experiments show the recirculating zone behind the hangar as well as the asymmetries in the flow field caused by a 20 mm Phalanx CIWS found on the starboard roof of the hangar. The numerical results agree favourably with the modified CPF experimental results and give further details of the air wake.

Author

Wakes; Numerical Analysis; Flow Distribution; Steady State; Unsteady Flow; Atmospheric Boundary Layer; Navier-Stokes Equation; Rotary Wings; Wind Velocity

19990053151 Defence Evaluation Research Agency, Flight Management and Control Dept., Bedford, UK

Modelling and Simulation of Ship Air Wakes for Helicopter Operations: A Collaborative Venture

Wilkinson, C. H., Defence Evaluation Research Agency, UK; Zan, S. J., Institute for Aerospace Research, Canada; Gilbert, N. E., Defence Science and Technology Organisation, Australia; Funk, J. D., Naval Air Warfare Center, USA; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 8-1 - 8-12; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The development of simulation for application to the helicopter-ship dynamic interface has been an activity under an international collaborative panel of The Technical Co-operation Programme since 1990. Modelling the ship air wake and its effect on the helicopter behaviour is regarded by the panel as one of the most significant technical challenges. Increasing the fidelity in this area can enhance the effectiveness of simulation in research, qualification and training, and open up opportunities to predict and

correct for 'troublespots' in the design of new ships. A number of approaches are being pursued concurrently aimed at applying Computational Fluid Dynamics and other, more empirical, analyses to achieve a modelling capability. All participants in the collaboration are also actively involved with conducting full- and model-scale testing to gain an improved understanding of the key features of the air wake topology and to develop a validation database. This paper details the collaborative efforts being pursued by the member nations, under the coordination of the authors. It summarises the work being conducted and draws together the various research aspects and validation tests. The aim is to present a comprehensive and co-ordinated approach to modelling and simulation of the air wake problem at the dynamic interface, putting into an operational context the more technical aspects to be discussed elsewhere in the Symposium. The paper demonstrates the application of air wake prediction in ship and aircraft design, and the value of air wake simulation in research and training.
Author
Computational Fluid Dynamics; Wakes; Ships; Aircraft Design; Computerized Simulation

19990053152 Tsentralni Aerogidrodinamicheskii Inst., Moscow, USSR
The Experience of Aerodynamic Disturbances Research Behind an Aircraft-Carrier Ship with Elements for Safe Operation of Ship-Based Aircraft
Maslov, L. A., Tsentralni Aerogidrodinamicheskii Inst., USSR; Valuev, N. O., Tsentralni Aerogidrodinamicheskii Inst., USSR; Zharinov, A. V., Tsentralni Aerogidrodinamicheskii Inst., USSR; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 9-1 - 9-6; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A opinion about some reasons of relatively late appearance of the first aircraft carrier in the Soviet Navy is expressed. TsAGI's works for provision of aerodynamic compatibility of ship-based aircraft and carrier are described. The works were directed on development of methodology of estimation of wind flow disturbances over flight deck and behind carrier by model experiment in wind tunnel. Its aim was design and realization of measures of reduction of these disturbances and its gradients up to level required for takeoff landing operation safety. Numerous model tests of different ship architecture variants allowed to study the mechanism of flow formation and to estimate the effects of motion ship kinematic parameters relative to wind and of some features of ship architecture on the flow structure. Some recommendations were developed and created on aircraft-carrier cruiser "Minsk" for deck flow leveling. The range of relative wind angles was determined for safe landing on carrier "Admiral Kuznetsov".
Author
Aircraft Carriers; Aerodynamics; Takeoff; Ships; Kinematics

19990053153 Bombardier Services Corp., Dynamics Interface Program, Arlington, VA USA
Simulation Tools in the Calculation of Aircraft-Ship Interface Operational Limits ***Application des Outils de Simulation pour le Calcul des Limites Operationnelles de l'Interface Dynamique Aeronef-Navire***
deFerrier, Bernard, Bombardier Services Corp., USA; Langlois, Bernard, Bombardier, Inc., Canada; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 10-1 - 10-12; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Helicopters operating from small ships are limited in the maritime environment by high winds and rough seas. In addition, man-made obstacles, such as, hangar wall generated turbulence, ship stack hot gas motor ingestion, inappropriate deck lighting and markings limit helicopters. Dynamic Interface (DI) is defined as the study of the relationship between an air vehicle and a moving platform. It is performed to reduce risks and maximize operational flexibility. Countries with a large number of platforms conduct DI testing as a matter of necessity. An analytic approach to helicopter/ship dynamic interface testing is presented. A brief synopsis of the theory and calculation of the ship motion simulation program is presented. The Ship Motion Simulation (SMS) model is derived from the relationship between the wave and ship motion spectrum. It incorporates seakeeping philosophy and applies various definitions of seaway spectral formulation. SMS defines a seaway, computes the hydrodynamic and hydrostatic forces imposed on a ship (defined as the product of its transfer function and the seaway) and calculates a resulting ship time history. The simulation is an extensive treatment of a floating object's response to the dynamic loads on its structure. The application of ship motion simulation as a developmental operational tool is introduced. The primary application of the SMS is in operational simulation such as aircraft launch and recovery; deck handling; and flight readiness or availability. The Aircraft/Ship Interface Simulation (DI) is a mathematical description of conditions limiting the availability of an air vehicle. Factors affecting an air vehicle on a moving platform are primarily ship motion; wind-over-deck; ship airwake turbulence; and deck conditions (wet, dry, oily obstructed, etc). Sample helicopter/ship interface operational limits or envelopes are discussed. Spin-off projects into other field of growth, such as visual aids, are developed.
Author
Computerized Simulation; Motion Simulation; Helicopters; Ships; Operational Problems; Wind Velocity; Sea Roughness

19990053155 Technische Univ., Ship Hydromechanics Lab., Delft, Netherlands

Motions and Added Resistance due to Waves of Surface Effect Ships

Moulijn, Joost C., Technische Univ., Netherlands; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 12-1 - 12-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents a computational method for motions and added resistance due to waves of Surface Effect Ships. The computed added resistance only includes the added resistance of the air cushion. This added resistance component was believed to be the largest. The results of the computational method are compared to experimental results of MARIN and to results of new experiments which are carried out at the Ship Hydrodynamics Laboratory of Delft University of Technology. The computed motions and cushion excess pressures agree well with the MARIN results. The computed added resistance is however much smaller than the added resistance that was measured by MARIN. This discrepancy was the major reason for the new experiments. The aim of the new experiments is to get insight into the magnitude and origin of added resistance of SESs. The new experiments are still in progress at the time this paper had to be delivered. This paper presents therefore only some first results of these experiments. The new experiments show that the added resistance of the air cushion is not large. The new results for added resistance are reasonable agreement with the computational results.

Author

Surface Effect Ships; Ground Effect Machines; Computation; Experiment Design

19990053156 Norwegian Univ. of Science and Technology, Dept. of Marine Hydrodynamics, Trondheim, Norway

Cobblestone Effect on SES

Ulstein, Tore, Norwegian Univ. of Science and Technology, Norway; Faltinsen, Odd M., Norwegian Univ. of Science and Technology, Norway; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 13-1 - 13-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Wave induced vertical accelerations (cobblestone oscillations) of a SES (Surface Effect Ships) in small sea states is studied. Resonant spatially uniform and nonuniform dynamic cushion variations are then important. A nonlinear time domain solution is used. The nonlinearities are mainly due to the flexible stern seal bag behaviour. It is demonstrated that both the spatially varying pressure underneath the flexible stern seal bag and the impact between the bag and the water are important for the vertical accelerations of the vessel. The influence of main parameters characterizing the stern seal bag is discussed.

Author

Surface Effect Ships; Operational Problems; Afterbodies; Hydrodynamics; Dynamic Characteristics

19990053159 Istituto Nazionale di Studi Espe Architettura Navale, Italian Ship Model Basin, Rome, Italy

Unsteady Flow Around a Hydrofoil Beneath Waves

Bulgarelli, U. P., Istituto Nazionale di Studi Espe Architettura Navale, Italy; Greco, M., Istituto Nazionale di Studi Espe Architettura Navale, Italy; Landrini, M., Istituto Nazionale di Studi Espe Architettura Navale, Italy; Lugni, C., Istituto Nazionale di Studi Espe Architettura Navale, Italy; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 16-1 - 16-12; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A general model for studying the unsteady free surface flow generated by a hydrofoil moving beneath a wavy free surface is presented. The flow field is assumed irrotational everywhere except for a think wake shed from the trailing edge. A boundary integral formulation for the velocity field is introduced and integral equations for the unknown velocity components are solved by an accurate as well as efficient method. The solution is stepped forward in time by evolution equations for the free surface and the wake. Test cases are solved for which experimental results are available. Both foils with and without angle of attack are considered and experimental wave profiles are successfully recovered. Drag and pressure coefficients on the hydrofoil satisfactorily compare with the experiments. The ability to handle highly nonlinear behaviors of the free surface is shown by computing breaking waves generated by a foil slightly immersed with a large angle of attack.

Author

Hydrofoils; Hydrofoil Craft; Hydroplanes (Vehicles); Unsteady Flow; Inviscid Flow; Flow Distribution; Hydrodynamics; Mathematical Models

19990053160 Academy of Sciences of the Ukraine, Inst. of Mathematics, Machines and Systems Problems, Kiev, Ukraine

Hydrodynamic Characteristics of Rudders Operating in Air-Sea Interface

Savchenko, V. T., Academy of Sciences of the Ukraine, Ukraine; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 17-1 - 17-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Results of experiments with a series of rectangular and triangular (in plane) foils are described. These foils have a wedge profile and function nearly as a solid body. Three conditions of flow around the foil were being guaranteed: a continuous, a cavitating and continuous with a gas-liquid layer (Gll) at the body. The research permitted us to find some effects and to design a special foil operating effectively at the body with a gas layer.
Author
Hydrodynamics; Cavitation Flow; Unsteady Flow; Hydrodynamic Coefficients; Aerodynamic Characteristics

19990053169 California Univ., Ocean Engineering Lab., Santa Barbara, CA USA
On the Prediction of Nonlinear Free-Surface Flows Past Slender Hulls Using 2D + t Theory: The Evolution of an Idea
Fontaine, E., California Univ., USA; Tulin, M. P., California Univ., USA; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 26-1 - 26-10; In English; See also 19990053143; Sponsored in part by the French Navy; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The basis, evolution and applications of the 2D + t nonlinear slender body theory are described through a review of the literature. Attention is focussed on practical problems, where nonlinearities, such as spray and wave breaking, play an important role. Examples of computations are provided to illustrate the capability of the method.
Author
Free Flow; Slender Bodies; Hulls (Structures); Flow Theory

19990053170 Kiev Univ., Dept. of Cybernetics, USSR
The Complex Boundary Integral Equation Method for a Problem of Entry of a 2D Solid Body in an Incompressible Liquid
Cherniy, Dmytro I., Kiev Univ., USSR; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 27-1 - 27-6; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The aim of this paper is extension of complex boundary integral equations method for non-linear non-stationary problems, in which appearance of separation and accumulative effects is taken into account. The problem of heavy liquid movement in a domain with moving boundary is considered as two-dimensional and non-stationary. Properties of some boundary elements can be altered, under change of boundary conditions. The boundary contour is not already the current line and can be deformed: it does not always consist of the same liquid particles but is filled by new ones. Non-linear initial boundary value problems is confined to finding the changing with respect to time, complex potential of velocities under given initial conditions in the deforming domain D.
Author
Boundary Integral Method; Integral Equations; Incompressible Fluids

19990053171 Institut de Mecanique des Fluides de Lille, Dept. d'Aerodynamique Appliquee, France
Evolution of the Base Bubble and Retractable Jets Behind an Immersed Launched Projectile ***Evolution de la Bulle de Culot et Jets Rentrants Derriere un Projectile Lance en Immersion***
Paquet, J. B., Institut de Mecanique des Fluides de Lille, France; Flodrops, J. P., Institut de Mecanique des Fluides de Lille, France; Dyment, A., Lille Univ., France; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 28-1 - 28-12; In French; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Predicting base bubble behavior during an underwater launch of a projectile is a complex problem: it involves non-fixed free surface flow, coupled with thermodynamic effects linked to hot and condensable pressurizing gases. First, a hydrodynamic model of bubble necking, already published, is discussed in relation to recent results. Assimilation of the bubble with a launched body provides the essential similarity parameters and allows for an initial numerical estimation up to the closing of the bubble. Second, a decomposition of the thermodynamic phenomena based on modeling and numerical calculation shows that mass condensation leads to an almost-polytropic variation in the gas pressure whereas the minor influence of condensation in the wall must be respected on a small scale. Third, the most recent improvements on the installation developed at Institute of Fluid Mechanics (IMFL) are presented. The latter allow one to see, under representative real conditions, the retractable jets and to measure the pressures and loads caused by their impact on the projectile. These results are not yet accessible via calculation.
Author
Bubbles; Projectiles; Retractable Equipment; Sea Launching; Free Flow; Submerging; Fluid Mechanics

19990053172 Academy of Sciences of the Ukraine, Inst. of Hydromechanics, Kiev, Ukraine
Undisturbed Motion of Vehicles in the Fluid
Savchenko, Y. N., Academy of Sciences of the Ukraine, Ukraine; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 29-1 - 29-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The purpose of this work consists in searching such body shapes and such ways of the motion creation under which the disturbances of the velocity and pressure fields be absent or, at least, will be reduced to some minimum outside some control volume enclosing the moving body. The undisturbed motion will be named such a motion, when in each point of some closed finite control surface the disturbances induced by the body motion are equal to zero. According to the principle of maximum the disturbance outside this control surface will be equal to zero too. Two main schemes of undisturbed motion ”Body in channel” and ”body with channel” were considered theoretically and experimentally. It was shown that the system of surface waves disappeared and wave drag was absent when models moved near the free surface of water.
Author
Velocity Distribution; Pressure Distribution; Free Flow; Fluid Mechanics

19990053353 Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan
Computation and Comparison for Heat and Fluid Flow Using a QUICK and Other Difference Schemes
Yang, Mo, Kyushu Univ., Japan; Tao, Wen Quan, Kyushu Univ., Japan; Ozoe, Hiroyuki, Kyushu Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 1998; Volume 12, No. 1, pp. 1-6; In English; See also 19990053352; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Numerical computations were carried out for four sample cases of heat and fluid flow using a QUICK and other finite difference schemes. It is found that for a forced convection a QUICK scheme provides much less grid dependence than other schemes such as a central difference scheme, an Upwind difference scheme, a power law scheme and a hybrid difference scheme. For natural convection of low-Prandtl number fluid, a QUICK scheme gave oscillatory convection while the other schemes did not do the same numerical conditions.
Author
Computation; Fluid Flow; Numerical Analysis; Heat Transmission

35
INSTRUMENTATION AND PHOTOGRAPHY

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

19990051023 Colorado Univ., Center for Astrophysics and Space Astronomy, Boulder, CO USA
Far-Infrared Heterodyne Spectrometer for SOFIA ***Final Report, 1 Apr. 1996 - 31 Dec. 1998***
Betz, A. L., Colorado Univ., USA; Boreiko, R. T., Colorado Univ., USA; 1998; 27p; In English
Contract(s)/Grant(s): NAG2-1062; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarizes work done under NASA Grant NAG2-1062 awarded to the University of Colorado. The project goal was to evaluate the scientific capabilities and technical requirements for a far-infrared heterodyne spectrometer suitable for the SOFIA Airborne Observatory, which is now being developed by NASA under contract to the Universities Space Research Association (USRA). The conclusions detailed below include our specific recommendations for astronomical observations, as well as our intended technical approach for reaching these scientific goals. These conclusions were presented to USRA in the form of a proposal to build this instrument. USRA subsequently awarded the University of Colorado a 3-year grant (USRA 8500-98-010) to develop the proposed Hot-Electron micro-Bolometer (HEB) mixer concept for high frequencies above 3 THz, as well as other semiconductor mixer technologies suitable for high sensitivity receivers in the 2-6 THz frequency band.
Author
Spectrometers; Sofia (Airborne Observatory); Heterodyning; Hot Electrons; Semiconductors (Materials)

19990052760 NASA Glenn Research Center, Cleveland, OH USA
A New Method to Measure Temperature and Burner Pattern Factor Sensing for Active Engine Control
Ng, Daniel, NASA Glenn Research Center, USA; May 1999; 10p; In English
Contract(s)/Grant(s): RTOP 274-00-00

Report No.(s): NASA/TM-1999-209090; E-11675; NAS 1.15:209090; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The determination of the temperatures of extended surfaces which exhibit non-uniform temperature variation is very important for a number of applications including the ”Burner Pattern Factor” (BPF) of turbine engines. Exploratory work has shown that use of BPF to control engine functions can result in many benefits, among them reduction in engine weight, reduction in operating cost, increase in engine life, while attaining maximum engine efficiency. Advanced engines are expected to operate at very high temperature to achieve high efficiency. Brief exposure of engine components to higher than design temperatures due to non-uniformity in engine burner pattern can reduce engine life. The engine BPF is a measure of engine temperature uniformity. Attainment of maximum temperature uniformity and high temperatures is key to maximum efficiency and long life. A new approach to determine through the measurement of just one radiation spectrum by a multiwavelength pyrometer is possible. This paper discusses a new temperature sensing approach and its application to determine the BPF.
Author
Temperature Measurement; Procedures; Turbine Engines; Temperature Sensors; Detection; Active Control

19990053346 Texas Technological Univ., Dept. of Electrical Engineering, Lubbock, TX USA
Multiplexed Holographic Data Storage in Bacteriorhodopsin
Mehrl, David J., Texas Technological Univ., USA; Krile, Thomas F., Texas Technological Univ., USA; June 1999; 90p; In English
Contract(s)/Grant(s): NAG2-1077; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Biochrome photosensitive films in particular Bacteriorhodopsin exhibit features which make these materials an attractive recording medium for optical data storage and processing. Bacteriorhodopsin films find numerous applications in a wide range of optical data processing applications; however the short-term memory characteristics of BR limits their applications for holographic data storage. The life-time of the BR can be extended using cryogenic temperatures [1], although this method makes the system overly complicated and unstable. Longer life-times can be provided in one modification of BR - the ”blue” membrane BR [2], however currently available films are characterized by both low diffraction efficiency and difficulties in providing photoreversible recording. In addition, as a dynamic recording material, the BR requires different wavelengths for recording and reconstructing of optical data in order to prevent the information erasure during its readout. This fact also put constraints on a BR-based Optical Memory, due to information loss in holographic memory systems employing the two-lambda technique for reading-writing thick multiplexed holograms.
Derived from text
Cryogenic Temperature; Holography; Data Storage; Optical Data Processing; Optical Memory (Data Storage); Bacteria

36
LASERS AND MASERS

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

19990052667 Lawrence Livermore National Lab., Livermore, CA USA
Preliminary Demonstration of Power Beaming With Non-Coherent Laser Diode Arrays
Kare, Jordin T.; Mitlitsky, Fred; Welsberg, Andrew; Feb. 26, 1999; 9p; In English; Prepared in collaboration with Kare Technical Consulting, San Ramon, CA.
Report No.(s): AD-A362586; UCRL-JC-133428; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A preliminary demonstration of free-space electric power transmission has been conducted using non-coherent laser diode arrays as the transmitter and standard silicon photovoltaic cell arrays as the receiver. The transmitter assembly used a high-power-density array of infrared laser diode bars, water cooled via integrated microchannel heat sinks and focused by cylindrical microlenses. The diode array composite beam was refocused by a parabolic mirror over a 10 meter path, and received on a 15 x 25 cm panel of thinned single crystal high efficiency silicon solar cells. The maximum cell output obtained was several watts, and the cell output was used to drive a small motor. Due to operating constraints and unexpected effects, particularly the high nonuniformity of the output beam, both the distance and total received power in this demonstration were modest. However, the existing transmitter is capable of supplying several hundred watts of light output, with a projected received electric power in excess of 200 watts. The source radiance is approximately 5 x 10(exp 9) W/m2-steradian. With the existing 20 cm aperture, useful power transmission over ranges to 100 meters should be achievable with a DC to DC efficiency of greater than 10%. Non-coherent sources of this type are readily scalable to powers of tens of kilowatts, and with larger apertures can be used directly for power transmission up to several kilometers. Future non-coherent diode laser sources may be suitable for power transmission over hundreds of kilome-

ters. Also, the experience gained with non-coherent arrays will be directly applicable to power beaming systems using coherent diode arrays or other array-type laser sources.
DTIC
Lasers; Diodes; Electric Power Transmission; Semiconductor Lasers; Transmitters; Single Crystals; Infrared Lasers

19990052965 Lawrence Livermore National Lab., Livermore, CA USA
Production of High-Value Isotopically Separated Materials ***Final Report***
Scheibner, K. F.; Comaskey, B.; Shaw, M. J.; Wilder, J. G.; Feb. 25, 1999; 5p; In English
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): AD-A362583; UCRL-ID-133503; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of this project was to complete the development of the laser systems and separator systems needed to investigate the potential for the economical separation of high value isotopes used in medical and industrial applications, then demonstrate this separation capability. The project was to focus on the isotopic purification of lead for use as solder in high-end electronics, and on the isotopic enrichment of thallium for medical applications. Ultimately the goal is to demonstrate the economical and technical viability of the technology for lead and thallium and to develop a more general capability for other possible isotope separation missions. Both lead and thallium are useful applications in this context because they require dye lasers, solid-state lasers, and a frequency doubling capability of some of the lasers. This later capability allows access to the wavelength range 250 to 450 nm, with tunable, high-power and high repetition frequency lasers. Until recently, these wavelengths have been largely inaccessible in combination with these other laser characteristics. In addition, up to two new potential laser-isotope separation applications would be conceptually developed through a process of needs analysis and technical feasibility studies.
DTIC
Lasers; Technology Assessment; Isotope Separation; Isotopic Enrichment

19990053118 NASA Goddard Space Flight Center, Greenbelt, MD USA
Interplanetary Microlaser Transponders
Degnan, John J., NASA Goddard Space Flight Center, USA; 1999; In English; Fundamental Physics in Space, 29-30 Apr. 1999, Washington, DC, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The feasibility of an asynchronous (i.e. independently firing) interplanetary laser transponder, capable of ranging between Earth and Mars and using the automated SLR2000 Satellite Laser Ranging (SLR) system as an Earth base station, has been suggested. Since that time, we have received a small amount of discretionary funding to further explore the transponder concept and to develop and test an engineering breadboard. Candidate operational scenarios for acquiring and tracking the opposite laser terminal over interplanetary distances have been developed, and breadboard engineering parameters were chosen to reflect the requirements of an Earth-Mars link Laboratory tests have been devised to simulate the Earth- Mars link between two independent SLR2000 transceivers and to demonstrate the transfer of range and time in single photon mode. The present paper reviews the concept of the asynchronous microlaser transponder, the transponder breadboard design, an operational scenario recently developed for an asteroid rendezvous, and the laboratory test setup. The optical head of the transponder breadboard fits within a cylinder roughly 15 cm in diameter and 32 cm in length and is mounted in a commercial two axis gimbal driven by two computer-controlled stepper motors which allows the receiver optical axis to be centered on a simulated Earth image. The optical head is built around a small optical bench which supports a 14.7 cm diameter refractive telescope, a prototype 2 kHz SLR2000 microlaser transmitter, a quadrant microchannel plate photomultiplier (MCP/PMT), a CCD array camera, spatial and spectral filters, assorted lenses and mirrors, and protective covers and sun shields. The microlaser is end-pumped by a fiber-coupled diode laser array. An annular mirror is employed as a passive transmit/receive (T/R) switch in an aperture-sharing arrangement wherein the transmitted beam passes through the central hole and illuminates only the central 2.5 cm of the common telescope (adequate to achieve a 10 arcsecond full laser beam divergence) while the receiver uses the remainder of the 14.7 cm aperture. Additional electronic instrumentation includes the diode pump array and associated heat sink and current drivers, rubidium frequency standard, timing distribution module, range gate generator, a recently developed all-digital correlation range receiver, and system computer. Acquisition of the opposite transponder terminal requires a search within a three-dimensional volume determined by the initial pointing uncertainty and a maximum 500 microsecond uncertainty in the laser time of fire at the opposite terminal for totally uncorrelated Earth and spacecraft clocks. The angular search is aided by a sensitive CCD array capable of imaging the Earth, Moon, and surrounding stars within the nominal + 0.5 degree cone of uncertainty associated with the initial pointing of a spacecraft body or microwave communications dish.
Derived from text
Feasibility Analysis; Breadboard Models; Charge Coupled Devices; Frequency Standards; Imaging Techniques; Transmitter Receivers; Transponders; Imp

19990053225 Massachusetts Univ., Boston, MA USA
Quantum Modeling ***Final Report, Aug. 1996 - Jul. 1997***
Sun, Gregory; Apr. 1999; 33p; In English
Contract(s)/Grant(s): F30602-96-2-0199; AF Proj. 2305
Report No.(s): AD-A363264; 5-28120; AFRL-SN-RS-TR-1999-76; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project analyzed the novel idea of constructing intersubband lasers on Si-based material systems, which could potential offer the great opportunity for monolithic integration of Si-based photonic devices with advanced Si electronics. The materials systems under investigation include quantum structures of SiGe/Si for mid- to far-infrared laser applications and of Si/ZnS for the near -infrared. The quantum-mechanical results have been published in referred journals.
DTIC
Quantum Wells; Semiconductor Lasers; Laser Applications

19990053463 Lawrence Livermore National Lab., Livermore, CA USA
High-Power Laser Source Evaluation ***Final Report***
Back, Christina A., Lawrence Livermore National Lab., USA; Decker, Christopher D., Lawrence Livermore National Lab., USA; Davis, John F., Lawrence Livermore National Lab., USA; Dixit, Sham, Lawrence Livermore National Lab., USA; Grun, Jacob, Lawrence Livermore National Lab., USA; Jul. 1998; 64p; In English
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): AD-A362788; UCRL-ID-129096-98; QDV-99-0001; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Robust Nuclear-Weapons-Effects Testing (NWET) capability will be needed for the foreseeable future to ensure the performance and reliability, in nuclear environments, of the evolving U.S. stockpile of weapons and other assets. Ongoing research on the use of high-energy lasers to generate environments of utility in nuclear weapon radiation effects simulations is addressed in the work described in this report. Laser-driven hohlraums and a variety of other targets have been considered in an effort to develop NWET capability of the highest possible fidelity in above-ground experiments. The envelope of large-system test needs is shown as the gray region. It does not represent the spectrum of any device; it is just the envelope of the spectral region of outputs from a number of possible devices. It is a goal of our laser-only and ignition-capsule source development work to generate x rays that fall somewhere in this envelope.
DTIC
X Rays; Bremsstrahlung; Nuclear Radiation; Radiation Effects; Nuclear Weapons; Tests; Simulation

19990053468 Aerospace Corp., Engineering and Technology Group, El Segundo, CA USA
Conversion of Laser Phase Noise to Amplitude Noise in a Resonant Atomic Vapor: The Role of Laser Linewidth
Camparo, James C.; Coffer, John G.; Apr. 15, 1999; 12p; In English
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A362816; TR-98(8555)-14; SMC-TR-99-11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

When laser light propagates through a resonant medium, the transmitted beam can exhibit excess intensity noise AMPLITUDE MODULATION (AM). In a semiclassical description of the phenomenon, laser phase noise (PM) induces fluctuations in the medium's electric susceptibility, which in turn cause fluctuations in the transmitted intensity. The process provides an efficient means for PM-to-AM conversion, and intuition suggests that large linewidth lasers should exhibit much greater PM-to-AM conversion than narrow linewidth lasers. Here we measure the relative intensity noise (RIN) for two diode lasers whose linewidth delta-v sub L differ by more than 10(exp 2), after the lasers have propagated through a resonant rubidium vapor. Though the RIN of the narrow linewidth laser is only reduced by a factor of about 6 compared to the broad linewidth laser, our results are nonetheless consistent with numerical simulations of the PM-to-AM conversion process. In particular, both computation and analytical theory indicate that RIN is a nonlinear function of delta-v sub L. For single-mode laser linewidth less than the atomic dephasing rate, RIN increases like square roots of delta-v sub L, while for linewidth greater than the atomic dephasing rate RIN is a decreasing function of delta-v sub L.
DTIC
Laser Pumping; Atomic Clocks; Laser Outputs; Semiconductor Lasers; Electromagnetic Noise

37
MECHANICAL ENGINEERING

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

19990049428 Sandia National Labs., Albuquerque, NM USA
Welding the AT-400A Containment Vessel
Brandon, E.; Nov. 01, 1998; 1p; In English
Report No.(s): DE00-002052; SAND98-2446; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Early in 1994, the Department of Energy assigned Sandia National Laboratories the responsibility for designing and providing the welding system for the girth weld for the AT-400A containment vessel. (The AT-400A container is employed for the shipment and long-term storage of the nuclear weapon pits being returned from the nation's nuclear arsenal.) Mason Hanger Corporation's Pantex Plant was chosen to be the production facility. The project was successfully completed by providing and implementing a turnkey welding system and qualified welding procedure at the Pantex Plant. The welding system was transferred to Pantex and a pilot lot of 20 AT-400A containers with W48 pits was welded in August 1997. This document is intended to bring together the AT-400A welding system and product (girth weld) requirements and the activities conducted to meet those requirements. This document alone is not a complete compilation of the welding development activities but is meant to be a summary to be used with the applicable references.
NTIS
Containment; Vessels; Arc Welding

19990050930 DaimlerChrysler Aerospace A.G., Military Aircraft, Munich, Germany
Self-Induced Brake Torque Oscillations of Landing Gear as an Interaction of Non-Linear Tyre with Brake Control System
Luber, Wolfgang G., DaimlerChrysler Aerospace A.G., Germany; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 211-224; In English; See also 19990050911; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The paper describes Brake Torque Oscillations at Brake Initiation as a quasi self-induced oscillation due to the interaction of non-linear tyre circumferential force characteristics with the brake control system. Usual means to suppress oscillation (dampers or modification of landing gear geometry) are ineffective in this case. This case demonstrates that not only unsuitable combinations of structural stiffness, damping, and pneumatic tyre characteristics may lead to unexpected vibration problems on landing gears. Rather, an unlucky combination of brake system design with the peculiarities of circumferential force development by a tyre can also produce a serious vibration problem. In a series of development rig tests for a fighter aircraft brake system, some tests were scheduled to demonstrate the fastest possible brake force rise at high speed. A fast brake force rise was considered to yield, at least in theory, the shortest possible landing ground run distance.
Author
Dynamic Structural Analysis; Landing Gear; Aircraft Brakes; Wheel Brakes; Braking; Oscillations

19990050931 Allied-Signal Aerospace Co., Aircraft Landing Systems, South Bend, IN USA
Nonlinear Transient Whirl Vibration Analysis of Aircraft Brake Systems
Chang, Craig F., Allied-Signal Aerospace Co., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 225-234; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The objective of this paper is to present a nonlinear transient analysis method for understanding and solving aircraft brake whirl vibration problems. Mathematical modeling and derivations of the brake mechanism, which include the hydraulic interaction between the brake and the fluid, will be discussed. The factors that influence whirl will be presented. Potential methods for resolving whirl vibration will also be discussed.
Author
Aircraft Brakes; Wheel Brakes; Aircraft Hydraulic Systems; Rotary Stability; Mathematical Models; Nonlinearity; Dynamic Structural Analysis; Rotation; Vibration

19990051003 NASA Langley Research Center, Hampton, VA USA
Integral Ring Carbon-Carbon Piston
Northam, G. Burton, Inventor, NASA Langley Research Center, USA; Mar. 23, 1999; In English; Provisional application of US-

Patent-Appl-SN-014187, filed 13 Mar. 1996
Patent Info.: Filed 12 Mar. 1997; US-Patent-5,884,550; US-Patent-Appl-SN-815535; US-Patent-Appl-SN-014187; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

An improved structure for a reciprocating internal combustion engine or compressor piston fabricate from carbon-carbon composite materials is disclosed. An integral ring carbon-carbon composite piston, disclosed herein, reduces the need for piston rings and for small clearances by providing a small flexible, integral component around the piston that allows for variation in clearance due to manufacturing tolerances, distortion due to pressure and thermal loads, and variations in thermal expansion differences between the piston and cylinder liner.

Official Gazette of the U.S. Patent and Trademark Office

Carbon-Carbon Composites; Internal Combustion Engines; Pistons; Piston Engines

19990052593 Federal Energy Technology Center, Morgantown, WV USA

Task 6.3/6.7.4 - Silicon Carbide Joining

John P. Hurley,; John P. Kay,; Feb. 01, 1998; 10p; In English
Report No.(s): DE00-001677; DE-FC21-93MC30097-53; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Future energy systems will be required to fire low-grade fuels and meet higher energy conversion efficiencies than today's systems. The steam cycle used at present is limited to a maximum temperature of 550 C, because above that the stainless steel tubes deform and corrode excessively. Although high-temperature alloys will suffice for the construction of these components in the near-term, the greatest efficiency increases can only be reached with the use of advanced structural ceramics such as silicon carbide (SiC). SiC does not melt, but instead sublimes at temperatures over 2000 C. Therefore, it is not possible to join pieces of it through welding, and most brazing compounds have much lower melting points so the joints lose strength at temperatures much lower than the maximum use temperature of the SiC. Since larger objects, such as heat exchangers, cannot be easily created from smaller ceramic pieces, the size of the SiC structures that can presently be manufactured are limited by the size of the sintering furnaces (approximately 10 feet for sintered alpha silicon carbide). In addition, repair of the objects will require the use of field joining techniques. Some success has been made by causing silicon and carbon to react at 1400-1500 C to form SiC in a joint but these joints contain continuous channels of unreacted silicon which cause the joints to corrode and creep excessively at temperatures below 1260 C. At present, no joining techniques are available that allow sintered alpha SiC to be used to its full potential.

NTIS

Silicon Carbides; Joining

19990052785 NASA Lewis Research Center, Cleveland, OH USA

Effects of Planetary Speed Reduction Ratio on Mean Service Life

Savage, M., Akron Univ., USA; Rubadeux, K. L., Hendrickson Co., USA; Coe, H. H., NASA Lewis Research Center, USA; Journal of Mechanical Design; March 1998; Volume 120, pp. 113-118; In English
Contract(s)/Grant(s): RTOP 581-30-13; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Planetary gear transmissions are compact speed reductions which use parallel-load paths to transmit high power. The range of possible reduction ratios is bounded from below and above by limits on the relative size of the planet gears. For a single plane planetary transmission, the speed-reduction ratio must be greater than two for planet gears to exist. As the ratio increase, so does the size of the planets relative to the sizes of the sun and ring. Which ratio is best for a planetary reduction can be resolved by studying a series of optimal designs. In this series, each design is obtained by maximizing the service life for a spur-gear planetary with a fixed size, speed reduction ratio, input speed, power and materials. The planetary gear reduction service life is modeled as a function of the two-parameter Weibull distributed service lives of the ball bearings and spur gears in the reduction. Planet-bearing life strongly influences the optimal reduction lives which point to an optimal planetary reduction ratio in the neighborhood of four to five.

Author

Gears; Weibull Density Functions; Mechanical Drives; Transmissions (Machine Elements); Mechanical Engineering; Speed Control

38
QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

19990051020 Pennsylvania State Univ., Applied Research Lab., State College, PA USA
Condition Monitoring of Large-Scale Facilities
Hall, David L., Pennsylvania State Univ., USA; March 1999; 78p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG2-1182; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This document provides a summary of the research conducted for the NASA Ames Research Center under grant NAG2-1182 (Condition-Based Monitoring of Large-Scale Facilities). The information includes copies of view graphs presented at NASA Ames in the final Workshop (held during December of 1998), as well as a copy of a technical report provided to the COTR (Dr. Anne Patterson-Hine) subsequent to the workshop. The material describes the experimental design, collection of data, and analysis results associated with monitoring the health of large-scale facilities. In addition to this material, a copy of the Pennsylvania State University Applied Research Laboratory data fusion visual programming tool kit was also provided to NASA Ames researchers.
Derived from text
Data Acquisition; Multisensor Fusion; Experiment Design; Feasibility; Aerodynamics; Fan Blades

39
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.

19990049421 Wright State Univ., Dept. of Mechanical and Materials Engineering, Dayton, OH USA
Structural Reliability Analysis and Optimization: Use of Approximations
Grandhi, Ramana V., Wright State Univ., USA; Wang, Liping, Wright State Univ., USA; May 1999; 324p; In English
Contract(s)/Grant(s): NAG3-1489; RTOP 523-22-13
Report No.(s): NASA/CR-1999-209154; E-11684; NAS 1.26:209154; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

This report is intended for the demonstration of function approximation concepts and their applicability in reliability analysis and design. Particularly, approximations in the calculation of the safety index, failure probability and structural optimization (modification of design variables) are developed. With this scope in mind, extensive details on probability theory are avoided. Definitions relevant to the stated objectives have been taken from standard text books. The idea of function approximations is to minimize the repetitive use of computationally intensive calculations by replacing them with simpler closed-form equations, which could be nonlinear. Typically, the approximations provide good accuracy around the points where they are constructed, and they need to be periodically updated to extend their utility. There are approximations in calculating the failure probability of a limit state function. The first one, which is most commonly discussed, is how the limit state is approximated at the design point. Most of the time this could be a first-order Taylor series expansion, also known as the First Order Reliability Method (FORM), or a second-order Taylor series expansion (paraboloid), also known as the Second Order Reliability Method (SORM). From the computational procedure point of view, this step comes after the design point identification; however, the order of approximation for the probability of failure calculation is discussed first, and it is denoted by either FORM or SORM. The other approximation of interest is how the design point, or the most probable failure point (MPP), is identified. For iteratively finding this point, again the limit state is approximated. The accuracy and efficiency of the approximations make the search process quite practical for analysis intensive approaches such as the finite element methods; therefore, the crux of this research is to develop excellent approximations for MPP identification and also different approximations including the higher-order reliability methods (HORM) for representing the failure surface. This report is divided into several parts to emphasize different segments of the structural reliability analysis and design. Broadly, it consists of mathematical foundations, methods and applications. Chapter I discusses the fundamental definitions of the probability theory, which are mostly available in standard text books. Probability density function descriptions relevant to this work are addressed. In Chapter 2, the concept and utility of function approximation are discussed for a general application in engineering analysis. Various forms of function representations and the latest developments in nonlinear adaptive approximations are presented with comparison studies. Research work accomplished in reliability analysis is presented in Chapter 3. First, the definition of safety index and most probable point of failure are introduced. Efficient ways of computing the safety index with a fewer number of iterations is emphasized. In chapter 4, the probability of failure prediction is presented

using first-order, second-order and higher-order methods. System reliability methods are discussed in chapter 5. Chapter 6 presents optimization techniques for the modification and redistribution of structural sizes for improving the structural reliability. The report also contains several appendices on probability parameters.
Derived from text
Failure Analysis; Reliability Analysis; Structural Reliability; Structural Design; Design Analysis; Optimization; Approximation

19990050913 Manchester Univ., Dynamics and Aeroelasticity Research Group, UK
A Combined Modal/Finite Element Analysis Technique for Nonlinear Beam Dynamic Response Under Harmonic Excitation
McEwan, Matthew I., Manchester Univ., UK; Wright, Jan R., Manchester Univ., UK; Cooper, Jonathan E., Manchester Univ., UK; Leung, Andrew Y. T., Manchester Univ., UK; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 13-22; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A method is proposed for modelling multi-mode large deflection beam response. Significant savings in computational time can be obtained compared with the direct integration nonlinear finite element method. The deflections from a number of static nonlinear finite element test cases are transformed into modal co-ordinates using the modes of the underlying linear system. Regression analysis is then used to find the unknown nonlinear modal stiffness coefficients. The governing nonlinear equations of motion are completed by including finite element derived modal mass, and an arbitrary damping model. The response of the beam to excitation of an arbitrary nature may then be found using time domain numerical integration. The work presented here extends upon the work of previous researchers to include non-coupled multi-modal response, and the effect of buckling due to axial loads. The proposed method is applied to the case of a homogeneous isotropic beam, which is simply supported and axially constrained at both ends. For the case of steady state harmonic excitation, results are compared with the direct integration nonlinear finite element method.
Author
Modal Response; Finite Element Method; Dynamic Response; Harmonic Excitation; Aeroelasticity; Dynamic Structural Analysis; Beams (Supports); Thermal Buckling

19990050928 Old Dominion Univ., Dept. of Aerospace Engineering, Norfolk, VA USA
Nonlinear Response of Composite Panels Under Combined Acoustic Excitation and Aerodynamic Pressure
Abdel-Motagaly, K., Old Dominion Univ., USA; Duan, B., Old Dominion Univ., USA; Mei, C., Old Dominion Univ., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 189-200; In English; See also 19990050911
Contract(s)/Grant(s): NAG1-2150; F33615-91-C-3205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A finite element formulation is presented for the analysis of large deflection response of composite panels subjected to aerodynamic pressure- at supersonic flow and high acoustic excitation. The first-order shear deformation theory is considered for laminated composite plates, and the von Karman nonlinear strain-displacement relations are employed for the analysis of large deflection panel response. The first-order piston theory aerodynamics and the simulated Gaussian white noise are employed for the aerodynamic and acoustic loads, respectively. The nonlinear equations of motion for an arbitrarily laminated composite panel subjected to a combined aerodynamic and acoustic pressures are formulated first in structure node degrees-of-freedom. The system equations are then transformed and reduced to a set of coupled nonlinear equations in modal coordinates. Modal participation is defined and the in-vacuo modes to be retained in the analysis are based on the modal participation values. Numerical results include root mean square values of maximum deflections, deflection and strain response time histories, probability distributions, and power spectrum densities. Results showed that combined acoustic and aerodynamic loads have to be considered for panel analysis and design at high dynamic pressure values.
Author
Acoustic Excitation; Composite Structures; Deflection; Finite Element Method; Dynamic Response; Aerodynamic Loads; Aeroelasticity; Dynamic Pressure; Panel Flutter; Modal Response; Rectangular Plates; Time Domain Analysis

19990050941 Washington Univ., Dept. of Aeronautics and Astronautics, Seattle, WA USA
Reduced Order Design-Oriented Stress Analysis using Combined Direct and Adjoint Solutions
Livne, Eli, Washington Univ., USA; Blando, Guillermo D., Washington Univ., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 345-368; In English; See also 19990050911; Sponsored by a NSF Young Investigator Award; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A new method for extracting accurate stress information from reduced order structural and aeroelastic models is presented. The method has second order accuracy when approximate reduced order direct and adjoint solutions (based on different reduced order bases) are used simultaneously to obtain approximate stresses. The method is applicable to both static and dynamic linear analysis. A review of four common methods for structural model order reduction (two variants of the mode displacement (MD) method, the Mode Acceleration (MA) method, and the Ritz Vector (RV) method) identifies sources of difficulty and causes of errors in stress behavior sensitivity calculations. The new method is then presented and its relations with the other methods examined. Considerations used for selection of the reduced order direct and adjoint bases are discussed. A series of static and dynamic test cases is used to assess accuracy of the new method in an analysis mode. Accuracy studies of sensitivity calculations follow. The present work hopes to contribute to the field of design-oriented structural dynamics in terms of both insight and practice.
Author
Dynamic Structural Analysis; Adjoints; Mathematical Models; Sensitivity; Approximation; Numerical Analysis

19990051026 Washington Univ., Dept. of Aeronautics and Astronautics, Seattle, WA USA
Analytic Sensitivity and Approximation of Skin Buckling Constraints in Wing-Shape Synthesis
Livne, Eli, Washington Univ., USA; Milosavljevic, Radomir, Washington Univ., USA; Journal of Aircraft; October 1995; Volume 32, No. 5, pp. 1102-1113; In English
Contract(s)/Grant(s): NAG2-723; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Explicit expressions for terms of the stiffness and geometric stiffness matrices are derived for the buckling analysis of trapezoidal fiber composite wing skin panels. The formulation is based on Ritz analysis using simple polynomials, and leads to explicit expressions for the analytic sensitivities of the stiffness and geometric stiffness matrices with respect to layer thickness, fiber directions, and panel shape. Integration with wing box analysis using either the equivalent plate approach or the finite element method, makes it possible to obtain sensitivities of panel buckling constraints with respect to wing planform shape or locations of internal ribs and spars. The analytic sensitivities are used to construct approximations of panel buckling constraints for integrated wing/panel design synthesis.
Author
Stiffness Matrix; Buckling; Composite Structures; Fiber Composites; Wing Planforms; Finite Element Method; Sensitivity

19990052589 Sandia National Labs., Albuquerque, NM USA
Reformulation of Elasticity Theory for Discontinuities and Long-Range Forces
Silling, S. A.; Oct. 01, 1998; 1p; In English
Report No.(s): DE00-001895; SAND98-2176; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Some materials may naturally form discontinuities such as cracks as a result of deformation. As an aid to the modeling of such materials, a new framework for the basic equations of continuum mechanics, called the 'peridynamic' formulation, is proposed. The propagation of linear stress waves in the new theory is discussed, and wave dispersion relations are derived. Material stability and its connection with wave propagation is investigated. It is demonstrated by an example that the reformulated approach permits the solution of fracture problems using the same equations either on or off the crack surface or crack tip. This is an advantage for modeling problems in which the location of a crack is not known in advance.
NTIS
Continuum Mechanics; Discontinuity; Elastic Properties

19990052628 NASA Langley Research Center, Hampton, VA USA
Progressive Failure Analysis Methodology for Laminated Composite Structures
Sleight, David W., NASA Langley Research Center, USA; March 1999; 92p; In English
Contract(s)/Grant(s): RTOP 538-13-12-04
Report No.(s): NASA/TP-1999-209107; L-17660; NAS 1.60:209107; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A progressive failure analysis method has been developed for predicting the failure of laminated composite structures under geometrically nonlinear deformations. The progressive failure analysis uses C(exp 1) shell elements based on classical lamination theory to calculate the in-plane stresses. Several failure criteria, including the maximum strain criterion, Hashin's criterion, and Christensen's criterion, are used to predict the failure mechanisms and several options are available to degrade the material properties after failures. The progressive failure analysis method is implemented in the COMET finite element analysis code and can predict the damage and response of laminated composite structures from initial loading to final failure. The different failure criteria and material degradation methods are compared and assessed by performing analyses of several laminated composite structures.

Results from the progressive failure method indicate good correlation with the existing test data except in structural applications where interlaminar stresses are important which may cause failure mechanisms such as debonding or delaminations.
Author
Laminates; Failure Analysis; Interlaminar Stress; Structural Design; Deformation; Composite Structures

19990052629 Clark-Atlanta Univ., Dept. of Engineering, GA USA
Elastic Buckling of Orthotropic Plates Under Varying Axial Stresses
Badir, Ashraf, Clark-Atlanta Univ., USA; Hu, Hurang, Clark-Atlanta Univ., USA; Diallo, Abdouramane, Clark-Atlanta Univ., USA; 1997; 10p; In English
Contract(s)/Grant(s): NAG1-1714; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The elastic buckling load of simply supported rectangular orthotropic plates subjected to a second degree parabolic variation of axial stresses in the longitudinal direction is calculated using analytical methods. The variation of axial stresses is equilibrated by nonuniform shear stresses along the plate edges and transverse normal stresses. The influence of the aspect ratio is examined, and the results are compared with plates subjected to uniform axial stresses.
Author
Elastic Buckling; Orthotropic Plates; Axial Stress; Aspect Ratio

19990052679 Japan Atomic Energy Research Inst., Center for Promotion of Computational Science and Engineering, Tokyo, Japan
Multidisciplinary Aero-Structural Modeling on Parallel Computers
Onishi, Ryoichi, Japan Atomic Energy Research Inst., Japan; Kimura, Toshiya, Japan Atomic Energy Research Inst., Japan; Guo, Zhigong, Institute of Physical and Chemical Research, Japan; Iwamiya, Toshiyuki, National Aerospace Lab., Japan; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 483-490; In English; See also 19990052675; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The system for coupled aero-structural analysis has been implemented on a distributed-parallel processing environment at Japan Atomic Energy Research Institute(JAERI). The system is based on loose coupling of CFD(Computational Fluid Dynamics) and CSD(Computational Structural Dynamics), solves fluid and structural equations concurrently exchanging each solution data, and has been applied to the dynamic aeroelastics problem of a high aspect-ratio swept-back wing. The analytical model of skin, spar, and rib construction of a wing box structure was created and used for aero-structural computations. Parallel and distributed approaches employed in the system is efficient for multidisciplinary applications.
Author
Aeroelasticity; Dynamic Structural Analysis; Multidisciplinary Design Optimization; Parallel Processing (Computers); Dynamic Response; Structural Design

19990052680 Oklahoma Univ., Norman, OK USA
Astros*: Seamless Integration of Astros with a Unified Aerodynamic Module: Applications Benchmarking and Testing
Striz, A. G., Oklahoma Univ., USA; Jung, S. Y., Oklahoma Univ., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 491-500; In English; See also 19990052675
Contract(s)/Grant(s): F33615-96-C-3217; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper reports application cases to benchmark and test the analysis capabilities of the seamless integration of the Automated STRuctural Optimization System (ASTROS) with a unified steady/unsteady aerodynamics module (ZAERO) called ASTROS*. With these unified aerodynamics, ASTROS* can now perform analysis and design optimization for realistic wing-body configurations throughout the linear subsonic/supersonic and the nonlinear transonic/hypersonic flight regimes. Three fully-built up wing/fuselage models were used to validate ASTROS* and to show its applicability in all Mach number ranges.
Author
Unsteady Aerodynamics; Body-Wing Configurations; Optimization; Applications Programs (Computers); Dynamic Structural Analysis; Aeroelasticity; Flutter Analysis

19990052684 Alberta Univ., Dept. of Mathematical Sciences, Edmonton, Alberta Canada
Application of the Centre Manifold Theory in Nonlinear Aeroelasticity
Liu, L., Alberta Univ., Canada; Wong, Y. S., Alberta Univ., Canada; Lee, B. H. K., National Research Council of Canada, Canada; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 533-542; In English; See also 19990052675; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In dynamic response investigations of aircraft structures, classical theories assume linear aerodynamics and linear structures, so that the aeroelastic equations can be reduced to a set of linear equations that can be readily solved. However, in many instances, linear aerodynamics give insufficiently accurate results. For example, when the airspeed approaches transonic Mach numbers, linear theory fails to detect the transonic dip and other phenomena associated with the presence of shock waves. Aircraft structures also can have nonlinearities that affect not only the flutter speed, but also the characteristics of the dynamical response. Hence, to obtain a better understanding of the physical and mathematical aspect of non-linear aeroelasticity, recent research has been directed towards the study of these two types of nonlinearities. Lee et. al. studied a two-degree-of-freedom aeroelastic system with a structural nonlinearity represented by a cubic restoring spring force. When the system is subject to an external forcing term with driving frequency w, Lee et. al. derived analytical formulae that provide amplitude-frequency relationships for the pitch and plunge motion, respectively. However, for a self-excited system (i.e. in the absence of external forcing term), the reference frequency w is not known, and the motion can not be determined from the amplitude-frequency relationships they derived. Several procedures were discussed to estimate the frequency value w for the self-excited system, but the results were not satisfactory except when the velocity U* is very close to the linear flutter speed U*(sub L). to overcome this limitation in Lee et. al. analysis, we apply the centre manifold theory of Carr and the principal of normal form, to derive a frequency relation for self-excited motion of a two-degree-of-freedom nonlinear system. Using the frequency equation and the amplitude- frequency relationships, limit cycle oscillation (LCO) for self-excited system can be predicted analytically.
Derived from text
Aeroelasticity; Dynamic Response; Flutter; Nonlinear Systems; Aircraft Structures; Mathematical Models; Airfoil Oscillations

19990052688 Defence Science and Technology Organisation, Aereonautical and Maritime Research Lab., Airframes and Engines Div., Melbourne, Australia
Creation of a Finite Element Model for F/A-18 Structural Dynamic Analyses Based on Ground Vibration Test Data
Dunn, S. A., Defence Science and Technology Organisation, Australia; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 585-594; In English; See also 19990052675; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In this paper, a technique for creating structural dynamic models directly from experimental data is proposed. The method is based on having a finite element model with prescribed geometry for nodes and beams and using the artificial intelligence optimisation tool of genetic algorithms. The aim is then to create an optimal model by selecting mass and stiffness properties such that the resulting model gives the best approximation to the real data. Such a process has been the subject of a number of earlier papers by the author and in this paper, results are presented for the creation of a complete aircraft model with symmetric boundary conditions based on actual ground vibration test data.
Author
Dynamic Models; Genetic Algorithms; Mathematical Models; Optimization; Aircraft Models; Finite Element Method; Dynamic Structural Analysis

19990052708 Manchester Univ., Dynamics and Aeroelasticity Research Group, UK
Identification of a Non-Proportionally Damped Truss Structure
Naylor, Steven, Manchester Univ., UK; Wright, Jan R., Manchester Univ., UK; Cooper, Jonathan E., Manchester Univ., UK; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 847-856; In English; See also 19990052675; Sponsored in part by LMS and LMS-DIFA; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In this paper, an extension of the force appropriation approach used for identifying the dynamic characteristics of non-proportionally damped structures is applied to a 3 bay cantilevered truss structure with damped struts. The Resonant Decay method involves exciting each mode of a structure using an appropriated excitation vector and then removing the excitation such that any modes coupled by damping forces will respond. A Least Squares curve fit is employed in modal space in order to identify the modal damping matrix. Three configurations are considered.
Author
Damping; Dynamic Characteristics; Trusses; Dynamic Models; Excitation; Dynamic Structural Analysis; System Identification

19990052756 Alabama Univ., Dept. of Civil and Environmental Engineering, Huntsville, AL USA
Sand Shear Band Thickness Measurements by Digital Imaging Techniques
Alshibli, Khalid A., Alabama Univ., USA; Sture, Stein, Colorado Univ., USA; Journal of Computing in Civil Engineering; Dec. 11, 1998; ISSN 0887-3801; Volume 13, No. 2; In English
Contract(s)/Grant(s): NAG8-38779

Report No.(s): Paper-19837; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Digital imaging analysis was used to study localized deformations in granular materials tested under plane strain condition. Two independent techniques were applied and compared. In the first technique, the digitized optical images of a grid printed on the latex membrane were used to measure the shear band orientation angle and thickness, and were found to be 54.5 degrees and 3.01 mm, respectively. The second technique involved introducing an ultra-low viscosity resin into the specimen in preparation for thin-sectioning and microscopic study of the internal fabric. A total of 24 microscopic images obtained from four thin sections were analyzed and void ratio variation was measured. The shear band thickness measurements from images located along the shear band axis (at two locations) were equal to 3.19 and 3.29 mm, which are very close to the average value obtained from surface analysis. The study was then extended to investigate the effects of sand grain-size, specimen density, and confining pressure on shear band thickness. It was found that the normalized shear band thickness decreases as grain-size increases and as density decreases. Finally, shear band thickness is dependent on the specimen dilatancy angle.

Author

Deformation; Granular Materials; Plane Strain; Thickness; Sands

19990052892 Ohio Aerospace Inst., Cleveland, OH USA

Passively Damped Laminated Piezoelectric Shell Structures with Integrated Electric Networks

Saravanos, Dimitris A., Ohio Aerospace Inst., USA; March 1999; 22p; In English

Contract(s)/Grant(s): NCC3-455; RTOP 523-21-13

Report No.(s): NASA/CR-1999-208871; NAS 1.26:208871; E-11515; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Multi-field mechanics are presented for curvilinear piezoelectric laminates interfaced with distributed passive electric components. The equations of motion for laminated piezoelectric shell structures with embedded passive electric networks are directly formulated and solved using a finite element methodology. The modal damping and frequencies of the piezoelectric shell are calculated from the poles of the system. Experimental and numerical results are presented for the modal damping and frequency of composite beams with a resistively shunted piezoceramic patch. The modal damping and frequency of plates, cylindrical shells and cylindrical composite blades with piezoelectric-resistor layers are predicted. Both analytical and experimental studies illustrate a unique dependence of modal damping and frequencies on the shunting resistance and show the effect of structural shape and curvature on piezoelectric damping.

Author

Damping; Composite Materials; Electric Networks; Equations of Motion; Finite Element Method

19990052969 General Electric Co., R and D Center, Schenectady, NY USA

Heat Transfer and Flow on the First Stage Blade Tip of a Power Generation Gas Turbine, Part 1, Experimental Results *Final Report*

Bunker, Ronald S., General Electric Co., USA; Bailey, Jeremy C., General Electric Co., USA; Ameri, Ali A., AYT Corp., USA; April 1999; 14p; In English

Contract(s)/Grant(s): NAS3-98106; NAS3-27571; DE-FC21-95MC-31176; RTOP 523-26-13

Report No.(s): NASA/CR-1999-209152; NAS 1.26:209152; E-11660; ASME-99-GT-169; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A combined computational and experimental study has been performed to investigate the detailed distribution of convective heat transfer coefficients on the first stage blade tip surface for a geometry typical of large power generation turbines(>100MW). This paper is concerned with the design and execution of the experimental portion of the study. A stationary blade cascade experiment has been run consisting of three airfoils, the center airfoil having a variable tip gap clearance. The airfoil models the aerodynamic tip section of a high pressure turbine blade with inlet Mach number of 0.30, exit Mach number of 0.75, pressure ratio of 1.45, exit Reynolds number based on axial chord of 2.57 x 10(exp 6), and total turning of about 110 degrees. A hue detection based liquid crystal method is used to obtain the detailed heat transfer coefficient distribution on the blade tip surface for flat, smooth tip surfaces with both sharp and rounded edges. The cascade inlet turbulence intensity level took on values of either 5% or 9%. The cascade also models the casing recess in the shroud surface ahead of the blade. Experimental results are shown for the pressure distribution measurements on the airfoil near the tip gap, on the blade tip surface, and on the opposite shroud surface. Tip surface heat transfer coefficient distributions are shown for sharp-edge and rounded-edge tip geometries at each of the inlet turbulence intensity levels.

Author

Gas Turbines; Blade Tips; Heat Transfer; Heat Transfer Coefficients; Pressure Distribution; Turbine Blades; Convective Heat Transfer

19990053306 Sandia National Labs., Albuquerque, NM USA
Laboratory Simulation of Response to a Shock Environment
Benham, R.; Duggins, B.; Mayes, R.; Simmermacher, T.; Jan. 04, 1999; 16p; In English; Shock and Vibration, 12-16 Oct. 1998, St. Paul Minneapolis, MN, USA
Report No.(s): DE00-003238; SAND99-0008C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The focus of this work will be to simulate a harsh, blast environment on a space structure. Data from a reverse Hopkinson bar (RHB) test is used to generate the response to a symmetric, distributed load. The RHB generates a high-amplitude, high-frequency content, concentrated pulse that excites components at near-blast levels. The transfer functions generated at discrete points, with the RHB, are used to generate an experimental model of the structure, which is then used in conjunction with the known pressure distribution, to estimate the component response to a blast. The shock spectrum of the predicted response and the actual response compared well in two of the three cases presented.
NTIS
Simulation; Spacecraft Structures; Shock

19990053413 SRI International Corp., Menlo Park, CA USA
Dynamic Failure of Materials. Volume 2 - Compilation of Russian Spall Data, ***20 May 1993 - 20 Sep. 1996***
Antoun, Tarabay H.; Seaman, Lynn; Curran, Donald R.; Nov. 01, 1998; 162p; In English
Contract(s)/Grant(s): DNA001-93-C-0104; Proj-SB, \ AJ
Report No.(s): AD-A362759; SRI-PYU-4727; DSWA-TR-96-77-V2; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Over the past three decades, scientist in the Former Soviet Union (FSU) and in the West have developed innovative experimental techniques, measurement diagnostics, and constitutive models of the Spall Process. Extensive literature has been built up over the years in Western publications. However, much of the FSU work was not available in English and was largely inaccessible to Western readers. Improved communication between Western and FSU scientists since the end of the Cold War now allows the parallel FSU and Western work to be collected, compared, cross-correlated, and examined for new insights and ideas for future directions. The goal of this project was to make formerly inaccessible FSU results available to Western readers and to create a handy reference source for fracture kinetics data, experimental techniques, measurement diagnostics, interpretation methods, constitutive modeling approaches, and numerical computation approaches and results. We hope this work will be useful to investigators and engineers dealing with fast load and fracture as well as to investigators working in the field of physics of strength.
DTIC
Fracturing; Loads (Forces); Cross Correlation; Kinetics; Diagnosis; Mathematical Models

42
GEOSCIENCES (GENERAL)

19990050991 Oregon State Univ., Corvallis, OR USA
Preliminary Investigation of Microbial Indicators in the Assessment of Oregon Streams
Campbell, H. M. K.; Sep. 29, 1998; 78p; In English
Report No.(s): PB99-147225; EPA/600/R-99/042; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The purpose of this research was to: (1) provide quantitative estimates of the levels of microbial indicators of public health significance in streams throughout the state of Oregon, (2) explore differences in stream bacterial levels in Oregon ecoregions, and (3) investigate the relationship between bacterial functional diversity and ecoregions.
NTIS
Oregon; Streams; Environmental Surveys; Indicators

19990052632 Geological Survey, Water Resources Div., Lakewood, CO USA
Water Resources Data for Colorado, Water Year 1998, Volume 1, Missouri River Basin, Arkansas River Basin, and Rio Grande Basin ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Crowfoot, R. M.; Bruce, N. L.; Unruh, J. W.; Steinheimer, J. T.; Ritz, G. F.; Apr. 1999; 468p; In English
Report No.(s): PB99-145492; USGS/WDR/CO-98/-Vol-1; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

This report (Volumes 1 and 2) contains discharge records for 316 gaging stations, stage and contents of 26 lakes and reservoirs, discharge measurements for 1 partial-record low-flow station and 1 miscellaneous site, peak flow information for 29 crest-stage partial-record stations; water-quality for 118 gaging stations and for 8 lakes and reservoirs, supplemental water-quality for 192

gaged sites; water-quality for 72 miscellaneous sites and 14 observation wells; water levels for 3 observation wells, and meteorological data for 25 sites. Seven pertinent stations operated by bordering states also are included in this report.
NTIS
Water Resources; River Basins; Meteorological Parameters; Ground Water; Hydrology

19990052836 Geological Survey, Water Resources Div., Cheyenne, WY USA
Water Resources Data for Wyoming, Water Year 1998, Volume 2, Ground Water ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Mason, J. P.; Miller, D. T.; Ogle, K. M.; Apr. 1999; 142p; In English
Report No.(s): PB99-141004; USGS/WDR/WY-98-2; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
Water resources data for the 1998 water year for Wyoming consists of records of stage, discharge and water quality of streams; stage and contents of lakes and reservoirs, and water levels and water quality of ground water. Volume 2 of this report contains water level records for 73 wells. Additional ground-water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous studies and programs. These data together with the data in Volume 1 represent part of the National Water Data System operated by the US Geological Survey and cooperating State and Federal agencies in Wyoming.
NTIS
Water Resources; Data Acquisition; Data Systems; Ground Water; Geological Surveys; Water Quality; Hydrology

19990052848 Geological Survey, Water Resources Div., Trenton, NJ USA
Relations of Surface-Water Quality to Streamflow in the Atlantic Coastal, Lower Delaware River, and Delaware Bay Basins, New Jersey, Water Years 1976-93
Hunchak-Kariouk, K.; Buxton, D. E.; Hickman, R. E.; 1999; 164p; In English
Report No.(s): PB99-149080; USGS/WRI-98-4244; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
This report presents the results of analyses of 18 water-quality constituents in samples collected at 28 surface-water-quality stations within the Atlantic Coastal, lower Delaware River, and Delaware Bay Basins (referred to as the study area) during water years 1976-93 (October 1, 1975, through September 30, 1993). Relations between each of the 18 constituents and streamflow at the 28 stations over the period of record were determined by testing for trends in the concentrations of constituents during low and high flows. Qualitative values of contributions from constant (point sources and ground water) and intermittent (nonpoint storm runoff) sources were estimated statistically by examining the relations between concentrations of constituents and steamflow, and load and streamflow.
NTIS
Water Quality; Delaware Bay (US); Delaware River Basin (US); Surface Water

19990052878 Forest Service, Southern Research Station, Asheville, NC USA
Old-Growth Definition for Dry and Dry-Mesic Oak-Pine Forests
White, D. L.; Lloyd, F. T.; Sep. 1998; 50p
Report No.(s): PB99-144867; FSGTR-SRS-23; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Dry and dry-mesic oak-pine forests are widely distributed from New Jersey to Texas, but representative old-growth stands are rare. Historical accounts of composition, along with information from existing old-growth stands, were used to characterize this type. Shortleaf pine and white oak were the most widely distributed trees across all old-growth stands. Shortleaf was the primary pine species of the oak-pine type in the Piedmont, Gulf Coastal Plain, and Interior Highlands, while pitch pine was predominant in the mountainous regions. Scarlet and chestnut oaks were more prevalent in the Appalachians. Maximum age for pitch and shortleaf pines exceeded 200 and 300 years, respectively. Forests of this type do not adhere to the steady state or equilibrium concept of forest dynamics; rather old-growth oak-pine may be ephemeral on a given site. Disturbance by fire or other agents distributed through space and time is required for its maintenance on the broader landscape. Characteristics of the living and dead components of old-growth oak-pine are presented.
NTIS
Forests; Growth; Trees (Plants)

19990052884 EQE International, Inc., Irvine, CA USA
Proceedings of the US-Japan Workshop on Earthquake Disaster Prevention for Lifeline Systems
Ballantyne, D.; Nov. 1998; 542p; In English, 4-7 Nov. 1997, Seattle, WA, USA
Report No.(s): PB99-142986; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche

The workshop focused on the current research and implementation activities of both countries. Papers addressed case studies related to seismic vulnerability assessment and design and retrofit of various lifeline systems. Particular emphasis was given to studies that summarize the recent performance of lifeline systems in major U.S. and Japan earthquakes. The following lifeline systems were considered: water and sewage, electric power and communications, natural gas and oil, transportation, and ports and harbors. Six technical sessions were conducted with the following themes: seismic damage of lifeline systems, seismic behavior of lifeline facilities, socio-economic impacts of seismic damage to lifeline facilities, seismic damage estimation and prediction for lifeline facilities, research and development in earthquake disaster prevention technology after the Northridge and Hanshin earthquakes, lifeline facilities and urban earthquake disaster prevention.
NTIS
Conferences; Earthquakes; Disasters; Geological Faults; Seismology

19990052933 Geological Survey, Water Resources Div., Portland, OR USA
Water Resources Data for Oregon, Water Year 1998 ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Hubbard, L. E.; Herrett, T. A.; Poole, J. E.; Ruppert, G. P.; Courts, M. L.; Mar. 31, 1999; 472p; In English
Report No.(s): PB99-140840; USGS/WDR/OR-98/1; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche
Water resources data for the 1998 water year for Oregon consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs and water levels of wells: Water discharge for 183 gaging stations on streams, canals and drains; Discharge data for 73 partial-record or miscellaneous sites and water-quality sampling sites; Stage and (or) contents for 26 lakes and reservoirs; Water-quality data for 62 streams, canals, lakes and wells; Water-quality for 2 atmospheric deposition sites; Air-temperature records for 1 data site; Light incident for 1 record. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating States and Federal agencies in Oregon.
NTIS
Data Systems; Geological Surveys; Water Resources; Water Quality; Hydrology; Surface Water; Ground Water

19990052934 Geological Survey, Water Resources Div., Lawrence, KS USA
Water Resources Data for Kansas, Water Year 1998 ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Putnam, J. E.; Lacock, D. L.; Schneider, D. R.; Carlson, M. D.; Mar. 1999; 466p; In English
Report No.(s): PB99-140832; USGS/WDR/KS-98/1; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche
Water-resources data for the 1998 water years for Kansas consist of records of stage, discharge, and water quality of streams; elevation and contents of lakes and reservoirs; and water levels of ground-water wells. This report contains records for water discharge at 149 gaging stations; elevation and contents at 19 watershed lakes and reservoirs; and water-level data at 19 wells. Also included are data for 27 high-flow and 2 low-flow partial-record stations; and 2 chemical quality of precipitation stations. Miscellaneous onsite water-quality data were collected at 138 stations. These data represent that part of the National Water Information System collected by the US Geological Survey in cooperation with State, local, and Federal agencies in Kansas.
NTIS
Geological Surveys; Hydrology; Surface Water; Ground Water; Water Quality; Data Systems

19990052935 Geological Survey, Water Resources Div., Baltimore, MD USA
Water Resources Data for Texas, Water Year 1998, Volume 4, Ground Water ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Gandara, S. C.; Barbie, D. L.; Apr. 01, 1999; 524p; In English
Report No.(s): PB99-140790; USGS/WDR/TX-98/4; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche
Water-resources data for the 1998 water year for Texas consists of records of state, discharge, and water quality of streams; stage and contents in lakes and reservoirs; and water levels and water quality in wells. Volume 4 contains water levels for 820 observation wells and 232 water-quality data for monitoring wells. These data represent that part of the National Water Data System operated by the US Geological Survey and cooperating Federal, State, and local agencies in Texas.
NTIS
Water Quality; Data Systems; Hydrology; Surface Water; Ground Water

19990052936 Geological Survey, Water Resources Div., Boise, ID USA
Water Resources Data for Idaho, Water Year 1998, Volume 1, Great Basin and Snake River Basin above King Hill ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Brennan, T. S.; Lehmann, A. K.; O'Dell, I.; Tungate, A. M.; Mar. 29, 1998; 406p; In English
Report No.(s): PB99-140766; USGS/WDR/ID-98/1; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

Water resources data for the 1998 water year for Idaho consists of records of stage, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; discharge of irrigation diversions; and water levels and water quality of groundwater. The two volumes of this report contain discharge records for 180 stream-gaging stations and 21 irrigation diversions; stage only records for 5 stream-gaging stations; stage only for 6 lakes and reservoirs; contents only for 16 lakes and reservoirs; water-quality for 59 stream-gaging stations and partial record sites, 4 lakes sites, and 571 groundwater wells; and water levels for 565 observation wells. Additional water data were collected at various sites not involved in the systematic data collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the US Geological Survey and cooperating State and Federal agencies in Idaho, adjacent States, and Canada.
NTIS
Geological Surveys; Data Acquisition; Data Systems; Water Resources; Water Quality; Ground Water; Hydrology; Surface Water

19990052937 Geological Survey, Water Resources Div., Middleton, WI USA
Water Resources Data for Wisconsin, Water Year 1998 ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Holmstrom, B. K.; Olson, D. L.; Ellefson, B. R.; Mar. 1999; 538p; In English
Report No.(s): PB99-140758; USGS/WDR/WI-98/1; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche
Water-resources data for the 1998 water year for Wisconsin include records of streamflow at gaging stations, partial-record stations, partial-record stations, and miscellaneous sites, records of precipitation, and records of chemical, biological, and physical characteristics of surface water. In addition, water levels in observation wells are reported. These data were collected by the US Geological Survey in cooperation with State and local agencies and other Federal agencies in Wisconsin.
NTIS
Geological Surveys; Water Resources; Data Systems; Surface Water; Hydrology; Ground Water; Water Quality

19990052938 Geological Survey, Water Resources Div., Ithaca, NY USA
Water Resources Data for New York, Water Year 1998, Volume 3, Western New York ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Hornlein, J. F.; Szabo, C. O.; Zajd, H. J.; Mulks, R. L.; Apr. 1999; 392p; In English
Report No.(s): PB99-140741; USGS/WDR/NY-98/3; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche
Water resources data for the 1998 water year for New York consist of records of stage, discharge, and water quality of streams; stage and content of lakes and reservoirs; water levels and water quality of ground-water wells; and quantity and chemical quality of precipitation. This volume contains records for water discharge at 69 gaging stations; stage only at 14 gaging stations; stage and contents at 6 gaging stations; water quality at 22 gaging stations, 17 wells, and 63 partial record stations; water levels at 19 observation wells; daily precipitation totals at 3 sites, and chemical quality of precipitation at 2 sites. Also included are data for 44 crest-stage partial record stations. Locations of these sites are shown on figure 1. Additional water data were collected at various sites not involved in the systematic data collection program and are published as miscellaneous measurements. These data together with the data in Volumes 1 and 2 represent that part of the National Water Data System operated by the US Geological Survey and cooperating State, local, and Federal agencies in New York.
NTIS
Data Acquisition; Geological Surveys; Data Systems; Water Resources; Water Quality; Hydrology; Surface Water

19990052945 Geological Survey, Water Resources Div., Miami, FL USA
Water Resources Data for Florida, Water Year 1998, Volume 2A, South Florida Surface Water ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Price, C.; Woolverton, J.; Richards, T.; Apr. 1999; 412p; In English
Report No.(s): PB99-145039; USGS/WDR/FL-98-Vol-2A; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche
Water resources data for 1998 water year in Florida consists of continuous or daily discharge for 307 streams, periodic discharge for 30 streams, continuous or daily stage for 89 streams, periodic stage for 4 streams, peak discharge for 38 streams, and peak stage for 38 streams; continuous or daily elevations for 51 lakes, periodic elevations for 51 lakes; continuous ground-water levels for 439 wells, periodic ground-water levels for 1958 wells; quality of water data for 118 surface-water sites and 267 wells.
NTIS
Water Resources; Ground Water; Surface Water; Water Sampling; Water Quality; Hydrology; Water Management

19990052946 Geological Survey, Water Resources Div., Tampa, FL USA
Water Resources Data for Florida, Water Year 1998, Volume 3B, Southwest Florida Ground Water ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Coffin, J. E.; Fletcher, W. L.; Apr. 01, 1999; 338p; In English
Report No.(s): PB99-145021; USGS/WDR/FL-98/Vol-3B; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche
Water resources data for the 1998 water year in Florida consist of continuous or daily discharges for 307 streams, periodic discharge for 30 streams, continuous daily stage for 89 streams, periodic stage for 4 streams, peak stage and discharge for 38 streams, continuous or daily elevations for 27 lakes, periodic elevations for 51 lakes; continuous ground-water levels for 439 wells, periodic ground-water levels for 1,958 wells, and quality-of-water data for 118 surface-water sites and 267 wells.
NTIS
Water Resources; Ground Water; Surface Water; Water Quality; Water Sampling; Chemical Analysis

19990052947 Geological Survey, Water Resources Div., Tampa, FL USA
Water Resources Data for Florida, Water Year 1998, Volume 3A, Southwest Florida Surface Water ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Coffin, J. E.; Fletcher, W. L.; Apr. 01, 1999; 390p; In English
Report No.(s): PB99-145013; USGS/WDR/FL-98/Vol-3A; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche
Water resources data for the 1998 water year in Florida consist of continuous or daily discharges for 307 streams, periodic discharge for 30 streams, continuous daily stage for 89 streams, periodic stage for 4 streams, peak stage and discharge for 38 streams, continuous or daily elevations for 27 lakes, periodic elevations for 51 lakes; continuous ground-water levels for 439 wells, periodic ground-water levels for 1,958 wells, and quality-of-water data for 118 surface-water sites and 267 wells.
NTIS
Water Resources; Florida; Surface Water; Ground Water; Hydrology

19990053001 National Oceanic and Atmospheric Administration, Great Lakes Environmental Research Lab., Ann Arbor, MI USA
Seasonal Climatology of Surface Energy Fluxes on the Great Lakes
Lofgren, B. M.; Zhu, Y.; Apr. 1999; 26p; In English
Report No.(s): PB99-144958; GLERL-CONTRIB-1132; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We estimate the seasonal cycle of latent, sensible, and net heat flux from the surface of the Great Lakes, using lake surface temperatures derived from the NOAA/AVHRR satellite instrument, along with meteorological data from surface station observations. Several well-known features are evident. Among these are very high outgoing fluxes of latent and sensible heat during the late fall and early winter, which drive strong cooling of the lakes, and greater seasonal variation of surface temperature and fluxes in shallower waters. Due to strong static stability of the overlying atmospheric boundary layer during the spring, both the magnitude and the spatial variation of latent and sensible heat flux are small during the spring season, and to a lesser degree the summer. The annual cycles of latent and sensible heat flux over the Great Lakes are opposite in phase to the same fluxes over land, indicating a large exchange of energy via atmospheric advection between the lake and land surfaces.
NTIS
Annual Variations; Seasons; Climatology; Meteorological Parameters; Heat Flux; Surface Energy; Great Lakes (North America)

19990053002 Forest Service, Southern Research Station, Asheville, NC USA
Proceedings: 12th Central Hardwood Forest Conference
Stringer, J. W., Editor; Loftis, D. L., Editor; Jan. 1999; 306p; In English, 28 Feb. - 2 Mar. 1999, Lexington, KY, USA
Report No.(s): PB99-144875; FSGTR-SRS-24; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche
There were 32 oral presentations, 11 abstracts, and 22 poster presentations presented at the 12th Central Hardwood Forest Conference. Presentation topics included wildlife management, nutrient dynamics, stand structure, reforestation/reclamation, timber harvesting, modeling and inventory, silviculture, disturbance effects, and genetics/tree improvements.
NTIS
Conferences; Forest Management; Timber Inventory; Reforestation

19990053126 National Health and Environmental Effects Research Lab., Western Ecology Div., Corvallis, OR USA
Forest Ecosystem Indicators: Monitoring, Assessment, Prediction (FEIMAP)
Brown, S.; Anderson, C.; Beedlow, P.; Cairns, M.; Hogsett, B.; Sep. 1998; 120p
Report No.(s): PB99-148611; EPA/600/R-99/038; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The authors present a plan for a long-term research project to support several of the Agency's research needs with reference to forests. Specifically, the overall goal of this plan is to develop and evaluate ecological indicators that support (1) EMAP's need for forest indicators of ecological integrity and sustainability, (2) the Global Change program's need for indicators of global change, and (3) risk assessment and risk management protocols. The authors consider ecological indicators to include predictive models to identify potential risks to global change and air pollutants, stress-response functions, methods, and measures and their behavior over time and space. These indicators can be used to assess and monitor change and trends in the condition of forest resources, link changes to likely stressors, predict response of forests to future environmental change, and identify early warning signals.
NTIS
Ecosystems; Ecology; Forests; Vegetation Growth; Plants (Botany); Biogeochemistry; Trees (Plants); Land Use; Forest Management

19990053134 Geological Survey, Water Resources Div., Lemoyne, PA USA
Water Resources Data for Pennsylvania, Water Year 1998, Volume 2, Susquehanna and Potomac River Basins ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Durlin, R. R.; Schaffstall, W. P.; 1999; 482p; In English
Report No.(s): PB99-149403; USGS/WDR/PA-98/Vol-2; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche
Water resources data for the 1998 water year for Pennsylvania consist of records of dischare and water quality of strams; contents and elevations of lakes and reservoirs; and water levels and water quality of ground-water wells. This report, Volume 2, contains (1) discharge records for 85 continuous-record streamflow-gaging stations and 16 partial-rectord stations, at 23 special study and miscellaneous streamflow sites; (2) elevation and contents records for 12 lakes and reservoirs; (3) water-quality records for 13 gaging stations and 80 ungaged streamsites; (4) water-level records for 30 ground-water network observation well and water-quality analyses of ground water from 8 wells; and (5) water-quality analyses at 34 special study ground-water wells. Site locations are shown in figures throughout the report. Additional water data collected at various sites not involved in the systematic data-collection program are also presented.
NTIS
Ground Water; Hydrology; Data Acquisition

19990053316 Lawrence Livermore National Lab., Livermore, CA USA
Determination of mineral abundances in samples from the exploratory studies facility using x-ray diffraction
Roberts, S.; Viani, R.; Jan. 13, 1998; 20p; In English
Report No.(s): DE98-054157; UCRL-ID-129748; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Tuff samples collected from the Exploratory Studies Facility (ESF) were X- rayed to estimate relative mineral abundances. X-ray analysis was performed on sub-samples of specimens collected from both the Single Heater Test (SHT) and Drift Scale Heater Test (DST) that were used for thermomechanical measurements, as well as samples collected from cores retrieved from boreholes in the Drift Scale Test Area. The abundance of minerals that could affect the behavior of the host rock at repository relevant temperatures is of particular interest. These minerals include crystobalite, which undergoes a phase transition and volume change at elevated temperature (-250 C), and smectite and clinoptilolite that can dehydrate at elevated temperature with accompanying volume reduction. In addition, the spatial distribution of SiO, polymorphs and secondary minerals may provide evidence for deducing past fluid pathways. The mineral abundances tabulated here include data reported previously in three milestone reports (Roberts and Viani, 1997a,b; Viani and Roberts, 1996) but re-analyzed, as well as previously unreported data. Previous X-ray diffraction analyses of samples from the ESF (Roberts and Viani, 1997a; Viani and Roberts, 1996) utilized the matrix flushing method of Chung (1974) and an internal intensity standard (corundum) to quantify the abundances of the phases present. Although the method is adequate for obtaining relative abundances, its accuracy and precision is limited by the inherent differences between the external standards used to compute the reference intensity ratio and the mineral phases in the sample. In a subsequent report (Roberts and Viani, 1997b) mineral abundances were obtained using the Rietveld method of whole X-ray pattern fitting (Snyder and Bish, 1989; Young, 1993). The Rietveld technique has the potential to be both more accurate and more precise for estimating mineral abundances (Snyder and Bish, 1989).
NTIS
Minerals; Abundance; X Ray Diffraction; Mineralogy

43
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.

19990050981 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Remote Sensing and Geoprocessing Techniques Applied to Determine New Urban Zones in the Basin of Una River: Sao Sebastiao. Sao Paulo State ***Sensoriamento Remoto e Geoprocessamento Aplicados ao Zoneamento Urbano da Bacia do Rio UNA: Municipio de Sao Sebastiao, SP***
Mazzocato, Maria Eugenia, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 222p; In Portuguese
Report No.(s): INPE-6820-TDI/641; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This study presents a terrain zoning to characterize, hierarchize and quantify its capability to the urban development, considering the physics, biological and anthropic regional aspects. The study area size is 120 sq km and it takes part of the Una river basin, in the Sao Sebastiao county, located in the North Litoral of Sgio Paulo state, Brazil. The study was developed into two parts: in the first one, it was developed thematic maps, by using satellite images, digital image processing techniques and cartographic data, in the second one it was used a Geographical Information System, to build up a data base to integration and spatial analysis. The GIS used was the SPRING and the data base was composed by satellite images, maps such as geomorphological map, geological map, declivity map, land use map, fractures isofrequency map, transport capability map, permeability map and erosion resistance map. It were used LANDSAT/TM Images, bands 3, 4 and 5 in several formats such as digital, analogical and slides. The study scale was 1:50,000.ln the satellites images it was possible to identify characteristics and terrain features not propitious to urban development. Besides a temporal satellite images analysis showed a tendency to the populational growing in the study area. In the study are suggested some proceedings that have to be done in order to minimize the human degradational effects in the real urbanization process.
Author
Remote Sensing; Image Processing; Geomorphology; Satellite Imagery; Structural Properties (Geology)

19990051018 California Univ., Remote Sensing Research Unit, Santa Barbara, CA USA
Validation of Land Cover Maps Utilizing Astronaut Acquired Imagery ***Final Report, 23 Jun. - 31 Dec. 1998***
Estes, John E., California Univ., USA; Gebelein, Jennifer, California Univ., USA; 1999; 60p; In English; Zip(tm) Disk: 100MB IBM-compatible Zip(tm) disk
Contract(s)/Grant(s): NAG9-1032
Report No.(s): NONP-NASA-DK-1999074734; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche; A02, Diskette

This report is produced in accordance with the requirements outlined in the NASA Research Grant NAG9-1032 titled ”Validation of Land Cover Maps Utilizing Astronaut Acquired Imagery”. This grant funds the Remote Sensing Research Unit of the University of California, Santa Barbara. This document summarizes the research progress and accomplishments to date and describes current on-going research activities. Even though this grant has technically expired, in a contractual sense, work continues on this project. Therefore, this summary will include all work done through and 5 May 1999. The principal goal of this effort is to test the accuracy of a sub-regional portion of an AVHRR-based land cover product. Land cover mapped to three different classification systems, in the southwestern USA, have been subjected to two specific accuracy assessments. One assessment utilizing astronaut acquired photography, and a second assessment employing LANDSAT Thematic Mapper imagery, augmented in some cases, high aerial photography. Validation of these three land cover products has proceeded using a stratified sampling methodology. We believe this research will provide an important initial test of the potential use of imagery acquired from Shuttle and ultimately the International Space Station (ISS) for the operational validation of the Moderate Resolution Imaging Spectrometer (MODIS) land cover products.
Derived from text
LANDSAT Satellites; Thematic Mappers (LANDSAT); Advanced Very High Resolution Radiometer; Imaging Spectrometers; Satellite Imagery; Remote Sensing; Aerial Photography

19990052722 NASA Goddard Space Flight Center, Greenbelt, MD USA
Additional Contributions to the Development of the New Snow-Physics Scheme for SSiB
Mocko, David M., General Sciences Corp., USA; Sud, Y. C., NASA Goddard Space Flight Center, USA; 1999; In English; Global Energy and Water Cycle, 14-19 Jun. 1999, Beijing, China; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Simplified Simple Biosphere Model (SSiB) had a well-documented problem with snowmelt timing and infiltration. A new snow-physics scheme was developed for use in SSIB. In this, the snow layer is separated from the soil, with its own energy

budget and temperature. Solar energy reaching the top of the snowpack is divided into three parts: one, reflected by the snow; two, absorbed by the snow; and three, transmitted to the ground following a simple extinction relation. Heat is exchanged between the ground and snow by conduction and by radiation through an arbitrary air-gap between them. In the GSWP exercise using the GEWEX ISLSCP Initiative I forcing data (hereafter ”offline”), it was found that the new snow scheme ameliorated a significant fraction of snowmelt time-delay as compared to observations from satellite. It also produced warmer ground temperatures under the snowpack, which allowed realistic meltwater infiltration, resulting in better simulated spring soil moisture recharge and peak runoff amount as compared to observations. An ensemble of six June-July-August (JJA) simulations for 1987 and 1988 were performed with the NASA Goddard GEOS II GCM coupled with the new snow-physics SSIB using new initial soil moisture (ISM) from the offline simulations. The GCM produced more realistic precipitation in northern regions that had large snowmelt and wetter ISM in response to better snow-physics, as compared to simulations with ISM without the new snow scheme. The new SSiB-GCM also increased the interannual precipitation signal in the Indian monsoon region, resulting from changes in ISM in the Himalayas and central Asia.
Derived from text
Snow Cover; Biosphere; Remote Sensing; Energy Budgets; Solar Energy; Snow

19990053438 Physics and Electronics Lab. TNO, The Hague, Netherlands
Geographical Information Extraction with Remote Sensing, Part 3, Appendices
vandenBroek, A. C., Physics and Electronics Lab. TNO, Netherlands; vanPersie, M., Physics and Electronics Lab. TNO, Netherlands; Noorbergen, H. H. S., Physics and Electronics Lab. TNO, Netherlands; Rijckenberg, G. J., Physics and Electronics Lab. TNO, Netherlands; August 1998; 117p; In English
Report No.(s): FEL-98-A077-Pt-3; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., Oude Waalsdorperweg 63, PO Box 96864, 2509 JG The Hague, The Netherlands), Hardcopy, Microfiche

As basis for the study we have used a collection of features and attributes, which have been selected as relevant for military terrain inventory. The features and attributes are extracted from a DIGEST (digital geographical information exchange standard) code list. About 60 features are selected covering 6 categories, which are listed here: 1. Culture; which includes typically man-made object like buildings, roads etc (code A). 2. Hydrography; for example rivers, canals, ditches, lakes etc (code B) 3. Relief portrayal; spot elevation, contour lines (code C) 4. Land forms; for example barren ground, depression (code D) 5. Vegetation; for example trees, crop land (code E) 6. Demarcation; e.g., an administrative boundary (code F) The complete list of features including the attributes is shown. In order to assess the ability of the sensors for geographical information extraction we have produced images from the above-mentioned sensors for the features which were available at the so-called Heerde testsite (an area of 10 by 20 km between the river Ussel and the Holterberg). About 40 features were found in the test area and are shown on hardcopies on the following pages with the scale adapted so that the resolution dimension (on paper) is about 0.5 mm. The corresponding scale is indicated on the hard copies. The actual feature is always in the centre of the images. For comparison a topographical map of scale 1:50,000 containing the features is also shown. Next to the hardcopies a concise description for the features with respect to detection and identification for the three wavelengths is given. This information is summarized in section 2 of the Appendix where we give keywords for each feature and attribute. These keywords are explained in the technical reference list in section 3 of Appendix A.
Derived from text
Information; Data Bases; Remote Sensing; Landforms; Inventories; Hydrography; Digital Data

44
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.

19990049425 Sandia National Labs., Albuquerque, NM USA
Probabilistic Analysis of Rechargeable Batteries in a Photovoltaic Power Supply System
Barney, P.; Ingersoll, D.; Jungst, R.; O’Gorman, C.; Paez, T. L.; Nov. 24, 1998; 1p; In English, 1-6 Nov. 1998, Boston, MA, USA; Sponsored by Electrochemical Society, Inc., USA
Report No.(s): DE00-002064; SAND98-2635C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We developed a model for the probabilistic behavior of a rechargeable battery acting as the energy storage component in a photovoltaic power supply system. Stochastic and deterministic models are created to simulate the behavior of the system component;. The components are the solar resource, the photovoltaic power supply system, the rechargeable battery, and a load. Artificial

neural networks are incorporated into the model of the rechargeable battery to simulate damage that occurs during deep discharge cycles. The equations governing system behavior are combined into one set and solved simultaneously in the Monte Carlo framework to evaluate the probabilistic character of measures of battery behavior.
NTIS
Electric Batteries; Photovoltaic Cells; Energy Storage; Electric Power Supplies

19990050972 NASA Lewis Research Center, Cleveland, OH USA
The Consortium for Advancing Renewable Energy Technology (CARET) ***Progress Report, Period ending Jun. 1998***
Gordon, E. M., NASA Lewis Research Center, USA; Henderson, D. O., NASA Lewis Research Center, USA; Buffinger, D. R., NASA Lewis Research Center, USA; Fuller, C. W., NASA Lewis Research Center, USA; Uribe, R. M., NASA Lewis Research Center, USA; 1998; 49p; In English
Contract(s)/Grant(s): NCC3-575; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Consortium for Advancing Renewable Energy (CARET) is a research and education program which uses the theme of renewable energy to build a minority scientist pipeline. CARET is also a consortium of four universities and NASA Lewis Research Center working together to promote science education and research to minority students using the theme of renewable energy. The consortium membership includes the HBCUs (Historically Black Colleges and Universities), Fisk, Wilberforce and Central State Universities as well as Kent State University and NASA Lewis Research Center. The various stages of this pipeline provide participating students experiences with a different emphasis. Some emphasize building enthusiasm for the classroom study of science and technology while others emphasize the nature of research in these disciplines. Still others focus on relating a practical application to science and technology. And, of great importance to the success of the program are the interfaces between the various stages. Successfully managing these transitions is a requirement for producing trained scientists, engineers and technologists. Presentations describing the CARET program have been given at this year's HBCU Research Conference at the Ohio Aerospace Institute and as a seminar in the Solar Circle Seminar series of the Photovoltaic and Space Environments Branch at NASA Lewis Research Center. In this report, we will describe the many positive achievements toward the fulfillment of the goals and outcomes of our program. We will begin with a description of the interactions among the consortium members and end with a description of the activities of each of the member institutions .
Author
Energy Technology; Universities; Research and Development; Education

19990050986 Sandia National Labs., Albuquerque, NM USA
InGaAsN Solar Cells with 1.0eV Bandgap, Lattice Matched to GaAs; Applied Physics Letters
Allerman, A. A.; Banas, J. J.; Gee, J. M.; Hammons, B. E.; Jones, E. D.; Nov. 24, 1998; 1p; In English
Report No.(s): DE00-002000; SAND98-2631J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The design, growth by metal-organic chemical vapor deposition, and processing of an In(0.07)Ga(0.93)As(0.98)N(0.02) solar cell, with 1.0 ev bandgap, lattice matched to GaAs is described. The hole diffusion length in annealed, n-type InGaAsN is 0.6-0.8 pm, and solar cell internal quantum efficiencies is greater than 70% are obtained. Optical studies indicate that defects or impurities, from InGAsN doping and nitrogen incorporation, limit solar cell performance.
NTIS
Indium Gallium Arsenides; Nitrogen Compounds; Solar Cells; Energy Gaps (Solid State); Crystal Lattices

19990052590 Sandia National Labs., Albuquerque, NM USA
Summary of State-of-the-Art Power Conversion Systems for Energy Storage Applications
Atcitty, S.; Gray-Fenner, A.; Ranade, S.; Sep. 01, 1998; 1p; In English
Report No.(s): DE00-001894; SAND98-2019; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The power conversion system (PCS) is a vital part of many energy storage systems. It serves as the interface between the storage device, an energy source, and an AC load. This report summarizes the results of an extensive study of state-of-the-art power conversion systems used for energy storage applications. The purpose of the study was to investigate the potential for cost reduction and performance improvement in these power conversion systems and to provide recommendations for future research and development. This report provides an overview of PCS technology, a description of several state-of-the-art power conversion systems and how they are used in specific applications, a summary of four basic configurations for the power conversion systems used in energy storage applications, a discussion of PCS costs and potential cost reductions, a summary of the standards and codes relevant to the technology, and recommendations for future research and development.
NTIS
Energy Storage; Energy Conversion

19990052599 NASA Goddard Space Flight Center, Greenbelt, MD USA

Nickel-Hydrogen Cell Testing Experience, NASA/Goddard Space Flight Center

Rao, Gopalakrishna M., NASA Goddard Space Flight Center, USA; 1999; 13p; In English; Space Power, 19-22 Apr. 1999, Long Beach, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objectives of the project were to test the Nickel-Hydrogen Cell to: (1) verify the Aerospace Cell Flight Worthiness, (2) Elucidate the Aerospace Cell Thermal Behavior, (3) Develop the Aerospace Battery Assembly Design(s) and In-orbit Battery Management plan(s) and (4) Understand the Aerospace Cell Failure Mechanism. The tests included the LEO and GEO Life cycle tests, Calorimetric Analysis, Destructive Physical analysis, and special tests. Charts show the Mission Profile Cycling Data, Stress Cycling Data. The test data complies with the mission requirements, validating the flight worthiness of batteries. The nominal stress and mission profile cycling performance test shows the charge voltage as high as 1.60V and recharge ratio greater than 1.05. It is apparent that the electrochemical signatures alone do not provide conclusive proof for Nickel precharge. The researchers recommend a gas and positive plate analyses for further confirmation.

CASI

Electric Potential; Nickel Hydrogen Batteries; Charge Efficiency; Energy Storage; Spacecraft Power Supplies; Electrochemistry; Accelerated Life Tests; Performance Tests

19990052941 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

Economic Impact Analysis of the Oil and Natural Gas Production NESHAP and the Natural Gas Transmission and Storage NESHAP *Final Report*

Conner, L.; May 1999; 254p; In English

Report No.(s): PB99-149049; EPA/452/R-99/003; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This report evaluates the impact of the final rule for controls of hazardous air pollutants (HAPs) in the Oil and Natural Gas Production industry and the Natural Gas Transmission and Storage industry. Total social costs are estimated by evaluating costs of compliance with the rule and associated market impacts, including: price changes in the natural gas market, adjustments in quantity produced, small entity impacts, and employment impacts.

NTIS

Air Pollution; Economic Impact; Industries; Natural Gas; Crude Oil

19990053327 Colorado School of Mines, Golden, CO USA

A General Framework to Provide for the Optimal Dispatch of Hybrid Renewable Power Systems

Gilchrist, Robert N., Colorado School of Mines, USA; May 07, 1999; 157p; In English

Report No.(s): AD-A363052; AFIT-FY99-95; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

A significant number of people worldwide live in rural villages with only part time electrical power or no power at all. In an effort to address this deficiency, the U.S. National Renewable Energy Laboratory (NREL) is developing hybrid renewable power systems composed of photovoltaic panels, wind turbines, battery banks, and diesel generators to deliver 24 hour power. In keeping life cycle costs of these systems to a minimum, an appropriate dispatch strategy can contribute as much to reducing cost as the proper choice of system architecture. Current dispatch strategies consider only current net load and current state of charge of batteries. The framework developed here considers future net load realizations in determining optimal dispatch strategies. The model is a Markov Decision Process solved using a Policy Iteration algorithm. The algorithm produces a policy that maps each state that the hybrid renewable power system can occupy to an optimal action. The dispatch policies consider immediate and long run ramifications of an action on life cycle cost. The results show that over different values of diesel fuel cost, battery wear cost, and loss of service penalties the optimal strategies minimize the long run average cost. Furthermore, minimal implementation costs make the optimal strategies an attractive alternative to heuristic strategies that are currently used to dispatch hybrid renewable power systems.

DTIC

Electric Power Supplies; Electric Generators; Renewable Energy; Wind Turbines; Windpowered Generators; Photovoltaic Cells

45
ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

19990052732 Environmental Protection Agency, Office of Water, Washington, DC USA
Contaminant Selection, Methods, and Sampling: Technical Background Information for the Unregulated Contaminant Monitoring Regulation
Apr. 1999; 74p
Report No.(s): PB99-147274; EPA/815/R-99/007; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The revised Unregulated Contaminant Monitoring Regulation (UCMR) as required by the 1996 SDWA Amendments, contains a list of unregulated contaminants (List 1) large Public Water Systems (PWSs) must test for. This document provides technical background information on the process used to select contaminants for inclusion in the revised UCMR list, the analytical methods that have been proposed for use in the revised monitoring program, and the rationale for the timing and location of monitoring for UCMR contaminants.
NTIS
Water Sampling; Water Pollution; Pollution Monitoring; Water Quality; Chemical Analysis

19990052733 Environmental Protection Agency, Office of Water, Washington, DC USA
Unregulated Contaminant Monitoring Regulation Analytical Methods and Quality Control Manual
Mar. 1999; 78p; In English
Report No.(s): PB99-147241; EPA/815/R-99/004; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The 1996 Safe Drinking Water Amendments (SDWA) directed EPA to substantially revise the Unregulated Contaminant Monitoring Regulations (UCMR) program. This document provides a brief overview of the revised UCMR and outlines the required analytical methods and quality control procedures that Public Water Systems (PWSs) and participating laboratories must follow. Appendix C contains Procedure for Determination of Method Detection Limits.
NTIS
Water Sampling; Water Pollution; Water Quality; Pollution Monitoring; Chemical Analysis; Quality Control

19990052734 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Zeolita un Adsorbente Versatil de Contaminantes del Aire (Zeolite, a Versatile Air Pollutant Adsorber) ***Final Report***
May 1999; 26p; In Spanish
Report No.(s): PB99-147175; EPA/456/F-99/003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this document is to make people aware of zeolite, what it is, and what other used it has had. Zeolite is a relatively new medium for adsorption, but has a long history in other uses. Synthetic zeolite has an important role to play in controlling volatile organic compound (VOC) emissions. This document describes what synthetic zeolite is, and what it can do. Also shown are a number of other instances in which the unique properties of zeolite have been used to advantage.
NTIS
Zeolites; Minerals; Air Pollution; Pollution Control; Air Quality

19990052735 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
National Emission Standards for Hazardous Air Pollutants (NESHAP) for the Polyether Polyols Manufacturing Industry: Summary of Public Comments and Responses
May 1999; 244p; In English
Report No.(s): PB99-147043; EPA/453/R-99/002B; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This document contains a summary of public comments received on the NESHAP for Polyether Polyols Production (40 CFR 63, subpart PPP), which was proposed on September 4, 1997 (62 FR 46804). This document also provides the EPA's response to each comment, and outlines the changes made to the regulation in response to public comments.
NTIS
Pollution Control; Air Pollution; Air Quality; Environmental Cleanup; Pollution Monitoring

19990052738 Environmental Protection Agency, Office of Water, Washington, DC USA
Method 1664, Revision A: n-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM; Non-Polar Material) by Extraction and Gravimetry
Feb. 1999; 32p

Report No.(s): PB99-121949; EPA/821/R-98/002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This method is for determination of n-hexane extractable material (HEM; oil and grease) and n-hexane extractable material that is not adsorbed by silica gel (SGT-HEM; non-polar material) in surface and saline waters and industrial and domestic aqueous wastes. Extractable materials that may be determined are relatively non-volatile hydrocarbons, vegetable oils, animal fats, waxes, soaps, greases, and related materials. This method is capable of measuring HEM and SGT-HEM in the range of 5 to 1000 mg/L, and may be extended to higher levels by analysis of a smaller sample volume collected separately.

NTIS

Water Pollution; Extraction; Gravimetry; Hydrocarbons; Surface Water

19990052845 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

Guideline on Data Handling Conventions for the PM NAAQS

Cohen, J.; Fitz-Simons, T.; Wayland, M.; Apr. 1999; 62p; In English

Report No.(s): PB99-149023; EPA/454/R-99/009; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This guidance provides information you, the state or local agency responsible for monitoring and interpreting air quality, need to determine whether you are meeting the standards for particulate matter in 40 CFR Part 50. It clarifies requirements for data handling and completeness in Appendix N to 40 CFR Part 50. It tells you how to handle missing data, different sampling frequencies, and calculating spatial averages for the PM-2.5 annual standard.

NTIS

Particulates; Statistical Analysis; Air Quality

19990052880 National Oceanic and Atmospheric Administration, Air Resources Lab., Silver Spring, MD USA

Air Stagnation Climatology for the USA (1948-1998)

Wang, J. X. L.; Angell, J. K.; Apr. 1999; 82p; In English

Report No.(s): PB99-143174; NOAA/ARL-ATLAS-1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

It has been observed that major air pollution episodes are usually related to the presence of stagnating anticyclones. Such anticyclones may linger over an area for a protracted period (4 days or more). During this period, surface wind speeds can fall to very low values. The near surface circulation is therefore insufficient to disperse accumulated pollutants, thereby causing distressful and possible hazardous conditions for the inhabitants of the area. In this atlas, the authors define the meteorological state which is favorable to an air pollution episode as an air stagnation event. The air stagnation event identifies areas where air may be trapped by poor ventilation due to persistent light or calm winds, and by the presence of inversions.

NTIS

Air Pollution; Climatology; USA

19990052883 Geological Survey, Idaho Falls, ID USA

Strontium Distribution Coefficients of Basalt Core Samples from the Idaho National Engineering and Environmental Laboratory, Idaho

Colello, Joseph J., Geological Survey, USA; Rosentreter, Jeffrey J., Idaho State Univ., USA; Bartholomay, Roy C., Geological Survey, USA; Liszewski, Michael J., Geological Survey, USA; Dec. 1998; 78p; In English

Report No.(s): PB99-143018; USGS/WRI-98-4256; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Strontium distribution coefficients (Kd's) were measured for 24 basalt core samples collected from selected sites at the Idaho National Engineering and Environmental Laboratory (INEEL). The measurements were made to help assess the variability of strontium Kd's as part of an ongoing investigation of strontium transport properties through geologic materials at the INEEL. The investigation is being conducted by the US Geological Survey and Idaho State University in cooperation with the US Department of Energy. Batch experiments were used to measure Kd's of basalt core samples using an aqueous solution representative of wastewater in waste-disposal ponds at the INEEL. Calculated strontium Kd's of the 24 basalt core samples ranged from 3.6 + or - 1.3 to 29.4 + or - milliliters per gram. These results indicate a narrow range of variability in the strontium sorptive capacities of basalt relative to those of the sedimentary materials at the INEEL. The narrow range of the basalt Kd's can be attributed to physical and chemical properties of the basalt, and to compositional changes in the equilibrated solutions after being mixed with the basalt.

NTIS

Coefficients; Strontium; Basalt; Core Sampling; Geological Surveys

19990052889 NASA Langley Research Center, Hampton, VA USA

The Clouds and the Earth's Radiant Energy System (CERES) Sensors and Preflight Calibration Plans

Lee, Robert B., III, NASA Langley Research Center, USA; Barkstrom, Bruce R., NASA Langley Research Center, USA; Smith,

G. Louis, NASA Langley Research Center, USA; Cooper, John E., NASA Langley Research Center, USA; Kopia, Leonard P., NASA Langley Research Center, USA; Lawrence, R. Wes, NASA Langley Research Center, USA; Thomas, Susan, Science Applications International Corp., USA; Pandey, Dhirendra K., Science Applications International Corp., USA; Crommelynck, Dominique A. H., Institut Royal Meteorologique de Belgique, Belgium; Journal of Atmospheric and Oceanic Technology; 1996; Volume 13, pp. 300-313; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Clouds and the Earth's Radiant Energy System (CERES) spacecraft sensors are designed to measure broadband earth-reflected solar shortwave (0.3-5 microns) and earth-emitted longwave (5- is greater than 100 microns) radiances at the top of the atmosphere as part of the Mission to Planet Earth program. The scanning thermistor bolometer sensors respond to radiances in the broadband shortwave (0.3-5 microns) and total-wave (0.3- is greater than 100 microns) spectral regions, as well as to radiances in the narrowband water vapor window (8-12 microns) region. 'ne sensors are designed to operate for a minimum of 5 years aboard the NASA Tropical Rainfall Measuring Mission and Earth Observing System AM-1 spacecraft platforms that are scheduled for launches in 1997 and 1998, respectively. The flight sensors and the in-flight calibration systems will be calibrated in a vacuum ground facility using reference radiance sources, tied to the international temperature scale of 1990. The calibrations will be used to derive sensor gains, offsets, spectral responses, and point spread functions within and outside of the field of view. The shortwave, total-wave, and window ground calibration accuracy requirements (1 sigma) are +/-0.8, +/-0.6, and +/-0.3 W /sq m/sr, respectively, while the corresponding measurement precisions are +/-O.5% and +/-1.0% for the broadband longwave and shortwave radiances, respectively. The CERES sensors, in-flight calibration systems, and ground calibration instrumentation are described along with outlines of the preflight and in-flight calibration approaches.
Author
Radiant Flux Density; Spacecraft Instruments; Broadband; Radiance; Water Vapor

19990052940 Sonoma Technology, Inc., Petaluma, CA USA
Analysis of Data from the 1995 NARSTO-Northeast Study. Volume 5. Three-Dimensional Analysis of Aircraft and Upper-Air Meteorological Data ***Final Report***
Roberts, P. T.; Dye, T. S.; Ray, S. E.; Anderson, J. A.; Blumenthal, D. L.; Apr. 1999; 140p; In English
Report No.(s): PB99-149148; STI-95426-1836-FR; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

High ozone concentrations in the Northeast are the result of a complex interplay between precursor emissions and meteorological conditions. to better understand these factors, a major field data collection program was undertaken in the northeastern USA under the auspices of NARSTO-Northeast. NARSTO (formerly the North American Research Strategy for Tropospheric Ozone) is a public/private partnership formed to conduct research on ground-level ozone and aerosols in North America. Data collection efforts during NARSTO-Northeast were focused within and just to the west of the urban corridor running from Washington D.C. to Boston, but the study area included all of New England and stretched as far west as Ohio and as far south as southern Virginia. An extensive database of routine and supplemental surface and upper-air meteorological and air quality observations was compiled as a result of this effort.
NTIS
Meteorological Parameters; Ozone; Aerosols; Gas Composition; Atmospheric Composition; Upper Atmosphere

19990052942 Environmental Protection Agency, Acid Rain Div., Washington, DC USA
Acid Rain Program Emissions Scorecard 1997: SO2, NO(x), Heat Input, and CO2 Emission Trends in the Electric Utility Industry
Jan. 1999; 118p; In English; Original contains color illustrations
Report No.(s): PB99-147571; EPA/430/R-98/020; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Established under Title IV of the Clean Air Act Amendments of 1990, the Acid Rain Program requires the electric utility industry to reduce emissions of sulfur dioxide (SO2) and nitrogen oxides (NO(x)), the pollutants that cause acid rain. to ensure that the desired emission reductions are achieved, the program implements an innovative market-based regulatory approach with utilities having flexible compliance options. After each calendar year, EPA determines the compliance of each facility relating to its SO2 and NO(x) emissions requirements and publishes a report documenting the results.
NTIS
Acid Rain; Air Quality; Air Pollution; Pollution Control; Pollution Monitoring; Atmospheric Composition

19990052993 Environmental Protection Agency, National Exposure Research Lab., Cincinnati, OH USA
Methods for the Determination of Chemical Substances in Marine and Estuarine Environmental Matrices
Sep. 1997; 218p; In English
Report No.(s): PB99-127326; EPA/600/R-97/072; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This manual contains eleven methods for determination of nutrients, metals, and chlorophyll. Since Revision 1.0 appeared in 1992, four new methods have been added, one deleted and four have been multilaboatory validated. Methods 440.0, 445.0, 446.0 and 447.0 have been multilaboratory validated, and Method 353.4 has been replaced with an improved method. The metals methods, Methods 200.10, 200.12 and 200.13 have not changed since the 1992 manual. Method 365.5 has remained the same and Method 440.0, that appeared in 1992, now contains multilaboratory validataion data. Two new chlorophyll methods, Methods 446.0 and 447.0, have been added and all three chlorophyll methods have been multilaboratory validated.
NTIS
Chemical Compounds; Marine Biology; Marine Environments; Estuaries; Ecosystems

19990053124 Envair, Albany, CA USA
Analysis of Data from the 1995 NARSTO-Northeast Air Quality Study, Volume 4, Observation-Driven Methods for Delineating VOC and NOx Limitation *Final Report*
Blanchard, C. L.; Mar. 31, 1998; 154p; In English
Report No.(s): PB99-149130; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

During 1995, an extensive data collection program was undertaken in the northeastern U.S. (NARSTO-Northeast) to provide insights into factors influencing the formation of ozone in that region. This section of the overall data-analysis effort uses four observation-driven methods (ODMs) to qualitatively evaluate the sensitivities of peak ozone concentrations to emissions of VOCs and NOx. At present, the levels of accuracy of ODMs have not been established, nor has their ability to sharply separate VOC-limited from NOx-limited regions been demonstrated. Insights into the consistency of each of the ODMs with the others are obtained by applying the four to a common data set consisting of measurements obtained at six NARSTO-Northeast research sites. Two of the methods are shown to yield comparable results when ozone concentrations exceed about 80 ppbv. A third method yields predictions that diverge from those of the first two methods, but is shown to be useful as a screening test.
NTIS
Air Quality; Exhaust Gases; Nitrogen Oxides

19990053223 Rensselaer Polytechnic Inst., Troy, NY USA
Physical and Chemical Environmental Factors Associated with the Temporal and Spatial Distribution of Cyanobacteria in Lake George, New York
Richardson, Lance E.; Apr. 1999; 122p; In English
Report No.(s): AD-A363278; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Cyanobacteria and environmental factors were studied in Lake George, New York from May 1998 to August 1998. Lake George, New York is a (meso) oligotrophic freshwater lake located in the southeast corner of the Adirondack State Park. An island filled channel known as The Narrows separates it into two distinct basins. The water in the lake flows from south to north where it empties into Lake Champlain near Ticonderoga, New York. The lake is dimictic, mixing in the spring and the fall, and stratification of the water column into a distinct epilimnion and hypolimnion occurs each summer. The lake undergoes a clear water phase in late May/early June. The goal of the study was to determine the temporal and spatial development of the cyanobacteria population in the north and south basins of the lake and their association to physical and chemical factors in the water column. Various nitrogen and phosphorus species were measured along with physical factors such as temperature, pH, dissolved oxygen, specific conductance, and illumination. These factors were then used to search for trends and associations with cyanobacteria enumerated by epifluorescent microscopy. One morphological genus, Synechococcus, was found to dominate the cyanobacteria population throughout the water column and throughout the period of the study. Abundance of Synechococcus increased after the clear water phase ended, reaching its maximum in both basins in early August. Other general trends showed the greatest initial abundance of Synechococcus at 20 and 25 meters in depth in the late spring and this moved up in the water column to an average of 15 meters after the clear water phase of the lake ended in mid-June. Slight temporal and spatial differences were found between the two sites, however linear regression found no strong associations between Synechococcus and any single chemical or physical factor.
DTIC
Chemical Properties; Bacteria; Dissolved Gases; Fresh Water; Water Flow; Nitrogen; Oxygen

19990053339 NASA Ames Research Center, Moffett Field, CA USA
Meteorology of the Southern Global Plume: African and South American Fires Pollute the South Pacific
Guo, Z., San Jose State Univ., USA; Chatfield, R. B., NASA Ames Research Center, USA; 1999; 8p; In English; Original contains color illustrations
Contract(s)/Grant(s): NCC2-756; RTOP 579-24-13-10; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An immense global plume of CO meanders widely around the world in the Southern Hemisphere. It arises over Southern America and Africa and flows eastward. The first emissions are in tropical Brazil, and the plume circulates around the world to South America again. The plume was largely unexpected until there were aircraft studies made in NASA's Pacific Exploratory Mission - Tropics (Part A). This paper describes the meteorology of the Global Plume, as our simulation, with a synoptic model adapted to global transport, reveals it with a tracer-CO simulation. The observations and their simulation require a particular set of conditions of pollutant accumulation, cumulonimbus venting with required strengths at a narrow range of altitude. Additionally, a particular subtropical conduction region, over the Indian Ocean, Australia, and the westeRNmost South Pacific, relatively free of storms, appears to be a key part of the mechanism. These conclusions are the results of a synoptic reconstruction of the PEMT-A period, September- October, 1996.
Author
Meteorology; Southern Hemisphere; Contaminants; Carbon Monoxide

19990053422 Systemexpert Consulting Ltd., Budapest, Hungary
Hungarian climate change action plan
Molnar, S.; Takacs, T.; Arpasi, M.; Farago, T.; Palvoelgyi, T.; Dec. 31, 1998; 93p; In English
Report No.(s): DE99-002029; DOE/PO/30116-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
In 1994--1996, within the framework of the US Country Studies Program, the Hungarian Country Study Team developed the national greenhouse gas emission inventory, and elaborated the mitigation options for the different sectors of the economy. In 1997, the development of a National Action Plan was begun as the continuation of this work. Results of the inventory study showed that greenhouse gas emissions decreased from the selected base level (i.e., from the yearly average emissions of 1985--1987) until 1994 by cca. 25%. However, this decrease was primarily caused by the deep economic recession. Therefore the policy makers have to face the problem of economic recovery without a relevant increase of greenhouse gas emissions in the near future. This is the main focus of the mitigation analysis and the National Action Plan.
NTIS
Climate Change; Greenhouse Effect

19990053454 Institute for the Study of Earth, Oceans and Space, Durham, NH USA
Influence of Vertical Transport on Free Tropospheric Aerosols over the Central USA in Springtime
Talbot, R. W., Institute for the Study of Earth, Oceans and Space, USA; Dibb, J. E., Institute for the Study of Earth, Oceans and Space, USA; Loomis, M. B., Institute for the Study of Earth, Oceans and Space, USA; Geophysical Research Letters; May 01, 1998; ISSN 0094-8534; Volume 25, No. 9, pp. 1367-1378; In English
Report No.(s): Paper-98GL00184; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
Measurements of the atmospheric aerosol chemical composition during the Subsonic Aircraft: Contrail and Cloud Effects Special Study (SUCCESS) indicate substantial vertical transport of boundary layer aerosol to the free troposphere over the south-central USA during springtime. Mixing ratios of water-soluble aerosol Ca(2+) at 6 - 12 km altitude exhibited a median mixing ratio of 20 pptv, with 15% of the measurements greater or = 100 pptv and a maximum of 1235 pptv. in air parcels with enhanced Ca(2+), the ratios K(+)/Ca(2+), Mg(2+)/Ca92+), and Na(2+)/Ca(2+) in the bulk aerosol were distinctly characteristic of those in limestone and/or cement. Significantly enhanced mixing ratios of aerosol SO4(2-), NO3(-), and NH4(+) were also concomitant with the elevated Ca(2+), suggesting transport of both crustal and anthropogenic aerosols to the upper troposphere. The mass concentration of water-soluble aerosol material was in the range 0.1 - 6 microgram/cu m STP, and estimated crustal dust levels were 7 - 160 microgram/cu m" STP.
Author
Aerosols; Chemical Composition; Atmospheric Chemistry; Boundary Layers; Clouds (Meteorology); Measuring Instruments

19990053476 Battelle Pacific Northwest Labs., Richland, WA USA
Laser Ablation/Ionization Characterization of Solids: Final Progress Report of the Strategic Environmental Research and Development Program
Hess, W. P., Battelle Pacific Northwest Labs., USA; Bushaw, B. A., Battelle Pacific Northwest Labs., USA; McCarthy, M. I., Battelle Pacific Northwest Labs., USA; Campbell, J. A., Battelle Pacific Northwest Labs., USA; Colson, S. D., Battelle Pacific Northwest Labs., USA; Apr. 1998; 53p; In English; Prepared in cooperation with Washington State Univ., Pullman, WA.
Contract(s)/Grant(s): DE-AC06-76RLO1830
Report No.(s): AD-A363248; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The Department of Energy has undertaken the enormous task of remediating defense wastes and environmental insults which have occurred over 50 years of nuclear weapons production. It is abundantly clear that significant technology advances are needed

to characterize, process, and store highly radioactive waste and to remediate contaminated zones. In addition to the processing and waste form issues, analytical technologies needed for the characterization of solids, and for monitoring storage tanks and contaminated sites do not exist or are currently expensive labor-intensive tasks. This report describes progress in developing sensitive, rapid, and widely applicable laser-based mass spectrometry techniques for analysis of mixed chemical wastes and contaminated soils. The remediation of defense waste and the long-term disposal of high-level mixed wastes requires chemical analysis of the waste streams. Efficient analytic methods are needed to characterize the chemical classes and concentrations of a wide variety of waste materials. Tank and crib waste sites contain broad distributions of radioisotopes, chelating agents, chromates, and ferrocyanides.
DTIC
Laser Ablation; Mass Spectroscopy; Radioactive Wastes; Waste Disposal

19990053484 Naval Research Lab., Center for Biomolecular Science and Engineering, Washington, DC USA
Field Demonstration of NRL Environmental Flow Immunosensor for Environmental Monitoring, ***Sep. 97***
Feb. 1998; 77p; In English
Report No.(s): AD-A363133; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

An NRL continuous flow immunosensor, known as the FAST 2000, has been developed that is adaptable for use in a variety of environmental monitoring platforms. During the past year, the FAST 2000 instrument was tested in initial field trials at numerous military bases identified by the EPA as priority Superfund cleanup sites. The field study objective was to measure the effectiveness and efficiency of the Flow Immunosensor in performing on-site field analysis for two selective explosives, TNT and RDX. Samples containing unknown concentrations of explosives were collected from groundwater and monitoring wells at various locations and analyzed in NRL sensor with no sample pretreatment or concentration. For data validation and in conjunction with the tests performed on-site by the Flow Immunosensor, independent laboratory analyses of lab splits from the field samples and explosives standards were performed by High Performance Liquid Chromatography using the EPA SW846 Method 8330 for explosives. In addition to the contaminated field samples, appropriate controls, blanks and interferents were tested in the lab for certification and validation data requirements. Results were evaluated based on accuracy, precision, rate of false positives/negatives, cost, time, and waste generation.
DTIC
Immunoassay; Environmental Engineering; Environmental Monitoring; Contamination; Continuum Flow

19990053490 Envirogen, Inc., Lawrenceville, NJ USA
Development of Biotrickling Filters to Treat Sulfur and VOC Emissions ***Final Report, 30 Sep. 1996 - 29 Sep. 1998***
Togna, A. P.; Webster, Todd S.; Revak, James; Yang, Yonghua; May 12, 1999; 5p; In English
Report No.(s): AD-A362950; N00014-96-C-0370; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of this Phase II Small Business Innovation Research project was to develop an efficient and cost-effective biological process to treat air emissions of significance to the Navy. During Phase I, the feasibility of treating these emissions using a biotrickling filter was tested. Biotrickling filters are similar to chemical scrubbers, but rely on microorganisms on the packing surface to remove and oxidize contaminants rather than chemicals. A 7-month field-pilot demonstration was conducted at North Island Naval Air Station near San Diego, California to demonstrate the effectiveness of the process for treatment of hazardous air pollutants (HAPs) from spray paint booths. Target HAP removals exceeded 88 percent for vapor contact times (packing volume divided by air flowrate) greater than 16 seconds. Carbon dioxide measurements indicated that the dominant removal mechanisms were absorption and biodegradation in the morning hours and biodegradation only in the afternoon hours. Performance was not affected by the intermittent operation in the paint booth. A cost analysis showed that for treatment of the entire air stream, over a 10-year project life, biotrickling filters designed for a 16 or 11 second contact time were less expensive than carbon adsorption or thermal systems.
DTIC
Sulfur; Air Pollution; Emission; Volatility; Organic Compounds

46
GEOPHYSICS

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

19990049405 Sandia National Labs., Albuquerque, NM USA
Value of Laboratory Experiments for Code Validations; International Journal of Rock Mechanics and Mining Science
Wawersik, W. R.; Dec. 14, 1998; 34p; In English
Report No.(s): DE00-002368; SAND98-2784J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Numerical codes have become indispensable for designing underground structures and interpretating the behavior of geologic systems. Because of the complexities of geologic systems, however, code calculations often are associated with large quantitative uncertainties. This papers presents three examples to demonstrate the value of laboratory(or bench scale) experiments to evaluate the predictive capabilities of such codes with five major conclusions: Laboratory or bench-scale experiments are a very cost-effective, controlled means of evaluating and validating numerical codes, not instead of but before or at least concurrent with the implementation of in situ studies. The design of good laboratory validation tests must identify what aspects of a code are to be scrutinized in order to optimize the size, geometry, boundary conditions, and duration of the experiments. The design of good and sometimes difficult numerical analyses and sensitivity studies. Laboratory validation tests must involve: Good validation experiments will generate independent data sets to identify the combined effect of constitutive models, model generalizations, material parameters, and numerical algorithms. Successfid validations of numerical codes mandate a close collaboration between experimentalists and analysts drawing from the full gamut of observations, measurements, and mathematical results.
NTIS
Laboratories; Numerical Analysis; Proving

19990051000 California Univ., Los Angeles, CA USA
Polar Magnetic Field Experiment ***Final Report, 1 Mar. 1996 - 31 Mar. 1999***
Russell, C. T., California Univ., USA; 1999; 16p; In English
Contract(s)/Grant(s): NAG5-3171; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This grant covers the initial data reduction and analysis of the magnetic field measurements of the Polar spacecraft. At this writing data for the first three years of the mission have been processed and deposited in the key parameter database. These data are also available in a variety of time resolutions and coordinate systems via a webserver at UCLA that provides both plots and digital data. The flight software has twice been reprogrammed: once to remove a glitch in the data where there were rare collisions between commands in the central processing unit and once to provide burst mode data at 100 samples per second on a regular basis. The instrument continues to function as described in the instrument paper (1.1 in the bibliography attached below). The early observations were compared with observations on the same field lines at lower altitude. The polar magnetic measurements also proved to be most useful for testing the accuracy of MHD models. WE also made important contributions to study of waves and turbulence.
Derived from text
Experimentation; Magnetic Fields; Polar Regions; Data Reduction; Data Processing

19990052716 Academy of Sciences (USSR), Space Research Inst., Moscow, USSR
Observation of Isolated Structures of the Low Latitude Boundary Layer with the INTERBALL/Tail Probe
Vaisberg, 0. L., Academy of Sciences (USSR), USSR; Smirnov, V. N., Academy of Sciences (USSR), USSR; Avanov, L. A., Academy of Sciences (USSR), USSR; Waite, J. H., Jr., Southwest Research Inst., USA; Burch, J. L., Southwest Research Inst., USA; Russell, C. T., California Univ., USA; Skalsky, A. A., Academy of Sciences (USSR), USSR; Dempsey, D. L., Southwest Research Inst., USA; Geophysical Research Letters; Dec. 01, 1998; ISSN 0094-8276; Volume 25, No. 23, pp. 4305-4308; In English; Sponsored in part by the Russian Foundation of Fundamental Investigations (RFFI) and INTAS
Contract(s)/Grant(s): NAG5-4130; RFFI-94-2-4232; INTAS-93-2031
Report No.(s): Paper-1998GL900167; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We analyze the structure of magnetospheric transients observed at the dusk-side low-latitude magnetopause with the Interball Tail Probe. Ion and magnetic field measurements are used to investigate one particular transient in more detail. This transient has distinct non-symmetric structure with the plasma characteristics and the flow properties of the leading part of the transient being quite different from those in the trailing part of the transient. The region separating these two parts corresponds to the change of the sign in the B(n) component. These observations support an earlier conclusion that some plasma irregularities within the Low

Latitude Boundary Layer (LLBL), formed as a result of sporadic reconnection, disconnect from the magnetopause, propagate and dissipate in the magnetosphere, and form what we call Disconnected Magnetosheath Transfer Events (DMTEs).
Author
Magnetohydrodynamic Flow; Magnetopause; Magnetic Fields; Flow Characteristics; Boundary Layers; Plasmas (Physics)

19990052717 Academy of Sciences (USSR), Space Research Inst., Moscow, USSR
The CUSP/Magnetosheath Interface on May 29, 1996: Interball-1 and Polar Observations
Savin, S. P., Academy of Sciences (USSR), USSR; Romanov, S. A., Academy of Sciences (USSR), USSR; Fedorov, A. O., Academy of Sciences (USSR), USSR; Zelenyi, L., Academy of Sciences (USSR), USSR; Klimov, S. I., Academy of Sciences (USSR), USSR; Yermolaev, I., Academy of Sciences (USSR), USSR; Budnik, E. Yu., Academy of Sciences (USSR), USSR; Nikolaeva, N. S., Academy of Sciences (USSR), USSR; Russell, C. T., California Univ., USA; Zhou, X-W., California Univ., USA; Urquhart, A. L., Rice Univ., USA; Reiff, P. H., Rice Univ., USA; Geophysical Research Letters; Aug. 01, 1998; ISSN 0094-8534; Volume 25, No. 15, pp. 2963-2966; In English; Sponsored in part by INTAS
Contract(s)/Grant(s): NAG5-4066; INTAS-93-2031
Report No.(s): Paper-98GL01402; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

On May 29, 1996, under steady strong northward IMF and high solar wind dynamic pressure conditions both Polar and Interball cross field lines that pass through the northern cusp and apparently close to the post-cusp reconnection site. The magnetopause current observed by Interball consists of two quite distinct layers, an inner broad current that is quite turbulent and another current that is quite abrupt and quiet. Polar also crosses current layers, similar to the Interball inner one. These observations support a model in which cusp field lines experience essentially stochastic behavior but on average provide topological connection between the cusp and magnetosheath.
Author
Magnetopause; Magnetosheath; Solar Wind; Turbulence; Planetary Magnetotails; Flux Transfer Events; Solar Planetary Interactions; Solar Terrestrial Interactions

19990052723 NASA Goddard Space Flight Center, Greenbelt, MD USA
Simulation of the December 1998 Stratospheric Major Warming
Manney, G. L., Jet Propulsion Lab., California Inst. of Tech., USA; Lahoz, W. A., Centre for Global Atmospheric Modelling, UK; Swinbank, R., Universities Space Research Association, USA; ONeill, A., Centre for Global Atmospheric Modelling, UK; Connew, P. M., Meteorological Office, UK; Zurek, R. W., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Prior to 1991, major warmings (defined by increasing zonal mean temperatures and zonal mean easterly winds from 60degN to the pole at 10 hPa) typically occurred approximately once every two Arctic winters; a major warming in mid-Dec. 1998 was the first since Feb. 1991. The Dec. 1998 warming was also the second earliest on record. The earliest, and the only other major warming on record before the end of Dec. was in early Dec 1987; prior to that, the earliest was in late Dec./early Jan. 1984-85. The 1984-85 and 1987 warmings resulted in the warmest and weakest lower stratospheric polar vortices in the 20 years before 1998-99. Fig. 1 compares temperatures and vortex strength in 1998-99 with those in the previous 20 years, using the US National Center for Environmental Prediction (NCEP) record; 1987-88 and 1984-85 are also highlighted. The Dec. 1998 warming had a more pronounced effect on mid-stratospheric temperatures than the Dec. 1987 warming (Fig. 1a), although smaller than that of warmings later in winter (e.g., 1984-85). 10-hPa temperatures fell well below average again in late Jan. 1999 and remained unusually low until an early final warming began in late Feb. 840 K PV gradients (Fig. 1c) set a record minimum in Jan. 1999, but were near average in Feb before the final warming. The effect of the Dec. 1998 warming on lower stratospheric temperatures was comparable to that of other major warmings; there was a brief period of record-high minimum 46-hPa temperatures in early Jan 1999 (Fig. 1b), and temperatures then fell to near average for a short period in mid-Feb. Lower stratospheric PV gradients were the weakest on record during the 1998-99 winter (Fig. 1d). The evolution of the vortex and minimum temperatures during 1998-99 was remarkably similar to that during 1987-88, the only previous year when a major warming was observed before the end of Dec.
Derived from text
Stratospheric Warming; Stratosphere; Vortices; Arctic Regions; Simulation

19990053132 NASA Langley Research Center, Hampton, VA USA
Atmos/Atlas 3 Infrared Profile Measurements of Trace Gases in The November 1994 Tropical and Subtropical Upper Troposphere
Rinsland, C. P., NASA Langley Research Center, USA; Gunson, M. R., Jet Propulsion Lab., California Inst. of Tech., USA; Wang, P.-H., Science and Technology Corp., USA; Arduini, R. F., Science Applications International Corp., USA; Baum, B. A., NASA

Langley Research Center, USA; Minnis, P., NASA Langley Research Center, USA; Minnis, P., NASA Langley Research Center, USA; Goldman, A., Denver Univ., USA; Abrams, M. C., ITT Defense and Electronics, USA; Zander, R., Liege Univ., Belgium; Mahieu, E., Liege Univ., Belgium; Mahieu, E., Liege Univ., Belgium; Salawitch, R. J., Jet Propulsion Lab., California Inst. of Tech., USA; Michelsen, H. A., Harvard Univ., USA; Irion, F. W., Jet Propulsion Lab., California Inst. of Tech., USA; Newchurch, M. J., Alabama Univ., USA; Journal of Quantitative Spectroscopy and Radiative Transfer; 1998; Volume 60, No. 5, pp. 891-901; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Vertical mixing ratio profiles of four relatively long-lives gases, HCN, C2H2, CO, and C2H6, have been retrieved from 0.01/cm resolution infrared solar occultation spectra recorded between latitudes of 5.3degN and 31.4degN. The observations were obtained by the Atmospheric Trace Molecule Spectroscopy (ATMOS) Fourier transform spectrometer during the Atmospheric Laboratory for Applications and Science (ATLAS) 3 shuttle flight, 3-12 November 1994. Elevated mixing ratios below the tropopause were measured for these gases during several of the occultations. The positive correlations obtained between the simultaneously measured mixing ratios suggest that the enhancements are likely the result of surface emissions, most likely biomass burning and/or urban industrial activities, followed by common injection via deep convective transport of the gases to the upper troposphere. The elevated levels of HCN may account for at least part of the ”missing NO,” in the upper troposphere. Comparisons of the observations with values measured during a recent aircraft campaign are presented.

Author

Infrared Radiation; Gas Analysis; Gas Transport; Troposphere; Space Transportation System Flights; Fourier Transformation; Tropical Regions; Hydrocyanic Acid; Ethane

19990053349 NASA Langley Research Center, Hampton, VA USA

ATMOS/ATLAS 3 Infrared Profile Measurements of Clouds in the Tropical and Subtropical Upper Troposphere

Rinsland, C. P., NASA Langley Research Center, USA; Gunson, M. R., Jet Propulsion Lab., California Inst. of Tech., USA; Wang, P.-H., Science and Technology Corp., USA; Arduini, R. F., Science Applications International Corp., USA; Baum, B. A., NASA Langley Research Center, USA; Minnis, P., NASA Langley Research Center, USA; Goldman, A., Denver Univ., USA; Abrams, M. C., ITT Defense and Electronics, USA; Zander, R., Liege Univ., Belgium; Mahieu, E., Liege Univ., Belgium; Salawitch, R. J., Jet Propulsion Lab., California Inst. of Tech., USA; Michelsen, H. A., Harvard Univ., USA; Irion, F. W., Jet Propulsion Lab., California Inst. of Tech., USA; Newchurch, M. J., Alabama Univ., USA; Journal of Quantitative Spectroscopy and Radiative Transfer; 1998; Volume 60, No. 5, pp. 902-919; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Vertical profiles of infrared cirrus extinction have been derived from tropical and subtropical upper tropospheric solar occultation spectra. The measurements were recorded by the Atmospheric Trace Molecule Spectroscopy (ATMOS) Fourier transform spectrometer during the Atmospheric Laboratory for Applications and Sciences (ATLAS) 3 shuttle flight in November 1994. The presence of large numbers of small ice crystals is inferred from the appearance of broad extinction features in the 8-12 micron region. These features were observed near the tropopause and at lower altitudes. Vertical profiles of the ice extinction (/km) in microwindows at 831, 957, and 1204/cm have been retrieved from the spectra and analyzed with a model for randomly oriented spheroidal ice crystals. An area-equivalent spherical radius of 6 microns is estimated from the smallest ice crystals observed in the 8-12 gm region. Direct penetration of clouds into the lower stratosphere is inferred from observations of cloud extinction extending from the upper troposphere to 50 mbar (20 km altitude). Cloud extinction between 3 and 5 microns shows very little wavelength dependence, at least for the cases observed by the ATMOS instrument in the tropics and subtropics during ATLAS 3.

Author

Infrared Radiation; Tropical Regions; Clouds (Meteorology); Troposphere; Fourier Transformation; Space Transportation System Flights

19990053412 Naval Research Lab., Plasma Physics Lab., Washington, DC USA

The WIND-HAARP-HIPAS Interferometer Experiment ***Interim Report***

Rodriguez, P.; Keskinen, M. J.; Kennedy, E. J.; McCarrick, M.; Preston, J.; Apr. 22, 1999; 12p; In English; Prepared in collaboration with Advanced Power Technologies Inc., Washington, DC, California Univ., Los Angeles, CA, Minnesota Univ., Minneapolis, MN and DESPA, Observatoire de Paris, Meudon, France.

Report No.(s): AD-A362758; NRL/MR/6750--99-8349; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report on the first experiment using two high power, high frequency transmitting facilities in a bistatic, interferometer mode. The HAARP and HIPAS facilities in Alaska radiated at 4525 kHz with total combined power of about 700 kW, in the direction of the WIND spacecraft. The WAVES experiment aboard WIND received the transmissions at a distance of about 25 earth

radii. The experimental setup thus resembled Young's two-slit experiment. The expected interference pattern was observed, and at the distance of WIND, the fringes sizes were about 30 km peak to peak.
DTIC
Radio Waves; High Frequencies; Plasmas (Physics); Modulus of Elasticity

19990053418 NASA Goddard Space Flight Center, Greenbelt, MD USA
Combined Microwave and Sferics Measurements as a Continuous Proxy for Latent Heating in Mesoscale Model Predictions
Chang, D.-E., Universities Space Research Association, USA; Morales, C. A., Maryland Univ., USA; Weinman, J. A., NASA Goddard Space Flight Center, USA; Olson, W. S., Maryland Univ. Baltimore County, USA; 1999; In English; Atmospheric Electricity, 7-11 Jun. 1999, Huntsville, AL, USA
Contract(s)/Grant(s): NAS5-32484; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Planar rainfall distributions were retrieved from data provided by the Tropical Rainfall Measuring Mission (TRMM) Microwave Imager (TMI) and Special Sensor Microwave/Imager (SSM/I) radiometers. Lightning generates Very Low Frequency (VLF) radio noise pulses called sferics. Those pulses propagate over large distances so that they can be continuously monitored with a network of ground based radio receivers. An empirical relationship between the sferics rate and the convective rainfall permitted maps of convective latent heating profiles to be derived continuously from the sferics distributions. Those inferred latent heating rates were assimilated into the Penn State/NCAR Mesoscale Model (MM5) that depicted an intense winter cyclone that passed over Florida on 2 February 1998. When compared to a 14 hour MM5 rainfall forecast using conventional data, the use of lightning data improved the forecast.
Author
Mesoscale Phenomena; Microwave Imagery; Convective Heat Transfer; Trmm Satellite; Very Low Frequencies; Remote Sensing; Heating; Lightning

19990053473 Geological Survey, Paleontological Investigations, Denver, CO USA
Results of the Field Study of the Paleontological Resources of the Fort Carson Military Reservation, Colorado
Raynolds, Robert, Geological Survey, USA; Nelson, Douglas, Geological Survey, USA; Olsen, Frederik, Geological Survey, USA; Mar. 1999; 88p; In English
Report No.(s): AD-A363332; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The sedimentary rocks at Fort Carson Military Reservation contain various outcrops of paleontologic significance. Outcrops with significant paleontologic resources range from the Jurassic Kimmeridgian, Morrison Formation to various undifferentiated Pleistocene alluviums. The paleontology survey reported in this manuscript is an important part of the Fort Carson Cultural Resources Management Program whose goal is to maintain the largest possible area for military training while protecting significant cultural and environmental resources. The current study is a demonstration project funded by a grant awarded to Fort Carson by the Legacy Resource Management Program. Congress established Legacy in 1991 to provide the Department of Defense (DoD) with an opportunity to enhance the management of resources on lands under DoD jurisdiction.
DTIC
Paleontology; Fossils; Radioactive Age Determination; Time Measurement

19990053495 Naval Postgraduate School, Monterey, CA USA
Efficient Computation of Nonlinear Transient Structural Synthesis for Seismic Isolation
Pearce, Cliff P.; Mar. 1999; 76p; In English
Report No.(s): AD-A362911; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A method of structural synthesis is presented using a recursive computational process. A structure can be modeled entirely linearly, with localized nonlinearities included as synthesized forces. The method allows retention of only the degrees of freedom (DOF) of interest, including, at a minimum, the DOF at which nonlinearities are applied. The method is illustrated using an n-degree of freedom finite element model of a simple structure. The method is shown to adjust the response of the system based on addition of a nonlinear base isolator. Finally, the method is compared to MATLAB's ODE45 function as a measure of accuracy and efficiency. The method is theoretically exact, and results in order of magnitude decreases in computational time for modification analysis.
DTIC
Mathematical Models; Computation; Seismology; Nonlinearity

47
METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

19990050992 National Weather Service, Climate Prediction Center, Camp Springs, MD USA
Proceedings of the Annual Climate Diagnostics and Prediction Workshop
1999; 366p; In English, 26-30 Oct. 1998, Miami, FL, USA; Original contains color illustrations
Report No.(s): PB99-146524; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

Table of Contents: Review of 1997-1998: Anomalies and Forecasts; Review of 1997-1998: Impacts, Attribution of Weather; Intraseasonal/Interannual Studies; Review of 1997-1998/Model Studies; Medium and Long Range Forecasting; Time Series/Data Set Studies; Data/Low Frequency Mode Studies; Models and Model Studies; Intraseasonal Variability; Interannual/Interdecadal Variability - Atlantic; Regional/Interannual-Interdecadal Studies; Interannual/Interdecadal Variability - Pacific; American Precipitation Variability; Interdecadal Variability - Diagnosis; Monsoon, Intraseasonal Studies; Seasonal to Interannual Prediction; ENSO; Monsoons.
NTIS
Conferences; Meteorology; Climatology; Anomalies; Weather Forecasting

19990051004 GenCorp Aerojet, Azusa, CA USA
Earth Observing System/Meteorological Satellite (EOS/METSAT). Advanced Microwave Sounding Unit-A (AMSU-A) Contamination Control Plan *Final Report*
Fay, M., GenCorp Aerojet, USA; October 1998; 56p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1998-208622; NAS 1.26:208622; AEROJET-10353D; CDRL-007; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This Contamination Control Plan is submitted in response the Contract Document requirements List (CDRL) 007 under contract NAS5-32314 for the Earth Observing System (EOS) Advanced Microwave Sounding Unit A (AMSU-A). In response to the CDRL instructions, this document defines the level of cleanliness and methods/procedures to be followed to achieve adequate cleanliness/contamination control, and defines the required approach to maintain cleanliness/contamination control through shipping, observatory integration, test, and flight. This plan is also applicable to the Meteorological Satellite (METSAT) except where requirements are identified as EOS-specific. This plan is based on two key factors: a. The EOS/METSAT AMSU-A Instruments are not highly contamination sensitive. b. Potential contamination of other EOS Instruments is a key concern as addressed in Section 9/0 of the Performance Assurance Requirements for EOS/METSAT Integrated Programs AMSU-A Instrument (MR) (NASA Specification S-480-79).
Derived from text
Advanced Microwave Sounding Unit; Meteorological Satellites; Earth Observing System (EOS); Contamination; Cleanliness

19990052634 National Weather Service, Silver Spring, MD USA
Service Assessment: South Texas Floods, October 17-22, 1998
Harned, S.; Reed, D.; Eblen, L.; Huse, T.; Carey, C.; Feb. 1999; 38p; In English
Report No.(s): PB99-144198; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During the weekend of October 17-18, 1998, torrential rains fell over south and southeast Texas. Up to 22 inches of rain fell which first result in deadly flash flooding from San Antonio to Austin followed by record breaking river floods along several south Texas rivers the following week. Based on provisional data from the USGS, which is subject to revision, the flood peak for this event was the highest known peak stage at 15 locations. The event occurred within the county warning areas (CWA) of three NOAA/NWS field forecast offices (NWSFO Austin/San Antonio, NWSO Houston/Galveston, NWSO Corpus Christi) and within the West Gulf River Forecast Center's (WGRFC's) area of responsibility. The potential for extremely heavy rainfall was anticipated by all offices and by the Hydrometeorological Prediction Center (HPC) and the Storm Prediction Center (SPC) of the National Centers for Environmental Prediction
NTIS
Geological Surveys; Weather Stations; Hydrometeorology; Forecasting; Floods

19990052672 Colorado Univ., Colorado Center for Astrodynamics Research, Boulder, CO USA
On-Line Access to Weather Satellite Imagery and Image Manipulation Software
Emery, William J., Colorado Univ., USA; Kelley, T., Colorado Univ., USA; Dozier, J., California Univ., USA; Rotar, P., National

Center for Atmospheric Research, USA; Bulletin of the American Meteorological Society; June 1995; Volume 76, No. 6, pp. 923-932; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Advanced Very High Resolution Radiometer and Geostationary Operational Environmental Satellite Imagery, received by antennas located at the University of Colorado, are made available to the Internet users through an on-line data access system. Created as a 'test bed' data system for the National Aeronautics and Space Administration's future Earth Observing System Data and Information System, this test bed provides an opportunity to test both the technical requirements of an on-line data system and the different ways in which the general user community would employ such a system. Initiated in December 1991, the basic data system experienced four major evolutionary changes in response to user requests and requirements. Features added with these changes were the addition of on-line browse, user subsetting, and dynamic image processing/navigation. Over its lifetime the system has grown to a maximum of over 2500 registered users, and after losing many of these users due to hardware changes, the system is once again growing with its own independent mass storage system.

Author

Advanced Very High Resolution Radiometer; On-Line Systems; Information Systems; Image Processing; Data Systems; Satellite Imagery; Earth Observing System (EOS)

19990052870 Illinois State Water Survey, Champaign, IL USA

Long-Term Variations in Seasonal Weather Conditions and Their Impacts on Crop Production and Water Resources in Illinois ***Topical Report***

Changnon, S. A.; Winstanley, D.; 1999; 44p; In English

Report No.(s): PB99-151540; ISWS/RR-127; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study reports the results of an analysis of long-term records of corn yields, water resource conditions, and seasonal weather conditions in Illinois and found major temporal shifts and important spatial variations in the types of seasonal weather conditions that have positive and negative impacts on yields and water conditions. Nineteen different types of corn-weather seasons (May-August) occurred during 1901-1997, of which nine types accounted for most of the high corn yields (highest 20 of the 97 values) and eight types produced most low yields (lowest 20 values). An assessment of the years with either high or low yields revealed three findings about the distributions of the corn-weather seasons creating these extremes: (1) some types were uniformly distributed throughout the century; (2) others were unevenly distributed over time, some occurring only in the century's early decades and others only in the last few decades; and (3) certain types varied greatly regionally. Yield responses to certain seasonal types varied over time.

NTIS

Crop Growth; Corn; Annual Variations

19990052879 National Association of Home Builders, National Research Center, Washington, DC USA

Monitoring of Near Ground Wind in a Built-Up Suburban Environment

Sep. 1998; 82p; In English

Contract(s)/Grant(s): H-21065CA

Report No.(s): PB99-144073; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report addresses the first phase of an effort to document the engineering characteristics of near-ground wind in a typical rough terrain (wooded/suburban) environment of an industrial park. The purpose is to explore the merits of considering shielding in wind design methodologies for homes and similar low-rise buildings. An industrial park in Upper Marlboro, MD was instrumented with five near-ground wind monitoring stations. The study found that the variation of wind speed between the five stations was significant, representing the range of wind conditions expected in a built-up exposure. In the moderately dense conditions of the industrial park, the effect of shielding at some locations was offset by an opposite effect of wind speed-up at other stations.

NTIS

Ground Wind; Suburban Areas; Structural Engineering

19990052980 Atmospheric and Environmental Research, Inc., Cambridge, MA USA

Advanced Geophysical Environmental Simulation Techniques ***Final Report, 2 Sep. 1994 - 1 Sep. 1997***

Gustafson, G. B.; d'Entremont, R. P.; Ivaldi, C. F.; Beresford, S. T.; Hogan, D. B.; May 08, 1998; 65p; In English

Contract(s)/Grant(s): F19628-94-C-0106; AF Proj. 7659

Report No.(s): AD-A360933; PL-TR-97-2159; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A three-year, multi-faceted effort to develop and apply state-of-the-art techniques for analysis of environmental satellite data is described. Principal accomplishments include development of satellite data analysis and image processing algorithms and software suitable for interpreting environmental satellite sensor measurements; adaptation and application of satellite-based cloud

property retrieval algorithms for processing of large multiple-satellite data sets; development and application of improved cloud-phase and cloud optical property retrieval algorithms; investigation of techniques potentially applicable for retrieval of cloud spatial properties from very high resolution remotely sensed data; and data analysis in support of a contrail-formation experiment. Software development and data analysis were performed using the Air Force Interactive Meteorological System (AIMS) located at PL. AIMS is an integrated computer facility that includes multiple direct-broadcast satellite ground stations and associated data processing facilities; an extensive satellite and conventional data archive; a database access system; and a library of environmental-property retrieval algorithms. Several system enhancements were developed for AIMS including a new Geostationary satellite acquisition and analysis capability. All software and data-analysis products developed under this effort are available on AIMS.
DTIC
Meteorological Parameters; Cloud Physics; Satellite Imagery; Meteorological Satellites; Geophysics; Environment Simulation; Remote Sensing; Satellite Observation

19990052985 Woods Hole Oceanographic Inst., Dept. of Applied Ocean Physics and Engineering, MA USA
Investigations of Atmospheric Forcing During the High Resolution Main Experiment ***Final Report***
Edson, James; Feb. 01, 1999; 83p; In English
Contract(s)/Grant(s): N00014-92-J-1585; N00014-96-J-0516
Report No.(s): AD-A361083; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The long term objective of this research is to relate the information received by radar antennae into relevant atmospheric and oceanic variables at spatial scales of 0.1 to 1 kilometer. Since radar backscatter is dependent on surface conditions, a better understanding of the mechanisms at work will allow researchers to develop new models relating backscatter to geophysical parameters. The improvement in the model physics also will improve their usefulness as interpretive tools in remote sensing studies at much larger scales (e.g., climate studies). Secondly, the simultaneous measurement of short wave spectra with wind stress and direction will allow us to test current theories of the growth and equilibrium of short waves and their modification by current gradients. These theories currently parameterize wind input, long wave interactions, and dissipation in attempting to determine the equilibrium short wave spectrum.
DTIC
Climate; Air Water Interactions; Remote Sensing

19990053117 NASA Goddard Space Flight Center, Greenbelt, MD USA
On the Role of Surface Friction in Tropical Intraseasonal Oscillation
Chao, Winston C., NASA Goddard Space Flight Center, USA; Chen, Baode, Universities Space Research Association, USA; Apr. 21, 1999; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The role of surface friction in the tropical intraseasonal oscillation (TIO), or the Madden-Julain oscillation (MJO), is investigated by first comparing two four-year integrations with the Goddard atmospheric general circulation model, one with surface friction and the other without. This comparison indicates that without surface friction the MJO not only still exists but also exists with higher intensity. A third experiment, where the removal of surface friction is done only in the tropics, reveals little chances in the MJO intensity from the second experiment. The oft-cited frictional wave-CISK (FWC) interpretation for the origin of the MJO, which emphasizes the role of frictional convergence in the surface layer, is reassessed in light of these experiments. These experiments do not support one of the central ideas in FWC that surface friction plays an instability enhancing role.
Author
Research; Friction Factor; Surface Layers; Oscillations

19990053119 NASA Goddard Space Flight Center, Greenbelt, MD USA
Climatic Variability of Precipitation from the Seasonal Cycle to ENSO Using GPCP's Merged Data Product and SSM/I-Based Microwave Estimates
Curtis, Scott, NASA Goddard Space Flight Center, USA; Huffman, George, Science Systems and Applications, Inc., USA; Nelkin, Eric, Science Systems and Applications, Inc., USA; 1999; In English; GEWEX Conference, 16-19 Jun. 1999, Beijing, China; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Satellite estimates and gauge observations of precipitation are useful in understanding the water cycle, analyzing climatic variability, and validating climate models. The Global Precipitation Climatology Project (GPCP) released a community merged precipitation data set for the period July 1987 through the present, and has recently extended that data set back to 1986. One objective of this study is to use GPCP estimates to describe and quantify the seasonal variation of precipitation, with emphasis on the Asian summer monsoon. Another focus is the 1997-98 El Nino Southern Oscillation (ENSO) and associated extreme precipitation events. The summer monsoon tends to be drier than normal in El Nino ears. This was not observed for 1997 or 1998, while for

1997 the NCEP model produced the largest summer rain rates over India in years. This inconsistency will be examined. The average annual global precipitation rate is 2.7 mm day as estimated by GPCP, which is similar to values computed from long-term climatologies. From 30 deg N to 30 deg S the average precipitation rate is 2.7 mm day over land with a maximum in the annual cycle occurring in February-March, when the Amazon basin receives abundant rainfall. The average precipitation rate is 3.1 mm day over the tropical oceans, with a peak earlier in the season (November-December), corresponding with the transition from a strong Pacific Intertropical Convergence Zone (ITCZ) from June to November to a strong South Pacific Convergence Zone (SPCZ) from December to March. The seasonal evolution of C, C, the Asian summer monsoon stands out with rains in excess of 15 mm day off the coast of Burma in June. The GPROF pentad data also captures the onset of the tropical Pacific rainfall patterns associated with the 1997-98 ENSO. From February to October 1997 at least four rain-producing systems traveled from West to East in the equatorial corridor. A rapid transition from El Nino to La Nina conditions occurred in May-June 1998. GPCP and GPROF were used to construct precipitation-based ENSO indices to monitor El Ninos (EL) and La Ninas and (LI).
Derived from text
Annual Variations; Climate Models; Climatology; Precipitation (Meteorology)

19990053467 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA
AWOS Data Acquisition System (ADAS), Automated Lightning Detection and Reporting System (ALDARS), Operational Test and Evaluation (OT & E) Final Test Report
Groot, Donald; Vuong, Hugh; Schlain, Ed; Stratton, Jock; Dec. 1998; 721p; In English
Report No.(s): AD-A362808; DOT/FAA/CT-TN98/23; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

The Federal Aviation Administration (FAA) Automated Weather Observation System (AWOS) Data Acquisition System (ADAS)/Automated Lightning Detection and Reporting System (ALDARS) Operation Test and Evaluation (OT&E) Final Test Report is prepared by the ADAS/ALDARS Test Director. This report provides the procedures. results, analysis, significant problems, and Problem Trouble Reports (PTR) for each test. The report also provides overall conclusions and recommendations that flow from the OT&E. The purpose of the ADAS/ALDARS project is to incorporate lightning data into the National Airspace System (NAS) via the Automated Surface Observation System (ASOS) AWOS One-Minute Observations (OMO) and the Aviation Routine Weather Report (METAR) and Aviation Selected Special Weather Report (SPECI) weather messages. This project also incorporated the capability for ADAS to generate METAR format weather messages and interface with the Integrated Terminal Weather System (ITWS). ADAS/ALDARS OT&E was performed to verify that all of the NAS level requirements associated with this project were correctly implemented. All testing was performed by the ACT-320 Weather Branch at the FAA William J. Hughes Technical Center.
DTIC
Detection; Lightning; Data Acquisition; Meteorological Parameters; Flight Conditions; Weather

19990053493 Naval Postgraduate School, Monterey, CA USA
Mapping Coastal Surface Winds in Monterey Bay Using High Frequency Radar
Delgado III, Raymond R.; Mar. 1999; 134p; In English
Report No.(s): AD-A362924; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Over-water wind directions derived from high frequency (HF) radar - the new Multi-frequency Coastal Radar (MCR) - are compared to in-situ observations to determine the skill of the radar measurements. Conventional beam processing of data collected from two MCR sites located around Monterey Bay during summer 1997 is used to create wind directions based on the relative strength of the positive and negative Bragg-resonant peaks, which correspond to the wind-driven waves approaching and receding from the radar, respectively. Based on a selected functional relationship that converts the radar signal to wind direction, radar-derived wind directions are created using a new wind-retrieval algorithm and are compared to mooring observations under a variety of wind conditions. Analysis indicates that the signal not only follows wind direction, but also strongly correlates to the wind speed measured at the mooring. Results show that many of the Bragg peaks are close to the noise level, and consequently, low signal-to-noise ratios restrict the statistical confidence of the measurements. Nonetheless, maps of radar-derived wind directions show good agreement with in situ observations, especially when the wind speed is relatively strong and is sustained for long duration.
DTIC
Radar; Mapping; Coasts; Wind Direction; Wind Velocity; Meteorological Parameters

48
OCEANOGRAPHY

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

19990050971 National Oceanic and Atmospheric Administration, Pacific Marine Environmental Lab., Seattle, WA USA
Bering Sea FOCI, 1991-1997. Fisheries-Oceanography Coordinated Investigations. Coastal Ocean Program ***Final Report***
Macklin, S. A.; Dec. 1998; 180p; In English
Report No.(s): PB99-147308; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

To develop an understanding of stock structure and recruitment variation in Bering Sea pollock, the Coastal Ocean Program of the National Oceanic and Atmospheric Administration (NOAA) funded a 7-year (1991-1997), interdisciplinary project named Bering Sea Fisheries-Oceanography Coordinated Investigations (BS FOCI; Schumacher and Kendall, 1995) for which NOAA and academic researchers were selected through a competitive process (Macklin, this report). The project goals, based on recommendations from an international symposium on pollock (Aron and Balsiger, 1989) were to (1) determine stock structure in the Bering Sea and its potential relationship to physical oceanography, and (2) examine recruitment processes in the eastern Bering Sea. Both of these have direct implication to management. An integrated set of field, laboratory, and modeling studies were established to accomplish these goals.
NTIS
Oceanography; Ocean Dynamics; Foci; Fisheries; Bering Sea; Coastal Ecology

19990052635 Alaska Univ., Coastal Marine Inst., Fairbanks, AK USA
Alaska Frozen Tissue Collection and Associated Electronic Database: A Resource for Marine Biotechnology ***Final Report***
Cook, J. A.; Jarrell, G. H.; Runck, A. M.; Demboski, J. R.; Mar. 1999; 36p; In English
Report No.(s): PB99-142812; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Alaska Frozen Tissue Collection (AFTC) is the primary regional archive for frozen zoological samples and a major contributor to biotechnology studies of the North Pacific and Arctic oceans. It has become the world's third largest frozen tissue collection for wild mammals. In addition to expanding the scope of the collection by recruiting contributions of marine mammal, bird, fish, and invertebrate specimens from throughout the North Pacific and Arctic oceans, a collection of approximately 5,000 seals was incorporated. These specimens span three decades of field work by the Alaska Department of Fish and Game, and include samples from throughout Alaska's wasters. This is the largest collection of western Arctic and North Pacific seals worldwide.
NTIS
Data Bases; Biotechnology; Tissues (Biology); Data Storage

19990053350 NASA Goddard Space Flight Center, Greenbelt, MD USA
SeaWiFS Postlaunch Technical Report Series, Volume 5, The SeaWiFS Solar Radiation-Based Calibration and the Transfer-to-Orbit Experiment
Hooker, Stanford B., Editor, General Sciences Corp., USA; Firestone, Elaine R., Editor, General Sciences Corp., USA; Barnes, Robert A., General Sciences Corp., USA; Eplee, Robert E., Jr., General Sciences Corp., USA; Biggar, Stuart F., Arizona Univ., USA; Thome, Kurtis J., Arizona Univ., USA; Zalewski, Edward F., Arizona Univ., USA; Slater, Philip N., Arizona Univ., USA; Holmes, Alan W., Santa Barbara Instrument Group, USA; June 1996; ISSN 1522-8789; 33p; In English
Report No.(s): NASA/TM-1999-206892/VOL5; NAS 1.15:206892/VOL5; Rept-99B00063; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The solar radiation-based calibration (SRBC) of the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) was performed on 1 November 1993. Measurements were made outdoors in the courtyard of the instrument manufacturer. SeaWiFS viewed the solar irradiance reflected from the sensor's diffuser in the same manner as viewed on orbit. The calibration included measurements using a solar radiometer designed to determine the transmittances of principal atmospheric constituents. The primary uncertainties in the outdoor measurements are the transmission of the atmosphere and the reflectance of the diffuser. Their combined uncertainty is about 5 or 6%. The SRBC also requires knowledge of the extraterrestrial solar spectrum. Four solar models are used. When averaged over the responses of the SeaWiFS bands, the irradiance models agree at the 3.6% level, with the greatest difference for SeaWiFS band 8. The calibration coefficients from the SRBC are lower than those from the laboratory calibration of the instrument in 1997. For a representative solar model, the ratios of the SRBC coefficients to laboratory values average 0.962 with a standard deviation of 0.012. The greatest relative difference is 0.946 for band 8. These values are within the estimated uncertainties of the calibration measurements. For the transfer-to-orbit experiment, the measurements in the manufacturer's courtyard are used to predict the digital counts from the instrument on its first day on orbit (August 1, 1997). This experiment requires an estimate of the

relative change in the diffuser response for the period between the launch of the instrument and its first solar measurements on orbit (September 9, 1997). In relative terms, the counts from the instrument on its first day on orbit averaged 1.3% higher than predicted, with a standard deviation of 1.2% and a greatest difference of 2.4% or band 7. The estimated uncertainty for the transfer-to-orbit experiment is about 3 or 4%.
Author
Postlaunch Reports; Sea-Viewing Wide Field-Of-View Sensor; Remote Sensors; Remote Sensing; Satellite-Borne Instruments; Calibrating; Ocean Surface; Oceanography

19990053421 NASA Goddard Space Flight Center, Greenbelt, MD USA
SeaWiFS Postlaunch Technical Report Series, Volume 4, The 1997 Prelaunch Radiometric Calibration of SeaWiFS
Hooker, Stanford B., Editor, NASA Goddard Space Flight Center, USA; Firestone, Elaine R., Editor, General Sciences Corp., USA; Johnson, B. Carol, National Inst. of Standards and Technology, USA; Early, Edward E., National Inst. of Standards and Technology, USA; Eplee, Robert E., Jr., General Sciences Corp., USA; Barnes, Robert A., General Sciences Corp., USA; Caffrey, Robert T., NASA Goddard Space Flight Center, USA; April 1999; 56p; In English
Contract(s)/Grant(s): NASA Order S-64096-E
Report No.(s): NASA/TM-1999-206892/VOL4; NAS 1.15:206892/VOL4; Rept-99B00036; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Sea-viewing Wide Field-of-view Sensor (SeaWiFS) was originally calibrated by the instrument's manufacturer, Santa Barbara Research Center (SBRC), in November 1993. In preparation for an August 1997 launch, the SeaWiFS Project and the National Institute of Standards and Technology (NIST) undertook a second calibration of SeaWiFS in January and April 1997 at the facility of the spacecraft integrator, Orbital Sciences Corporation (OSC). This calibration occurred in two phases, the first after the final thermal vacuum test, and the second after the final vibration test of the spacecraft. For the calibration, SeaWiFS observed an integrating sphere from the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) at four radiance levels. The spectral radiance of the sphere at these radiance levels was also measured by the SeaWiFS Transfer Radiometer (SXR). In addition, during the calibration, SeaWiFS and the SXR observed the sphere at 16 radiance levels to determine the linearity of the SeaWiFS response. As part of the calibration analysis, the GSFC sphere was also characterized using a GSFC spectroradiometer. The 1997 calibration agrees with the initial 1993 calibration to within +/- 4%. The new calibration coefficients, computed before and after the vibration test, agree to within 0.5%. The response of the SeaWiFS channels in each band is linear to better than 1%. In order to compare to previous and current methods, the SeaWiFS radiometric responses are presented in two ways: using the nominal center wave-lengths for the eight bands; and using band-averaged spectral radiances. The band-averaged values are used in the flight calibration table. An uncertainty analysis for the calibration coefficients is also presented.
Author
Calibrating; Ocean Data Acquisitions Systems; Ocean Color Scanner; Radiance; Postlaunch Reports; Radiometers

19990053487 Woods Hole Oceanographic Inst., MA USA
Red Sea Studies *Final Report, 1 Mar. 1995 - 31 Dec. 1998*
Pratt, Lawrence; May 05, 1999; 4p; In English
Contract(s)/Grant(s): N00014-95-1-0456
Report No.(s): AD-A363049; WHOI-13045600; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This work was focused on the dynamics of stratified flow in sea straits, primarily the Bab al Mandab (BAM). Possible hydraulic control of the exchange flow in the BAM was investigated by analyzing data collected by Drs. Steve Murray and Bill Johns as part of a recent 2-year field program The analysis centered on the calculation of long wave speeds for the first and second baroclinic modes of the stratified shear flows at the sill and narrowest section of the Strait. Doing so required advancements in the theory of internal long waves in straits with nonuniform cross-channel topography. The hydraulic character of the flow is vital in the understanding of the stratification in the BAM and in the neighboring Red Sea and Gulf of Aden. Theoretical studies of the effects of rotation on hydraulically controlled flows in straits were also carried out. The results reveal some remarkable structural features such as transverse hydraulic jumps, recirculations and splitting of the flow.
DTIC
Fluid Flow; Red Sea; Stratified Flow; Topography

19990052724 San Jose State Univ., Dept. of Psychology, CA USA
Behavioral and Physiological Effects of Hindlimb Unloading in Rats ***Final Report, 1 Apr. 1991 - 31 Dec. 1998***
Fox, Robert A., San Jose State Univ., USA; 1998; 82p; In English
Contract(s)/Grant(s): NCC2-723; SJSU-21-1614-3502; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The overarching objective of this project was to identify changes in neural and biochemical systems of the central and peripheral nervous systems (the CNS and PNS) that are related to disruptions of functional motor responses, or motor control. The identification of neural and biochemical changes that are related to sensory-motor adaptation elicited as animals react to changes in the gravitational field was of particular interest. Thus, the major objective of this work was to study disruptions of motor responses that arise after (sic. due to) chronic exposure to altered gravity (G). to do this, parallel studies investigating changes in neural, sensory, and neuromuscular systems were conducted after animals (rats) experienced chronic exposure to conditions of altered-G. Conditions of altered-G included hyper-G produced by centrifugation, micro-G produced by orbital flight, and simulated micro-G produced by hind limb suspension. A second major interest was to examine the contribution of putative changes in sensory systems to disruptions of motor responses. to do this, motor responses and reflexes of rats were studied following chronic treatment with streptomycin sulfate (STP, an ototoxic chemical) to damage the vestibular hair cells.
Author
Cells (Biology); Central Nervous System; Damage; Neuromuscular Transmission; Physiological Effects; Physiological Responses; Rats

19990052725 Houston Univ., Connective Tissue Research Lab., TX USA
An Evaluation of Collagen Metabolism in Non Human Primates Associated with the Bion 11 Space Program-Markers of Urinary Collagen Turnover and Muscle Connective Tissue ***Final Report, 1 Jul. 1996 - 28 Feb. 1999***
Vailas, Arthur C., Houston Univ., USA; Martinez, Daniel A., Houston Univ., USA; 1999; 37p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG2-1089; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Patients exhibiting changes in connective tissue and bone metabolism also show changes in urinary by-products of tissue metabolism. Furthermore, the changes in urinary connective tissue and bone metabolites precede alterations at the tissue macromolecular level. Astronauts and Cosmonauts have also shown suggestive increases in urinary by-products of mineralized and non-mineralized tissue degradation. Thus, the idea of assessing connective tissue and bone response in spaceflight monkeys by measurement of biomarkers in urine has merit. Other investigations of bone and connective histology, cytology and chemistry in the Bion 11 monkeys will allow for further validation of the relationship of urinary biomarkers and tissue response. In future flights the non-invasive procedure of urinary analysis may be useful in early detection of changes in these tissues. The purpose of this grant investigation was to evaluate mineralized and non-mineralized connective tissue responses of non-human primates to microgravity by the non-invasive analysis of urinary biomarkers. Secondly, we also wanted to assess muscle connective tissue adaptive changes in three weight-bearing skeletal muscles: the soleus, media] gastrocnemius and tibialis anterior by obtaining pre-flight and post-flight small biopsy specimens in collaboration with Dr. V. Reggie Edgerton's laboratory at the University of California at Los Angeles.
Author
Evaluation; Metabolism; Primates; Connective Tissue; Degradation; Detection; Microgravity; Musculoskeletal System

19990052859 Purdue Univ., Dept. of Animal Sciences, West Lafayette, IN USA
Hypogravity's Effect on the Life Cycle of Japanese Quail ***Final Report***
Hester, Patricia Y., Purdue Univ., USA; 1999; 18p; In English
Contract(s)/Grant(s): NAG2-1001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A series of studies were conducted to determine the effect of activities preceding space-flight and during space-flight on quail embryonic development. While the overall development of the quail embryos was evaluated, the report presented herein, focused on calcium utilization or uptake from eggshells by developing embryos during incubation in space and on earth. In the pre-space trials, fertilized quail eggs were subjected to pre-night dynamics including forces of centrifugation, vibration, or a combination of vibration and centrifugation prior to incubation for 6 or 16 days. In another trial, fertile quail eggs were tested for survivability in a refrigerator stowage kit for eggs (RSKE) which was subsequently used to transport the eggs to space. Eggs in the RSKE were subjected to shuttle launch dynamics including G force and random vibration profiles. In the space- flight trials, 48 fertile quail eggs were launched on space shuttle Flight STS-76 and were subsequently incubated in a Slovakian incubator onboard space sta-

tion, MIR. Two sets of ground controls each with 48 fertile eggs with and without exposure to launch dynamics were initiated 5 days post-launch. There was a laboratory control (incubated in Lyon RX2 incubator at 37.5 C) and a synchronous control (incubated in Lyon RX2 incubator at 39 - 400 C), which simulated the temperature of the space-flight incubator. Following space-flight trials, post-flight trials were conducted where quail eggs were incubated in Lyon RX2 or Slovakian incubators under various temperatures with or without launch dynamics. Eggshells from all study trials were retrieved and analyzed for calcium content to determine if its utilization by developing quail embryos was affected by activities preceding space-flight or during incubation in space under microgravity. Results from the pre-flight and post-flight showed that pre-flight activities and shuttle launch dynamics had no effect on calcium uptake from the eggshell by developing embryos. However, calcium uptake from the eggshell by developing embryos incubated in micro,aravity was impaired by 12.6% when compared to embryos incubated on earth under laboratory control environment. This impairment was unlikely due to factors other than microgravity. In general, calcium utilization by developing embryos increased with age of incubation with the most increase occurring at day 16 of incubation.
Author
Research; Eggs; Embryos; Exposure; Fertility; Life (Durability); Microgravity

19990053345 Indiana Univ., Bloomington, IN USA
Spaceflight Effects on Mammalian Development Summary of Research ***Final Report, 1 Jun. 1994 - 31 May 1998***
Alberts, Jeffrey, Indiana Univ., USA; [1998]; 5p; In English
Contract(s)/Grant(s): NCC2-870; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Pregnant rats were flown as small payloads on the Space Shuttle and studied during the flight and for approximately a week after returning to Earth, when they were due to deliver their offspring. Studies of vestibular function in the rat pups were examined as part of the research program. Daily videorecordings were made of the rats' behavior in the Animal Enclosure Modules (AEMS) and in identical compartments maintained in the Orbiter Environment Simulator at the Kennedy Space Center (referred to below as Synchronous Control groups). There was continuous postflight surveillance of the rat dams, including timelapse recordings of labor and delivery. The videorecords provided by crewmembers constitute the best systematic views of spaceflown rats to date, despite the dramatic deterioration of visibility sustained after about the 4th day of flight. We were able to make both qualitative and quantitative observations. Rats were observed to engage in a varied repertoire of species-typical activities within the confines of the AEM. We devised a kinematic coding scheme by which we classified and quantified the movements made by dams in space and in the 1-g control condition. We found that movements involving pitch and yaw were about equivalent in Flight and Synchronous animals. In contrast, Flight dams displayed about seven times more rolling movements than did Control. NASA enabled early access to the AEMs after the Shuttle landed. Rats were intact and healthy. Body weight gain during the 9-11 day flights was equivalent to Controls. Post-flight observations, derived from 24hr/day videorecordings, showed that Flight rats ambulated less, reared fewer times and spent less time bipedal than did controls. Overall, their anti-gravitational responses appeared compromised.
Derived from text
Rats; Space Shuttles; Payloads; Modules; Mammals; Environment Simulators; Embryology

19990053359 Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan
Synthetic Studies on Dolabellane Diterpenoids. Synthesis of 10-epi-Clavudiol A: An Epimer of a Marine Dolabellanoid
Kato, Nobuo, Kyushu Univ., Japan; Nakanishi, Kohji, Kyushu Univ., Japan; Omoto, Mineko, Kyushu Univ., Japan; Mori, Akira, Kyushu Univ., Japan; Takeshita, Hitoshi, Tohwa Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 1998; Volume 12, No. 1, pp. 37-44; In English; See also 19990053352; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

In the line of our synthetic studies on the me&um-ring containing higher terpenoids, we have applied our strategy, which is featured by obtaining a diterpenic skeleton from two monoterpene units, to the synthesis of the dolabellane family having a fused 5-11 bicyclic skeleton. From functionalized iridoid and geranyl synthons, 10-epi-clavudiol A, an epimer of marine dolabellane clavudiol A, has been totally synthesized Noteworthy steps include a feasible isomerization of the more substituted double bond to the less substituted one via the reduction of the allylic hloride mediated by Cr(II)Cl2 in the presence of alcoholic proton source and an intramolecular pinacol coupling to form the eleven-membered ring.
Author
Research; Synthesis (Chemistry); Musculoskeletal System; Isomerization

52
AEROSPACE MEDICINE

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

19990051008 Texas Technological Univ., Graduate Faculty, Lubbock, TX USA
The Role of Musculoskeletal Dynamics and Neuromuscular Control in Stress Development in Bone
DeWoody, Yssa, Texas Technological Univ., USA; [1996]; 110p; In English; Sponsored in part by the Helen Hodges Foundation
Contract(s)/Grant(s): NAG2-899; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The role of forces produced by the musculotendon units in the stress development of the long bones during gait has not been fully analyzed. It is well known that the musculotendons act as actuators producing the joint torques which drive the body. Although the joint torques required to perform certain motor tasks can be recovered through a kinematic analysis, it remains a difficult problem to determine the actual forces produced by each muscle that resulted in these torques. As a consequence, few studies have focused on the role of individual muscles in the development of stress in the bone. This study takes a control theoretic approach to the problem. A seven-link, eight degrees of freedom model of the body is controlled by various muscle groups on each leg to simulate gait. The simulations incorporate Hill-type models of muscles with activation and contraction dynamics controlled through neural inputs. This direct approach allows one to know the exact muscle forces exerted by each musculotendon throughout the gait cycle as well the joint torques and reaction forces at the ankle and knee. Stress and strain computed by finite element analysis on skeletal members will be related to these derived loading conditions. Thus the role of musculoskeletal dynamics and neuromuscular control in the stress development of the tibia during gait can be analyzed.
Author
Neuromuscular Transmission; Psychomotor Performance; Musculoskeletal System; Finite Element Method

19990053425 Civil Aeromedical Inst., Oklahoma City, OK USA
The First Seven Years (1991-1998) of the FAA's Postmortem Forensic Toxicology Proficiency-Testing Program *Final Report, 1991-1998*
Chaturvedi, A. K., Civil Aeromedical Inst., USA; April 1999; 18p; In English
Contract(s)/Grant(s): AM-B-91-TOX-65; AM-A-92-TOX-71; AM-A-93-TOX-71; AM-B-94-TOX-71; AM-B-95-TOX-201; AM-B-96-TOX-202; AM-B-97-TOX-202; AM-B-98-TOX-202
Report No.(s): DOT/FAA/AM-99/11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Postmortem biosamples from the victims of aviation accidents are submitted to the Civil Aeromedical Institute (CAMI) for forensic toxicology, wherein acquiring accurate and authentic analytical data is the primary objective. Adherence to quality assurance/quality control (QA/QC) procedures is essential to achieve that objective, and proficiency-testing (PT) is an integral part of QA/QC of laboratories. However, there was previously no suitable PT program that could address the complexity of forensic toxicology. Existing PT programs do not include decomposed samples and solid tissues, and the majority of aviation (and to some extent, even medical examiner and coroner) case samples are putrid and of multiple types. Therefore, CAMI in July 1991 started such a needed PT program. This program is used to (1) professionally develop and maintain technical currency on a voluntary, interlaboratory, and self-evaluation basis and (2) quantifiably assess methods in the absence and presence of interfering substances. There are currently about 30 laboratories in the program, including CAMI's Toxicology and Accident Research Laboratory. Functioning under various governmental / non-governmental agencies and academic institutions, these laboratories represent a broad cross- section of the country. PT samples are distributed quarterly, and result summaries are sent to the participants, while maintaining their anonymity. Since the inception of the program, 28 PT samples encompassing whole blood, plasma, urine, kidney, or liver, with (or without) drugs and common chemicals (nicotine, caffeine, beta - phenylethylamine, etc.) have been evaluated by the participants. Analytical findings were generally consistent with the anticipated values, but they were dependent on the nature and conditions of the specimens and types of the added analytes. Some incidences of false positives of concern were noted, as well. This is a nationally recognized PT program: It is one of the few programs recommended by the American Board of Forensic Toxicology in which laboratories may participate for their accreditation by the Board. Although participation in this program is currently free of charge, it has a potential for commercialization through the private sector. Whether the program is in the private or public sector, it will continue to supporting the QA/QC component of forensic toxicology, thereby enhancing operational performance.
Author
Blood Plasma; Aerospace Medicine; Toxicology; Quality Control

53
BEHAVIORAL SCIENCES

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

19990052719 Civil Aeromedical Inst., Oklahoma City, OK USA
The Influence of Ergonomic Interventions on Employee Stress and Physical Symptoms
Joseph, Kurt M., Civil Aeromedical Inst., USA; Thompson, Richard C., Civil Aeromedical Inst., USA; Bailey, Larry L., Civil Aeromedical Inst., USA; Williams, Clara A., Civil Aeromedical Inst., USA; Worley, Jody A., Civil Aeromedical Inst., USA; Schroeder, David J., Civil Aeromedical Inst., USA; June 1999; 7p; In English
Report No.(s): DOT/FAA/AM-99/7; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A recent report by the GAO (1997) indicates that private-sector employers spend as much as $20 billion annually for employee injuries and illnesses due to musculoskeletal disorders (MSDs). While the etiologic mechanisms are poorly understood, there is increasing evidence that psychosocial risk factors related to the job and work environment play a role in the development of work-related MSDS. A longitudinal study was completed to determine the influence of six psychosocial factors and two cost-effective ergonomics interventions on physical discomfort and stress scores reported by employees within a Federal Aviation Administration organization. The results of the study revealed that stress scores decreased significantly across time. However, physical symptom scores did not change across time, nor were they affected by the ergonomic interventions. Two psychosocial factors provided significant and reliable adjustments to stress and physical discomfort scores.
Author
Human Factors Engineering; Musculoskeletal System; Injuries; Stress (Physiology)

19990052754 Emma Pendleton Bradley Hospital, East Providence, RI USA
Individual Differences in Response to Sleep Deprivation: Assessment of Fatigue Following Sleep Loss ***Final Report, 15 Nov. 1994 - 15 Nov. 1997***
Carskadon, Mary A., Emma Pendleton Bradley Hospital, USA; 1997; 16p; In English
Contract(s)/Grant(s): NCC2-872; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Previous work has indicated that a small but significant number of participants in sleep deprivation studies or in simulated shift work experiments manifests an exaggerated performance decrement when they reach a critical point in the experiment, usually near the trough of the circadian cycle or the middle of the night. Those who show this exaggerated response do not appear to differ from other non-nal volunteers in any substantial way according to usual screening criteria or baseline values. The present study aims to examine factors that may provide the basis for this extreme response. We propose that a preexisting sleep deficit-as manifested by low values on the Multiple Sleep Latency Test (MSLT)-may account for extreme responders. It has been shown that among normal volunteers screened for a variety of studies, approximately 20 to 25 percent show low (is less than 6 minutes) MSLT scores on a consistent basis, whereas a like proportion shows consistently high MSLT scores (> 13 minutes). Additionally, studies by this group have indicated that subjects with low MSLT scores may suffer from chronic insufficient sleep, as further substantiated by the finding that they have consistently higher nocturnal sleep efficiency and that their MSLT scores rise to normal values when sleep is extended. We hypothesize that the short MSLT subjects have a significant long-term sleep deficit that leads to a marked intolerance for sleep deprivation or shift work. We further suggest that this sleep debt may signify an increased sleep need in these individuals that is not met either due to personal preference or to societal pressures (or both). If this speculation is accurate, then we predict that the tolerance for sleep deprivation in such individuals can be increased by ”pretreatment” with sleep extension. Thus, the present study is designed to test the following two hypotheses: (1) subjects with nominal sleep patterns who have low MSLT scores (e.g., Sleepy subjects) will show an exaggerated response (performance decrement) to sleep loss compared to subjects who have high MSLT scores (Alert subjects) on a nominal sleep schedule; (2) when permitted to extend sleep--thus discharging their sleep debt-the Sleepy subjects will show a sleep-loss response resembling that of the Alert subjects.
Author
Sleep; Sleep Deprivation; Rest; Fatigue (Biology); Work-Rest Cycle

19990052839 Civil Aeromedical Inst., Oklahoma City, OK USA
An Investigation of the Relationship Between Chronological Age and Indicators of Job Performance for Incumbent Air Traffic Control Specialists
Heil, Michael C., Civil Aeromedical Inst., USA; June 1999; 16p; In English
Report No.(s): DOT/FAA/AM-99/18; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Over the last few decades, researchers have consistently found a negative relationship between the age of Air Traffic Control Specialists (ATCSS) and both training success and ratings of job performance (Trites, 1961; Trites & Cobb, 1962; Cobb, 1967;

VanDeventer & Baxter, 1984). As more ATCSs reach retirement age and the FAA prepares for renewed hiring efforts, there is a need of once again explore this issue. According to Schroeder, Broach, and Farmer (1997), the potential effects of aging on cognitive functioning, and the consequences of these changes on job performance and future training requirements, are important considerations associated with the aging of the ATCS workforce. The present study revisited the issue of ATCS age and performance using incumbent controllers and newly developed measures of job performance. A recent Air Traffic-Selection and Training (AT-SAT) concurrent validation study afforded an opportunity to investigate the relationship between age and performance using criterion measures that did not exist for previous studies. One of these measures, a computer based performance measure (CBPM), served as a measure of the technical skills necessary to effectively and efficiently separate traffic on the job. Assessment ratings of 'ob performance by peers and supervisors also served as a criterion measure for the current study. Results of ANOVA and regression analysis revealed that, on average, older ATCSs received lower scores on measures of job performance.
Author
Air Traffic Controllers (Personnel); Tasks; Regression Analysis; Human Performance

19990052932 Federal Aviation Administration, Office of Aviation Research, Atlantic City, NJ USA
Evaluation of the Screener Aptitude Test Battery Items *Final Report*
Neiderman, E. C.; Fobes, J. L.; Maguire, W.; Snyder, M.; Feb. 1999; 38p; In English
Report No.(s): PB99-145054; DOT/FAA/AR-99/23; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Six perceptual and cognitive tests were fielded at 18 major US airports to develop a screener aptitude test to reliably, validly, and fairly predict future performance of checkpoint security screener candidates. Performance measures included both knowledge acquisition and training transfer to the field. Some tests correlated with computer-based training performance or threat image projection detection data (Hidden Figures Test, Hidden Patterns Test, Spatial Relations Test) while others did not. Some of these three tests showed adverse impact for minorities and women (Hidden Figures Test, Spatial Relations Test). While reliability, validity, and fairness concerns were associated with individual tests at this stage, their limitations may be overcome by a test battery onstructed from revisions of the particular tests found to predict learning and training transfer.
NTIS
Aptitude; Electric Batteries; Screening

19990052978 Walter Reed Army Inst. of Research, Washington, DC USA
Operation Joint Guard (SFOR) Bosnia: Assessment of Operational Stress and Adaptive Coping Mechanisms of Soldiers, *Jun. 1996 - Apr. 1997*
Campbell, Spencer J.; Ritzer, Darren R.; Valentine, John N.; Gifford, Robert K.; Mar. 1998; 68p; In English
Report No.(s): AD-A360892; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Human Dimensions Research Teams (HDRT) from Walter Reed Army Institute of Research conducted 3 major studies in Bosnia during Operations Joint Endeavor and Joint Guard. The teams' mission was to assess soldiers' operational stress and psychological and physical well-being in relation to previous deployments and garrison norms using standardized measures. This, report summarizes the research completed by the third team (Operation Joint Guard) The psychological status of the theater is assessed and compared to other major deployments and garrison norms. Recommendations based on the results and lessons learned are presented.
DTIC
Stress (Physiology); Human Performance; Adaptation

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

19990052718 NASA Ames Research Center, Moffett Field, CA USA
Development of the Monolith Froth Reactor for Catalytic Wet Oxidation of CELSS Model Wastes
Abraham, Martin, Toledo Univ., USA; Fisher, John W., NASA Ames Research Center, USA; [1995]; 12p; In English
Contract(s)/Grant(s): NCC2-5151; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The aqueous phase oxidation of acetic acid, used as a model compound for the treatment of CELSS (Controlled Ecological Life Support System) waste, was carried out in the monolith froth reactor which utilizes two-phase flow in the monolith channels. The catalytic oxidation of acetic acid was carried out over a Pt/Al2O3 catalyst, prepared at The University of Tulsa, at temperatures

and pressures below the critical point of water. The effect of externally controllable parameters (temperature, liquid flow rate, distributor plate orifice size, pitch, and catalyst distance from the distributor plate) on the rate of acetic acid oxidation was investigated. Results indicate reaction rate increased with increasing temperature and exhibited a maximum with respect to liquid flow rate. The apparent activation energy calculated from reaction rate data was 99.7 kJ/mol. This value is similar to values reported for the oxidation of acetic acid in other systems and is comparable to intrinsic values calculated for oxidation reactions. The kinetic data were modeled using simple power law kinetics. The effect of ”froth” feed system characteristics was also investigated. Results indicate that the reaction rate exhibits a maximum with respect to distributor plate orifice size, pitch, and catalyst distance from the distributor plate. Fundamental results obtained were used to extrapolate where the complete removal of acetic acid would be obtained and for the design and operation of a full scale CELSS treatment system.
Author
Acetic Acid; Catalysts; Feed Systems; Liquid Flow; Orifices; Reaction Kinetics

19990052786 Institute for Human Factors TNO, Soesterberg Netherlands
Which Track to Sail with the Virtual Ship? ***Final Report Welke Koers Moet Gevaren Worden Met Het Virtuele Schip?***
Werkhoven, P. J., Institute for Human Factors TNO, Netherlands; Bakker, N. H., Institute for Human Factors TNO, Netherlands; Sep. 21, 1998; In English
Contract(s)/Grant(s): A97/KM/310; TNO Proj. 788.1
Report No.(s): TD98-0263; TNO-TM-98-A053; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

By order of the Royal Netherlands Navy, the TNO Human Factors Research Institute has investigated which type of Virtual Environment (VE) techniques can support the design of ships with respect to human factors engineering and communication. The investigation made use of the results of previous projects in which the required VE-functionality was specified Werkhoven, 1995), in which a VE assessment technique was developed (Wientjes & Werkhoven, 1997), in which a proto-type Head-Mounted Display (HMD)-based system was built and in which a virtual bridge was validated with respect to a real bridge using the assessment methods developed (Werkhoven, 1997). to be able to balance the functionality of HMD-based systems against that of alternative VE systems, identical assessment methods have been applied to a Cave Automatic Virtual Environment. The experimental results of this assessment are described here. The quantitative results of the assessment of the HMD-based and CAVE system as well as of the real bridge, together with de various general and specific potentials and limitations of both VE-systems are compared. Benefits and bottle-necks are discussed in the light of application areas relevant for the Royal Netherlands Navy. The discussion goes beyond VE for human factors engineering studies. It is indicated how VE constitutes an integrated communication tool for sharing information, knowledge, ideas and prototypes among various people involved in the ship design process, in testing, construction and training. Finally, an inventory is presented of important research questions in the field of human factors engineering (digital representations of human bodies, navigation interfaces, information management tools and haptic feedback) of which the answers will determine the feasibility and track of the virtual ship.
Author
Ships; Virtual Reality; Display Devices; Human Factors Engineering

19990053224 Army Research Inst. of Environmental Medicine, Natick, MA USA
An Evaluation of Prototype Electrically Heated Handwear
Santee, William R.; Mullen, Stephen P.; Laprise, Bradley S.; Blanchard, Laurie A.; Jan. 1999; 35p; In English
Report No.(s): AD-A363276; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study compared the responses of eight subjects wearing prototype electrically heated gloves and unheated handwear at 0 deg C, -9 deg C and - 18 deg C. The premise of the study was that the electrically heated gloves would maintain hand warmth at least equal to bulkier issue gloves, thus enhancing performance by reducing handwear bulk. Finger temperatures and endurance time were measured while the subjects wore either a battery-powered electrically heated glove or an issue Intermediate Cold-Wet Glove (ICWG). The test plan was to test in 2 day blocks for each temperature, with half the subjects wearing the prototype glove and the other half the control ICWG glove on each day. Additional testing was done with the unheated prototype glove and a combination of the heated liner with the ICWG shell. The heated prototype glove was better than the control glove at 0 deg C and provided as much or slightly more thermal protection than the control glove at -9 deg C. It was not a viable option at - 18 deg C. The combination of the heated liners with the insulated ICWG shells was also better relative to the unheated ICWG.
DTIC
Gloves; Prototypes; Thermal Protection

19990050940 NASA Langley Research Center, Hampton, VA USA
A Survey of Shape Parameterization Techniques
Samareh, Jamshid A., NASA Langley Research Center, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 333-344; In English; See also 19990050911; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper provides a survey of shape parameterization techniques for multidisciplinary optimization and highlights some emerging ideas. The survey focuses on the suitability of available techniques for complex configurations, with suitability criteria based on the efficiency, effectiveness, ease of implementation, and availability of analytical sensitivities for geometry and grids. The paper also contains a section on field grid regeneration, grid deformation, and sensitivity analysis techniques.
Author
Parameterization; Multidisciplinary Design Optimization; Mathematical Models; Shape Functions; Aircraft Design

19990051005 NASA Glenn Research Center, Cleveland, OH USA
The Vertical Linear Fractional Initialization Problem
Lorenzo, Carl F., NASA Glenn Research Center, USA; Hartley, Tom T., Akron Univ., USA; May 1999; 16p; In English
Contract(s)/Grant(s): RTOP 523-22-13
Report No.(s): NASA/TP-1999-208919; NAS 1.60:208919; E-11699; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a solution to the initialization problem for a system of linear fractional-order differential equations. The scalar problem is considered first, and solutions are obtained both generally and for a specific initialization. Next the vector fractional order differential equation is considered. In this case, the solution is obtained in the form of matrix F-functions. Some control implications of the vector case are discussed. The suggested method of problem solution is shown via an example.
Author
Differential Equations; Linear Equations; Eigenvectors

19990052743 Rutherford Appleton Lab., Computational Science and Engineering Dept., Chilton, UK
Row Ordering for Frontal Solvers in Chemical Process Engineering
Scott, J. A.; May 25, 1999; ISSN 1358-6254; 34p; In English
Report No.(s): PB99-149916; RAL-TR-1999-035; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The solution of chemical process engineering problems often requires the repeated solution of large sparse linear systems of equations that have a highly asymmetric structure. The frontal method can be very efficient for solving such systems on modern computer architectures because, in the innermost loop of the computation, the method exploits dense linear algebra kernels, which are straightforward to vectorize and parallelize. However, unless the rows of the matrix can be ordered so that the frontsize is never very large, frontal methods can be uncompetitive with other sparse solution methods. The authors review a number of row ordering techniques that use a graph theoretical framework and, in particular, the authors show that a new class of methods that exploit the row graph of the matrix can be used to significantly reduce the frontsizes and greatly enhance frontal solver performance. Comparative results on large-scale chemical process engineering matrices are presented.
NTIS
Computer Programs; Chemical Engineering; Algorithms; Architecture (Computers); Computer Programming

19990052744 Rutherford Appleton Lab., Computational Science and Engineering Dept., Chilton, UK
Rational Lanczos Method for the Hermitian Eigenvalue Problem
Meerbergen, K.; Apr. 30, 1999; ISSN 1358-6254; 26p; In English
Report No.(s): PB99-149890; RAL-TR-1999-025; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

Applications such as the modal analysis of structures and acoustic cavities require a number of eigenvalues and eigenvectors of large scale Hermitian eigenvalue problems. The most popular method is probably the spectral transformation Lanczos method. An important disadvantage of this method is that a change of pole requires a complete restart. In this paper, the authors investigate the use of the rational Krylov method for this application. This method does not require a complete restart after a change of pole.

The authors prove that for a specific implementation, numerical instabilities can occur when the pole is not chosen carefully. Numerical examples illustrate the theory.
NTIS
Eigenvalues; Eigenvectors; Structural Analysis

19990052753 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Research in Applied Mathematics, Fluid Mechanics and Computer Science ***Semiannual Report, 1 Oct. 1998 - 31 Mar. 1999***
May 1999; 52p; In English
Contract(s)/Grant(s): NAS1-97046; NAS1-19480; NAS1-18605; NAS1-18107; NAS1-17070; NAS1-17130; NAS1-15810; NAS1-16394; NAS1-14101; NAS1-14472; RTOP 505-90-52-01
Report No.(s): NASA/CR-1999-209333; NAS 1.26:209333; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report summarizes research conducted at the Institute for Computer Applications in Science and Engineering in applied mathematics, fluid mechanics, and computer science during the period October 1, 1998 through March 31, 1999.
Author
Computer Techniques; Fluid Mechanics; Mathematics

19990052849 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Type IIB Matrix Theory at Two Loops
Hambli, N.; Dec. 1998; 26p
Report No.(s): PB99-148785; IHES/P/98/70; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The IKKT matrix model was proposed to be a non-perturbative formulation of type IIB superstring theory. One of its important consistency criteria is that the leading one-loop 1/r(sup 8) effective interaction between a cluster of type IIB D-objects should not receive any corrections from higher loop effects for it to describe accurately the type IIB supergravity results. In analogy with the BFSS matrix model versus the eleven-dimensional supergravity example, we shoe in this work that the one-loop effective potential in the IKKT matrix model is also not renormalized at the two-loop order.
NTIS
Matrix Theory; String Theory; Supergravity

19990052872 Royal Inst. of Tech., Dept. of Mathematics, Stockholm, Sweden
New Invariant Tensors in CR Structures and a Normal Form for Generic Semidefinite Levi Degeneracies
Ebenfelt, P.; Mar. 1998; 36p; In English
Report No.(s): PB99-150658; TRITA-MAT-1998-18; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In 1974, Chern and Moser (CM) solved the biholomorphic equivalence problem for real-analytic hypersurfaces in C(sup n + 1) at Levi nondegenerate points. (The case n = 1 was considered and solved by E. Cartan (C1-2).) They presented a complete set of biholomorphic invariants at a Levi nondegenerate point of such a hypersurface.
NTIS
Invariance; Tensors; Analytic Functions

19990052873 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Symplectic Reduction and Family Quantization
Zhang, W.; Jan. 1999; 20p
Report No.(s): PB99-148694; IHES/M/99/05; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We generalize the recently proved Guillemin-Sternberg geometric quantization conjecture (GS) to the family case by extending to this situation the analytic approach developed by Tian and the author in (TZ1).
NTIS
Measurement; Manifolds (Mathematics)

19990052875 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Computer Calculation of the Degree of Maps into the Poincare Homology Sphere
Hayat-Legrand, C.; Matveev, S.; Zieschang, H.; Feb. 1999; 22p; In English
Report No.(s): PB99-148660; IHES/M/99/11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The paper is devoted to the elaboration of a computer algorithm for calculating the degree. We apply the algorithm to maps into the Poincare homology sphere P and under certain restrictions give an experimental explicit formula for deg(f) through

numerical invariants of phi. The formula reduces the problem of finding out degree one maps onto P to purely number-theoretical questions. For background information see (HWZ) and (HZ).
NTIS
Poincare Spheres; Homology; Algorithms; Computer Programs

60
COMPUTER OPERATIONS AND HARDWARE

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

19990052851 State Univ. of New York, Dept. of Physics and Astronomy, Stony Brook, NY USA
Advanced Single Flux Quantum Devices ***Final Report, 15 Aug. 1997 - 14 Aug. 1998***
Likharev, Konstantin K.; Bunyk, P.; Chao, W.; Filippov, T.; Kameda, Y.; Feb. 1999; 8p; In English
Contract(s)/Grant(s): F49620-97-1-0528; AF Proj. 1651
Report No.(s): AD-A361044; AFRL-SR-BL-TR-99-0082; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goal of the present effort is the further development of ultrafast ”Rapid Single-Flux-Quantum”(RSFQ) devices and circuits based on the storage, transfer, and processing of digital bits encoded by single quanta of magnetic flux. This approach offers several key advantages over other possible digital superconductor technologies, most importantly an extremely high operation speed and extremely low power consumption.
DTIC
Architecture (Computers); Superconductors (Materials); Integrated Circuits

61
COMPUTER PROGRAMMING AND SOFTWARE

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

19990049420 NASA Glenn Research Center, Cleveland, OH USA
An Automated Code Generator for Three-Dimensional Acoustic Wave Propagation with Geometrically Complex Solid Wall Boundaries
Dyson, Rodger William, Jr., NASA Glenn Research Center, USA; June 1999; 354p; In English
Contract(s)/Grant(s): RTOP 538-03-11
Report No.(s): NASA/TM-1999-209182; E-11691; NAS 1.15:209182; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

Finding the sources of noise generation in a turbofan propulsion system requires a computational tool that has sufficient fidelity to simulate steep gradients in the flow field and sufficient efficiency to run on today’s computer systems. The goal of this dissertation was to develop an automated code generator for the creation of Software that numerically solves the linearized Euler equations on Cartesian grids in three dimensional spatial domains containing bodies with complex shapes. It is based upon the recently developed Modified Expansion Solution Approximation (MESA) series of explicit finite-difference schemes that provide spectral-like resolution with extraordinary efficiency. The accuracy of these methods can, in theory, be arbitrarily high in both space and time, without the significant inefficiencies of Runge-Kutta based schemes. The complexity of coding these schemes was, however. very high, resulting in code that could not compile or took so long to write in FORTRAN that they were rendered impractical. Therefore, a tool in Mathematica was developed that could automatically code the MESA schemes into FORTRAN and the MESA schemes themselves were reformulated into a very simple form, making them practical to use without automation or very powerful with it. A method for automatically creating the MESA propagation schemes and their FORTRAN code in two and three spatial dimensions, is shown with up to 29th order accuracy in space and time. Also, a method for treating solid wall boundaries in two dimensions is shown with up to 11th order accuracy on grid aligned boundaries and with up to 2nd order accuracy on generalized boundaries. Finally, an automated method for parallelizing these approaches on large scale parallel computers with near perfect scalability is presented. All these methods are combined to form a turnkey code generation tool in Mathematica that once provided the CAD geometry file can automatically simulate the acoustical physics by replacing the traditionally labor

intensive tasks of grid generation. algorithm development, FORTRAN coding, and wall boundary treatments with automated algorithmic procedures.
Author
Cartesian Coordinates; Finite Difference Theory; Applications Programs (Computers); Computer Aided Design; Wave Propagation; Computer Programming; Grid Generation (Mathematics); Aeroacoustics; Aerodynamic Noise; Software Development Tools; Euler Equations of Motion

19990050920 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Goettingen, Germany
Computer-Controlled Normal Mode Tuning
Sinapius, J. M., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Lake, R. C., Army Research Lab., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 89-100; In English; See also 19990050911; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Normal mode testing is a long-standing test method of experimental modal analysis. Typically, the harmonic responses of a harmonically-excited structure are investigated during normal mode testing with regard to their phase relation to the excitation. While classical phase resonance methods are suitable for checking the linearity of the structural dynamic behaviour of aerospace structures, a significant amount of time is required to perform normal mode tuning, consequently resulting in considerable costs incurred during the prototype development period. However, improvements in computer technologies and measurement techniques enable improvements in the classical phase resonance procedure, especially with regard to minimizing the test schedule without loss of accuracy of the results. This paper focuses on new methods for automated tuning and on-line data evaluation procedures for normal mode testing by investigating band-limited frequency responses for analytical and experimental vibration systems during the on-line tuning process. Three different approaches for accelerating the tuning process are investigated with respect to their on-line capabilities. In general, these methods deliver estimations about eigenfrequency, modal damping, and generalized mass, but differ in the amount of modal information delivered and, consequently, in the computational effort required. The three different methods of computer-controlled normal mode testing were experimentally verified via ground testing using the Piezoelectric Aeroelastic Response Tailoring Investigation (PARTI) testbed at NASA Langley's Transonic Dynamic Tunnel, as well as the 20m spanwidth sailplane FS-33 located at DLR. Experimental results obtained from these applications are described and initial experiences are discussed.
Author
On-Line Systems; Tuning; Modal Response; Computer Techniques; Vibration Mode; Frequency Response

19990052601 Stanford Univ., Stanford, CA USA
An Integrated Environment for Efficient Formal Design and Verification ***Final Report, 1 Jan. 1994 - 31 Dec. 1998***
1998; 6p; In English
Contract(s)/Grant(s): NAG2-891; ARPA Order A721; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The general goal of this project was to improve the practicality of formal methods by combining techniques from model checking and theorem proving. At the time the project was proposed, the model checking and theorem proving communities were applying different tools to similar problems, but there was not much cross-fertilization. This project involved a group from SRI that had substantial experience in the development and application of theorem-proving technology, and a group at Stanford that specialized in model checking techniques. Now, over five years after the proposal was submitted, there are many research groups working on combining theorem-proving and model checking techniques, and much more communication between the model checking and theorem proving research communities. This project contributed significantly to this research trend. The research work under this project covered a variety of topics: new theory and algorithms; prototype tools; verification methodology; and applications to problems in particular domains.
Author
Algorithms; Program Verification (Computers); Theorem Proving

19990052736 National Inst. of Standards and Technology, Information Technology Lab., Gaithersburg, MD USA
NIST LEIDIR Prototype: Inserting Hypertext Links into the POMS Using Information Retrieval. Installation Guide, User Guide and Software Documentation
Tebbutt, J. M.; May 1999; 24p
Report No.(s): PB99-144925; NISTIR-6321; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document provides comprehensive information about the LEIDIR prototype automatic hypertext generation system, developed by the National Institute of Standards and Technology (NIST) in collaboration with Social Security Administration (SSA). The system creates a hypertext version of the SSA's Program Operations Manual System (POMS) from the familiar

CDROM distribution. This document is organized as follows: (1) Introduction to the LEIDIR system, how it works, and the advantages it offers; (2) Description of resources required by the system, including other software; (3) Installation guide; (4) User guide; (5) Description of the directory structure used by the system; and (6) Documentation of the purpose and operation of each system module.
NTIS
Information Retrieval; Hypertext; Information Transfer; Document Markup Languages; On-Line Systems; Information Systems

19990052740 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Language for Specifying the Composition of Reliable Distributed Applications
Ranno, F.; Shivastava, S. K.; Wheater, S. M.; Jan. 1999; 30p; In English; Distributed Computing Systems, 26-29 May 1998, Amsterdam, Netherlands
Report No.(s): PB99-149940; TRS-646; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
This paper describes the design of a scripting language aimed at expressing task (unit of computation) composition and inter-task dependencies of distributed applications whose execution could span arbitrary large durations. This work is motivated by the observation that an increasingly large number of distributed applications are constructed by composing them out of existing applications, and are executed in a heterogeneous environment. The resulting applications can be very complex in structure, containing many notification and dataflow dependencies between their constituent applications. The language enables applications to be structured with the properties of modularity, interoperability, dynamic reconfigurability and fault-tolerance.
NTIS
Programming Languages; Distributed Processing; Distributed Memory; Architecture (Computers); Computer Programming; Applications Programs (Computers)

19990052741 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Architectural Support for Dynamic Reconfiguration of Large Scale Distributed Applications
Shrivastava, S. K.; Wheater, S. M.; Jan. 1999; 24p; In English; Configurable Distributed Systems, 4-6 May 1998, Unknown
Report No.(s): PB99-149932; TRS-645; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
In a distributed environment, it is inevitable that long running applications will require support for dynamic reconfiguration because, for example, machines may fail, services may be moved or withdrawn and user requirements may change. In such an environment it is essential that the structure of running applications can be modified to reflect such changes. A complication is that such long running applications are frequently composed out of existing applications. The resulting application can be very complex in structure, containing many temporal dependencies between constituent applications. This paper describes an approach that supports the dynamic reconfiguration of large scale distributed applications. An application composition and execution environment has been designed and implemented as a transactional workflow system that enables sets of inter-related tasks (applications) to be carried out and supervised in a dependable manner. A task model that is expressive enough to represent temporal dependencies between constituent tasks has been developed. The workflow system maintains this structure and makes it available through transactional operations for performing changes to it. Use of transactions ensure that changes can be carried out atomically with respect running applications. The workflow system is general purpose and open: it has been designed and implemented as a set of CORBA services to run on top of a given ORB.
NTIS
Distributed Processing; Architecture (Computers); Distributed Memory

19990052742 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
System for Specifying and Coordinating the Execution of Reliable Distributed Applications
Ranno, F.; Shrivastava, S. K.; Wheater, S. M.; Jan. 1999; 26p; In English; Distributed Applications and Interoperable Systems, 30 Sep. - 2 Oct. 1997, Cottbus, Germany
Report No.(s): PB99-149924; TRS-644; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
This paper describes the design and implementation of a coordination language (scripting language) and the supporting execution environment for expressing the run-time composition of distributed applications and their dependencies. The system supports interoperability as it has been designed and implemented as a set of CORBA services. Dynamic control is made possible because the execution environment is built using a transactional workflow management system where sets of interrelated tasks can be carried out and supervised in a dependable manner. The paper describes how relevant ideas from the fields of workflow

management and software architectures can be combined to provide an advanced application construction and execution environment, using distributed objects and middleware technologies.
NTIS
Programming Languages; Computer Programming; Algorithms; Programming Environments; Software Engineering

19990052750 Research Inst. for Advanced Computer Science, Moffett Field, CA USA
Specification-Based Browsing of Software Component Libraries
Fischer, Bernd, Research Inst. for Advanced Computer Science, USA; Proceedings of the Journal of Automated Software Engineering; June 1999; In English
Contract(s)/Grant(s): Sn11/2-3
Report No.(s): RIACS-TR-99.03; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Specification-based retrieval provides exact content-oriented access to component libraries but requires too much deductive power. Specification-based browsing evades this bottleneck by moving any deduction into an off-line indexing phase. In this paper, we show how match relations are used to build an appropriate index and how formal concept analysis is used to build a suitable navigation structure. This structure has the single-focus property (i.e., any sensible subset of a library is represented by a single node) and supports attribute-based (via explicit component properties) and object-based (via implicit component similarities) navigation styles. It thus combines the exact semantics of formal methods with the interactive navigation possibilities of informal methods. Experiments show that current theorem provers can solve enough of the emerging proof problems to make browsing feasible. The navigation structure also indicates situations where additional abstractions are required to build a better index and thus helps to understand and to re-engineer component libraries.
Author
Libraries; Computer Programs; Theorems; Proving

19990052843 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Building Configurable Applications in Java
Little, M. C.; Wheater, S. M.; Jan. 1999; 24p; In English; Configurable Distributed Systems, May 1998, Bristol, UK
Report No.(s): PB99-149981; TRS-653; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

There are many reasons why applications may require configuration, however the one which dominates Java applications is that of security restrictions. Because an application may be provided different capabilities by different users, it becomes difficult to write build-once, run-anywhere applications. Insisting that all security sensitive applications execute within controlled or restricted environments may limit the types of application which can be built. Therefore, in this paper the authors shall describe how they have constructed a configuration infrastructure in Java which allows applications to dynamically adapt themselves to the types of security restrictions that exist when they are executed. Because the system does not change the language it is portable across Java implementations. The authors shall also describe how they have used this system to build a toolkit for the construction of electronic commerce applications, which allow atomic transactions to span Web browsers and servers.
NTIS
Computer Information Security; Information Resources Management; Selective Dissemination of Information; Information Transfer

19990052852 Georgia Inst. of Tech., School of Information and Computer Science, Atlanta, GA USA
Hypermedia Prototype for Demonstration ***Final Report, Sep. 1995 - Dec. 1997***
Liebeskind, Susan; Bolter, Jay D.; Pennywitt, Kirk; Feb. 1999; 41p; In English
Contract(s)/Grant(s): F30602-95-C-0124; AF Proj. 2810
Report No.(s): AD-A361065; AFRL-IF-RS-TR-1999-29; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report is the culmination of development of HyperTech, an interface to multimedia data (text, graphics, imagery, video, and audio). Hypermedia capitalized upon the associations between data hypermedia can be used to produce large, richly-connected and cross-referenced bodies of information. The software has multiple methods of viewing data, automated lining based upon text content, and import/export of Hypertext Markup Language (HTML) format. The environment was built upon a relational database. The payoff is an alternative interface which can supplement existing retrieval methods. This work focused upon improving access to data on intelligence workstations. This report provides an overview of the effort, a listing of applicable documents, detail discussions of the approach, and suggestions for future work.
DTIC
Hypertext; Relational Data Bases; Document Markup Languages

19990052893 Fairchild Space and Defense Systems, Technical Support Center, Greenbelt, MD USA
Optical Surface Analysis Code (OSAC), 7.0 ***Final Report***
Glenn, P., Fairchild Space and Defense Systems, USA; August 1998; 234p; In English
Contract(s)/Grant(s): NAS5-31786
Report No.(s): NASA/CR-1999-209232; NAS 1.26:209232; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche
The purpose of this modification to the Optical Surface Analysis Code (OSAC) is to upgrade the PSF program to allow the user to get proper diffracted energy normalization even when deliberately obscuring rays with internal obscurations.
Author
Surface Properties; Diffraction; Computer Programs

19990052979 Reading Univ., UK
Evaluation of Geostatistics and Wavelets for Identifying Relations Between Imagery and Different Spatial Resolutions and for Data Compression ***Interim Report, Jul. - Dec. 1998***
Oliver, Margaret A.; Jan. 08, 1999; 44p; In English
Contract(s)/Grant(s): N68171-98-M-5311
Report No.(s): AD-A360898; RSSUSA-4/1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This is the first report of the project to apply geostatistics and wavelet analysis to art of the area chosen at Fort A.P. Hill in northeastern Virginia. This report embraces a summary of time spent at TEC, cokriging of Korean temperature data, and the comparison between geostatistics and wavelet analysis in these sections. Although this report is the first, it covers almost half of the work to be one. The cokriging of temperature in Korea is an exercise to determine whether estimates can be improved by using more information on altitude to estimate temperature with smaller error than by ordinary kriging. Wavelets and geostatistics can both be used for filtering data for data reconstruction. A comparison between he two approaches is described.. It seems that wavelets provide a more accurate method for data reconstruction, but geostatistics is more appropriate for exploring different resolutions of spatial variation that have been identified by the variogram.
DTIC
Imagery; Wavelet Analysis; Variance (Statistics); Spatial Distribution; Data Compression

19990052990 Rutherford Appleton Lab., Dept. for Computation and Information, Chilton, UK
The EVEREST Pre-Processor, 4.0
Ashby, J. V., Rutherford Appleton Lab., UK; Fowler, R. F., Rutherford Appleton Lab., UK; Greenough, C., Rutherford Appleton Lab., UK; Jan. 06, 1999; ISSN 1358-6254; 82p; In English
Report No.(s): PB99-127482; RAL-TR-1998-083; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche
The authors describe the EVEREST Pre-Processor Module which forms part of the EVEREST suite of programs. The Pre-Processor Module of the EVEREST Suite provides a straightforward way of defining the geometrical structure of simple devices. Three basic mechanisms are provided: primitive commands, BLOCKS command and STANDARD models.
NTIS
Computer Programs; Functional Design Specifications

19990052991 Rutherford Appleton Lab., Dept. for Computation and Information, Chilton, UK
The EVEREST Solver Module, 4.0
Ashby, J. V., Rutherford Appleton Lab., UK; Fowler, R. F., Rutherford Appleton Lab., UK; Greenough, C., Rutherford Appleton Lab., UK; Jan. 06, 1999; ISSN 1358-6254; 68p; In English
Report No.(s): PB99-127474; RAL-TR-1998-082; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche
In this report the authors describe Version 4.0 of the EVEREST Solver Module which forms part of the EVEREST semiconductor device modelling suite of programs. The solution module solves the semiconductor devicd equations in steady state or transient mode in three dimensions.
NTIS
Semiconductor Devices; Models; Computer Programs; Modules

19990053221 Lehigh Univ., Dept. of Computer Science and Electrical Engineering, Bethlehem, PA USA
Year End Progress Report for ONR Young Investigator Grant N00014-97-1-0774 ***Interim Report, Jun. 1998 - May 1999***
Blum, Rick S.; May 17, 1999; 7p; In English
Contract(s)/Grant(s): N00014-97-1-0774
Report No.(s): AD-A363335; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This research attempts to develop a fundamental understanding of the issues involved in the design and performance analysis of distributed signal detection schemes. Such knowledge is currently lacking. This is especially true for cases with statistically dependent observations from sensor to sensor, a practical case on which this research focuses. Some emphasis is being devoted to developing design algorithms, applications, and algorithms for image fusion. The goal of these studies is to produce tools and techniques for pressing practical problems. This report describes the progress made in the last year. The investigation produced several significant results that illustrate how little is really known about the underlying theory of distributed signal detection. For example, given a distributed scheme which uses a given number of bits for the decisions at all but the last sensor, we can show that the last sensor should not use more than a certain number of bits in its decision. If more bits are used at the last sensor, then the same performance can be obtained by using less bits, which implies lower speed communications.
DTIC
Signal Processing; Reliability Analysis; Algorithms; Multisensor Fusion

19990053323 Naval Postgraduate School, Monterey, CA USA
AMPL: An Exclusive Technology for DecisionNet
Casey, Michael P.; Mar. 1999; 139p; In English
Report No.(s): AD-A362883; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
This thesis describes the design and implementation of an exclusive technology agent for DecisionNet -- a distributed decision support technology marketplace for the World Wide Web. Unlike the independent technologies presently supported by DecisionNet, exclusive technologies require software agents to facilitate interactions between their providers and consumers. The exclusive technology agent described herein would allow use of the AMPL mathematical modeling language through the DecisionNet environment and provide database support for AMPL objects. An AMPL agent for DecisionNet provides a searchable repository to facilitate sharing and reuse of AMPL objects. It also provides a means for clients to formulate and execute AMPL problems without having to purchase AMPL software or learn the AMPL language. The data structure described in this thesis has three distinct types of exclusive objects: model schema, dataset, and solver. A complete AMPL problem contains one object of each type. An AMPL agent assists DecisionNet technology providers in the registration, modification, and withdrawal of AMPL objects, and assists DecisionNet consumers in the selection and execution of AMPL problems.
DTIC
Software Engineering; Decision Support Systems; Theses; Prediction Analysis Techniques; Mathematical Models; Internets

19990053332 Lawrence Livermore National Lab., Livermore, CA USA
User documentation for KINSOL, a nonlinear solver for sequential and parallel computers
Taylor, A.; Jul. 01, 1998; 59p; In English
Report No.(s): DE98-058881; UCRL-ID-131185; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
KINSOL is a general purpose nonlinear system solver callable from either C or FORTRAN programs. It is based on NKSOL (3), but is written in ANSI-standard C rather than FORTRAN77. Its most notable feature is that it uses Krylov Inexact Newton techniques in the system's approximate solution, thus sharing significant modules previously written within CASC at LLNL to support CVODE(6, 7)/PVODE(9, 5). It also requires almost no matrix storage for solving the Newton equations as compared to direct methods. The name KINSOL is derived from those techniques Krylov Inexact Newton SOLver. The package was arranged so that selecting one of two forms of a single module in the compilation process will allow the entire package to be created in either sequential (serial) or parallel form. The parallel version of KINSOL uses MPI (Message-Passing Interface) (8) and an appropriately revised version of the vector module NVECTOR, as mentioned above, to achieve parallelism and portability KINSOL in parallel form is intended for the SPMD (Single Program Multiple Data) model with distributed memory, in which all vectors are identically distributed across processors. In particular, the vector module NVECTOR is designed to help the user assign a contiguous segment of a given vector to each of the processors for parallel computation Several primitives were added to NVECTOR as originally written for PVODE to implement KINSOL KINSOL has been run on a Cray-T3D, an eight-processor DEC ALPHA and a cluster of workstations. It is currently being used in a simulation of tokamak edge plasmas and in groundwater two-phase flow studies at LLNL. The remainder of this paper is organized as follows Section 2 sets the mathematical notation and summarizes the basic methods Section 3 summarizes the organization of the KINSOL solver, while Section 4 summarizes its usage Section 5 describes a preconditioner module, Section 6 describes a set of FORTRAN/C interfaces, Section 7 describes an example problem, and Section 8 discusses availability.
NTIS
Sequential Computers; Parallel Computers

19990053465 Massachusetts Inst. of Tech., Lab. of Electronics, Cambridge, MA USA
Training Spatial Knowledge Acquisition Using Virtual Environments ***Annual Report, 1 Feb. 1997 - 31 Jan. 1998***
Durlach, Nathaniel I.; Apr. 26, 1999; 14p; In English
Contract(s)/Grant(s): N00014-96-1-0379
Report No.(s): AD-A362800; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The purpose of this study is to explore the potential benefits of using current VE technology for training spatial orientation and navigation skills.
DTIC
Data Acquisition; Virtual Reality; Attitude (Inclination); Computer Assisted Instruction

19990053494 State Univ. of New York, Albany, NY USA
Data Quality Tools for Data Warehousing - A Small Sample Survey
Neely, M. P.; Jan. 1998; 13p; In English
Report No.(s): AD-A362923; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
It is estimated that as high as 75% of the effort spent on building a data warehouse can be attributed to back-end issues, such as readying the data and transporting it into the data warehouse (Atre, 1998). Data quality tools are used in data warehousing to ready the data and ensure that clean data populates the warehouse, thus enhancing usability of the warehouse. This research focuses on the problems in the data that are addressed by data quality tools. Specific questions of the data can elicit information that will determine which features of the data quality tools are appropriate in which circumstances. The objective of the effort is to develop a tool to support the identification of data quality issues and the selection of tools for addressing those issues. A secondary objective is to provide information on specific tools regarding price, platform, and unique features of the tool.
DTIC
Estimating; Surveys; Data Management

19990053498 Space and Naval Warfare Systems Center, San Diego, CA USA
User's Guide for the Naval Communications Assessment Tool (NCAT) Software Version 2.0 ***Final Report***
Hepner, T. A.; Apr. 1999; 64p; In English
Report No.(s): AD-A362901; SPAWAR/CA-TD-3070; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This User's Guide provides instructions sufficient to execute the Naval Communications Assessment Tool (NCAT) Software Version 2.0 of the Coverage Prediction Improvement Program.
DTIC
Communication; Documentation; User Manuals (Computer Programs)

62
COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

19990049388 Sandia National Labs., Albuquerque, NM USA
Simulation Intranet Architecture
Holmes, V. P.; Linebarger, J. M.; Miller, D. J.; Vandewart, R. L.; Dec. 02, 1998; 1p; In English; WEB SIM 1999, 17-21 Jan. 1999, San Francisco, CA, USA
Report No.(s): DE00-002068; SAND98-2707C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The SIMDarion Intranet (SI) is a term which is being used to describe one element of a multidisciplinary distributed and distance computing initiative known as DisCom2 at Sandia National Laboratory (http ct al. 1998). The Simulation Intranet is an architecture for satisfying Sandia's long term goal of providing an end-to-end set of services for high fidelity full physics simulations in a high performance, distributed, and distance computing environment.
NTIS
Computerized Simulation; Architecture (Computers)

19990050979 Computer Sciences Corp., Lanham, MD USA
JSWITCH/JSAT: Real-Time and Offline World Wide Web Interface
Maury, Abigail H., Computer Sciences Corp., USA; Critchfield, Anna, Computer Sciences Corp., USA; Langston, Jim, Computer Sciences Corp., USA; [1998]; 8p; In English; SCD, Brazil; Sponsored by Instituto Nacional de Pesquisas Espacias, Brazil; No

Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Jswitch, a Java-based spacecraft Web interface to telemetry and command handling, is a prototype, platform-independent user interface to a spacecraft command and control system that uses Java technology, readily available security software, standard World Wide Web (NVV;W) protocols, and commercial off-the- shelf (COTS) products. Jsat, a Java-based science analysis and trending tool, is a major element in Jswitch. Both Jswitch and Jsat were developed for NASA's Goddard Space Flight Center (GSFC). Jsat provides Web interface, user access to science instrument data by sending the processed science satellite trend data (user-specified graphics, tables, and reports) as Java applets via the Web to the user upon request. Jsat reduces ground science instrument data processing costs and decreases processing time by eliminating the need for special operations personnel assigned to process science instrument data requests, run trend analysis software, and collect and distribute results. Jswitch reduces operational costs by providing access to spacecraft telemetry and command from any standard Web browser.
Author

Java (Programming Language); World Wide Web; Applications Programs (Computers); Spacecraft Control; Telemetry; Data Acquisition; Data Processing; Protocol (Computers); Real Time Operation

19990052730 NASA Langley Research Center, Hampton, VA USA

Toward a More Flexible Web-Based Framework for Multidisciplinary Design

Rogers, J. L., NASA Langley Research Center, USA; Salas, A. O., NASA Langley Research Center, USA; Advances in Engineering Software; 1999; ISSN 0965-9978; Volume 30, pp. 439-444; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In today's competitive environment, both industry and government agencies are under pressure to reduce the time and cost of multidisciplinary design projects. New tools have been introduced to assist in this process by facilitating the integration of and communication among diverse disciplinary codes. One such tool, a framework for multidisciplinary design, is defined as a hardware-software architecture that enables integration, execution, and communication among diverse disciplinary processes. An examination of current frameworks reveals weaknesses in various areas, such as sequencing, monitoring, controlling, and displaying the design process. The objective of this research is to explore how Web technology can improve these areas of weakness and lead toward a more flexible framework. This article describes a Web-based system that optimizes and controls the execution sequence of design processes in addition to monitoring the project status and displaying the design results.
Author

World Wide Web; Client Server Systems; On-Line Systems; Computer Systems Design; Architecture (Computers)

19990052844 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK

Java Transactions for the Internet

Little, M. C.; Shrivastava, S. K.; Jan. 1999; 30p; In English; Object-Oriented Technologies and Systems (COOTS), Apr. 1998
Report No.(s): PB99-149973; TRS-652; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The Web frequently suffers from failures which affect the performance and consistently of applications run over it. An important fault-tolerance technique is the use of atomic transactions for controlling operations on services. While it has been possible to make server-side Web applications transactional, browsers typically did not possess such facilities. However, with the advent of Java it is now possible to consider empowering browsers so that they can fully participate within transactional applications. In this paper the authors present the design and implementation of a standards complaint transactional toolkit for the Web. The toolkit allows transactional applications to span Web browsers and servers and supports application specific customization, so that an application can be made transactional without compromising the security policies operational at browsers and servers.
NTIS

Java (Programming Language); Client Server Systems; Internets; Object-Oriented Programming; World Wide Web; Computer Systems Design; Distributed Processing

19990052853 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia

An Analysis of Transmission and Storage Gains from Sliding Checksum Methods

Taylor, Richard; Jana, Rittwik; Nov. 1998; 18p; In English
Report No.(s): AD-A361069; DSTO-TR-0743; DODA-AR-01-672; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In a previous report we described, modelled and analyzed a protocol "rsync" for synchronizing related files at different ends of a communications channel with a minimum of transmitted data. This report identifies the extent of the gains that this method may provide by performing experiments on large repositories of data. The outcome is a new method of compressing large directories of data that together with conventional methods provides major gains in compression factors. As is explained in the report

these gains in compression are also indicative of the data transmission gains available when mirroring a collection of files at a remote site using rsync.
DTIC
Data Bases; Data Management; Distributed Processing

19990052867 SRI International Corp., Menlo Park, CA USA
Partitioning in Avionics Architectures: Requirements, Mechanisms, and Assurance
Rushby, John, SRI International Corp., USA; June 1999; 75p; In English
Contract(s)/Grant(s): NAS1-20334; RTOP 519-51-11-01
Report No.(s): NASA/CR-1999-209347; NAS 1.26:209347; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Automated aircraft control has traditionally been divided into distinct ”functions” that are implemented separately (e.g., autopilot, autothrottle, flight management); each function has its own fault-tolerant computer system, and dependencies among different functions are generally limited to the exchange of sensor and control data. A by-product of this ”federated” architecture is that faults are strongly contained within the computer system of the function where they occur and cannot readily propagate to affect the operation of other functions. More modern avionics architectures contemplate supporting multiple functions on a single, shared, fault-tolerant computer system where natural fault containment boundaries are less sharply defined. Partitioning uses appropriate hardware and software mechanisms to restore strong fault containment to such integrated architectures. This report examines the requirements for partitioning, mechanisms for their realization, and issues in providing assurance for partitioning. Because partitioning shares some concerns with computer security, security models are reviewed and compared with the concerns of partitioning.
Author
Automatic Flight Control; Avionics; Computer Information Security; Fault Tolerance; Distributed Processing; Architecture (Computers)

19990052992 Rutherford Appleton Lab., Dept. for Computation and Information, Chilton, UK
Elements of a Framework to Increase Usability of Systems Linked to the Web
Guedj, R. A., Rutherford Appleton Lab., UK; Dec. 10, 1998; ISSN 1358-6254; 14p; In English
Report No.(s): PB99-127458; RAL-TR-1998-077; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Information Systems of the future will have a Web front-end and will be strongly influenced by Web architecture, constraints and environment. The lack of a self-evident conceptual framework, together with the paradoxical situation of having to design an information system for a community of users whose needs and abilities are mostly unknown, forces us to look for preliminary steps towards a framework. Those steps include looking for regularities in specific situations of human consumable data types and the fundamental media to represent information and transforming the results into Metadata, exploiting theories that seem pertinent in analogous situations, such as conversation theory, identifying what constitutes a style of design for the Web and deriving guidelines for styles of design from guidelines for styles of writing, in particular the Classic Style. It is expected that a pertinent conceptual framework might emerge by following this course.
NTIS
Information Systems; World Wide Web; Computer Networks; Information Dissemination

19990052994 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA
Testing Runtime Infrastructure/ Network Interactions for Latency
Wright, Darrell; Harris, Clyde; Engler, Harold; Mar. 1998; 9p; In English; Presented at the Simulation Interoperability Workshop, Orlando, FL, March 1998. Prepared in cooperation with Georgia Tech Research Inst., Electronic Systems Lab., Atlanta, GA.
Report No.(s): AD-A359452; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Joint Advanced Distributed Simulation (JADS) Joint Test Force (JTF) is chartered by Office of the Secretary of Defense to investigate the utility of Advanced Distributed Simulation (ADS) Technology to Test and Evaluation (T&E). JADS is executing three test programs (C4I, Precision Guided Munitions and Electronic Warfare) representing slices of the overall T&E spectrum as well as observing other activity within the T&E community to form its conclusions. One of the slices, the Electronic Warfare test, is using HLA. to understand expected latency prior to the test execution, JADS is building a testbench to integrate and test the hardware and principle software components. This paper discusses the JADS plan to test the wide area network system latency prior to building the network and hosting the self-protection jammer (SPJ) test federation. The primary focus of this paper is on

the process and tools used by JADS to characterize the RTI/network interactions, the system characterization measurements made in the testbed, and how that characterization will be fed back into the federation design.
DTIC
Electronic Warfare; Wide Area Networks; Distributed Interactive Simulation; Systems Simulation

19990053232 Arizona State Univ., Tempe, AZ USA
An Integrated Approach for Security on Demand in High Speed, Shared Use Networks
Schumacher, Henry Jerry; May 1999; 156p; In English
Report No.(s): AD-A363245; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This dissertation presents a user level security on demand system, resulting from an integration of a fundamental framework for network security with the fundamental and unique characteristics of Asynchronous Transfer Mode (ATM) networks. The framework offers a conceptual structure encapsulating the fundamental knowledge and set of relationships in network security, permitting systematic and scientific reasoning about network security. The changing nature of networks from a set of unconnected entities, controlled and used by a specific class of users, to an increasingly interconnected and integrated, mixed use, set of networks, simultaneously shared by different classes of users, requires a mechanism to enable these mixed use networks to meet the diverse security requirements of all users. The framework, developed as a part of this dissertation, provides the ability for all user groups, such as the military, government, industry and academia, to define their security requirements within its context and enable the framework, when integrated into an ATM network, to provide a template for matching network security resources to individual user requirements. The user level aspect of the security system is unique and is enabled by the ATM network's call setup process. In this approach, during the call setup phase, the security posture of every node and link is computed, utilizing the security framework. When the system configures a virtual path from source to destination, every node and link is verified to meet the user specified security, in addition to bandwidth and other quality of service (QoS) requirements. Traffic is launched when the call setup succeeds, otherwise, the call fails. Thus, the approach is consistent with the basic characteristics of ATM networks, offering comprehensive security while viewing security as a distributed network resource, allocating it to each user efficiently, based on demand and dictated by the need.
DTIC
Computer Networks; Asynchronous Transfer Mode; Bandwidth; Computer Information Security

19990053300 Electronics Research Lab., Salisbury Australia
A Transmission Availability Forecast Service for Internet Protocol Networks
Blair, W. D., Electronics Research Lab., Australia; Jana, R., Electronics Research Lab., Australia; Feb. 1999; 39p; In English
Report No.(s): AD-A363086; DSTO-RR-0146; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The quality of available network connections, especially the bandwidth available to clients using the connections, has a large impact on the performance of distributed applications. For example, document transfer applications such as the World Wide Web suffer a dramatic increase in response times as a result of network congestion causing a reduction in the available bandwidth of the connection. This paper recognizes the explosion of interest in the use of Internet Protocol (IP) networks within the Australian Defense Organization and describes the development of a software tool for estimating the available bandwidth between a server and client in a distributed computing environment. We discuss the design and implementation details of the Transmission Availability Forecaster (TAF) probe and present validation studies demonstrating its reliability and accuracy in the context of actual Internet conditions.
DTIC
Data Management; World Wide Web; Protocol (Computers); Information Transfer; On-Line Systems; Client Server Systems; Distributed Processing

19990053419 NASA Marshall Space Flight Center, Huntsville, AL USA
Using the World Wide Web for GIDEP Problem Data Processing at Marshall Space Flight Center
McPherson, John W., Hernandez Engineering, Inc., USA; Haraway, Sandra W., NASA Marshall Space Flight Center, USA; Whirley, J. Don, NASA Marshall Space Flight Center, USA; 1999; In English; Government-Industry Data Exchange Program (GIDEP), 4-6 May 1999, Toronto, Ontario, Canada
Contract(s)/Grant(s): NAS8-40364; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Since April 1997, Marshall Space Flight Center has been using electronic transfer and the web to support our processing of the Government-Industry Data Exchange Program (GIDEP) and NASA ALERT information. Specific aspects include: (1) Extraction of ASCII text information from GIDEP for loading into Word documents for e-mail to ALERT actionees; (2) Downloading of GIDEP form image formats in Adobe Acrobat (.pdf) for internal storage display on the MSFC ALERT web page; (3)

Linkage of stored GRDEP problem forms with summary information for access from the MSFC ALERT Distribution Summary Chart or from an html table of released MSFC ALERTs (4) Archival of historic ALERTs for reference by GIDEP ID, MSFC ID, or MSFC release date; (5) On-line tracking of ALERT response status using a Microsoft Access database and the web (6) On-line response to ALERTs from MSFC actionees through interactive web forms. The technique, benefits, effort, coordination, and lessons learned for each aspect are covered herein.
Author
On-Line Systems; World Wide Web; Communication Networks; Electronic Publishing

19990053464 Naval Postgraduate School, Monterey, CA USA
When Is a Simple Model Adequate for Use in Scheduling in MSHN
Carff, Paul F.; Mar. 1999; 95p; In English
Report No.(s): AD-A362793; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Current resource management systems do not provide a way to use measurements taken from an application's execution on one computer to predict that application's performance on another computer. More details are needed in both their application and resource models in order to make this prediction. However, very detailed models are also not desirable. Models that are too detailed incur unnecessary overhead when values corresponding to the detail are being obtained; they are subject to higher variances; and the benefit of computing schedules using them may be outweighed by the time required to compute those schedules. This thesis proposes a model that balances the level of detail, and therefore the quality of their predictions of resource usage, against the cost of computing schedules. to assess the quality of the proposed model, an application emulator was designed, built, and used. The results from running the application emulator demonstrated that the proposed model is able to predict the relative resource usage of an asynchronous application that has substantially more computation requirements than communication requirements. However, an even more detailed model is needed to successfully predict resource requirements of both synchronous and communication-intensive applications.
DTIC
Distributed Processing; Management Systems; Resources Management; Synchronism; Computation

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.

19990050918 Air Force Seek Eagle Office, Eglin AFB, FL USA
Limit Cycle Oscillation Prediction using Artificial Neural Networks
Denegri, Charles M., Jr., Air Force Seek Eagle Office, USA; Johnson, Michael R., Air Force Seek Eagle Office, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 71-80; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A static artificial neural network in the form of a multi-layer perceptron is investigated to determine its ability to predict linear and nonlinear flutter response characteristics. The network is developed and trained using linear flutter analysis and flight test results from a fighter test. Eleven external store carriage configurations are used as training data and three configurations are used as test cases. The network was successful in predicting the aeroelastic oscillation frequency and amplitude responses over a range of Mach numbers for two of the test cases. Predictions for the third test case were not as good. Several network sizes were investigated and it was found that small networks tended to over-generalize the training data and are not capable of accurate prediction beyond the sample space. Conversely, networks that were too large, or trained to error levels that were extreme, tended to memorize the training data, and are also unable to produce adequate predictions beyond the sample space. The results of this study indicate that relatively simple networks using small training sets can be used to predict both linear and nonlinear flutter response characteristics.
Author
Aeroelasticity; Flutter Analysis; Neural Nets; Dynamic Response; Wing Oscillations

19990051009 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
GI/G/m Queueing Simulation adn GI/G/m Queue Approximations for Ph/Ph/m Queues ***Simulacao de Filas GI/G/m e Verificacao de Aproximacoes Destas por Filas Ph/Ph/m***
Ferreira, Jose Olimpio, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 224p; In Portuguese

Report No.(s): INPE-7011/TDI/659; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The performance evaluation of a GI/G/m queueing system is a classic hard problem. These multi-server queues are notoriously difficult to be evaluated analytically and, a analytic solution is possible only for special cases, just as the queues M/M/m, M/D/m, M/K2/m, GI/H2/m, GI/EK/m, GI/Ph/m, Ph/D/m (epsilon) Ph/Ph/m. The computer simulation models, despite requiring many hardware resources (work memory, storage memory, processing speed of the CPU) and consuming large amount of computer time in the execution of the simulation runs, allow the evaluation of more realistic models. The computer simulation models can be convenient enough to check the validity of assumptions needed in an analytic model and to check the results of the analytic model. This study deals with the estimation of steady-state (long-run) measures of performance for GI/G/m queueing systems through simulation models. It also checks the GI/G/m queues approximations by Ph/Ph/m queues.

Author

Analysis (Mathematics); Computerized Simulation; Queueing Theory; Mathematical Models; Steady State

19990052840 Research Inst. for Advanced Computer Science, Moffett Field, CA USA

Mission Operations with an Autonomous Agent

Pell, Barney, Research Inst. for Advanced Computer Science, USA; Sawyer, Scott R., Lockheed Martin Missiles and Space, USA; Muscettola, Nicola, RECOM Technologies, Inc., USA; Smith, Benjamin, Jet Propulsion Lab., California Inst. of Tech., USA; Bernard, Douglas E., Jet Propulsion Lab., California Inst. of Tech., USA; March 1998; 28p; In English; Autonomous Agents, 1998

Report No.(s): RIACS-TR-98.08; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Remote Agent (RA) is an Artificial Intelligence (AI) system which automates some of the tasks normally reserved for human mission operators and performs these tasks autonomously on-board the spacecraft. These tasks include activity generation, sequencing, spacecraft analysis, and failure recovery. The RA will be demonstrated as a flight experiment on Deep Space One (DSI), the first deep space mission of the NASA's New Millennium Program (NMP). As we moved from prototyping into actual flight code development and teamed with ground operators, we made several major extensions to the RA architecture to address the broader operational context in which PA would be used. These extensions support ground operators and the RA sharing a long-range mission profile with facilities for asynchronous ground updates; support ground operators monitoring and commanding the spacecraft at multiple levels of detail simultaneously; and enable ground operators to provide additional knowledge to the RA, such as parameter updates, model updates, and diagnostic information, without interfering with the activities of the RA or leaving the system in an inconsistent state. The resulting architecture supports incremental autonomy, in which a basic agent can be delivered early and then used in an increasingly autonomous manner over the lifetime of the mission. It also supports variable autonomy, as it enables ground operators to benefit from autonomy when L'@ey want it, but does not inhibit them from obtaining a detailed understanding and exercising tighter control when necessary. These issues are critical to the successful development and operation of autonomous spacecraft.

Author

Artificial Intelligence; Failure; Spacecraft Recovery; Synchronism

19990053321 Pennsylvania Univ., Dept. of Electrical Engineering, Philadelphia, PA USA

Biomorphic Networks for ATR and Higher-Level Processing ***Quarterly Report, 1 Jan. - 1 Apr. 1999***

Farhat, Nabil H., Pennsylvania Univ., USA; Apr. 20, 1999; 7p; In English

Contract(s)/Grant(s): N00014-94-1-0931

Report No.(s): AD-A362731; QR-17; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During the period of this report work progressed on the design and implementation in analog hardware of a parametrically modulated logistic processing element for use in the construction of fast analog Parametrically Coupled Logistic Map Networks. The design is based on a periodically driven spiking neuron circuit. In preceding work we put forth the hypothesis that the basic functional unit in the cortex is not the single neuron but is the neuronal assembly or netlet and that the behavior of a netlet can be mathematically modeled by a parametrically modulated logistic map, a nonlinear iterative mapping on the unit interval. We also presented evidence of the utility of such processing elements in the modeling of cortical networks and introduced a new family of networks which we named Parametrically Coupled Logistic Map Networks (abbreviated PCLMNs) that are increasingly appearing to be key to efficient simulation and study of higher-level functions performed by the cortex which is the seat of all higher level brain functions. The advantages of developing the theoretical and practical foundations for such Corticonic networks should be obvious especially for the development of new generation of machines with brain-like intelligence that goes beyond the capabilities of present day neural and connectionist models.

DTIC

Neural Nets; Cybernetics; Machine Learning; Artificial Intelligence; Belief Networks

19990053499 Naval Postgraduate School, Monterey, CA USA

The Effects of Texture on Distance Estimation in Synthetic Environments

Rowland, James H., III; Mar. 1999; 76p; In English

Report No.(s): AD-A362882; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

To determine whether egocentric distance judgments are accurate in a virtual environment with different ground surface textures. Observers were immersed within a virtual environment consisting of a large L-shaped room with a column located down one corridor and a flagpole located down the other. The observer's task was to view the column, then turn 90 degrees to view the other corridor where the flag was positioned. The observer then moved the flag's position (by using the joystick) until the distance between the observer and the flag was the same as the distance between the observer and the column. A within-subject design with column size (2 levels), column distance (4 levels), and surface texture (9 levels) was used. The texture beneath the column and the flag was varied from a high-density texture (grass), to medium-density (brick), to a low-density texture pattern (carpet). A within-subject design with column size (2 levels), column distance (4 levels), and surface texture (9 levels) was used. Subjects' distance estimates were significantly better when the brick texture was used underneath the column, than when the grass or carpet texture was used.

DTIC

Visual Perception; Virtual Reality; Estimating; Synthetic Metals

64
NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

19990050919 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. for Aeroelasticity, Goettingen, Germany

A Procedure to Improve Convergence and Accuracy of Iterative Model Updating Methods

Keye, Stefan, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 81-88; In English; See also 19990050911; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

An improvement to enhance both convergence and accuracy of iterative finite element model updating methods is proposed. The sensitivity of each individual correction parameter with respect to the eigenvectors and eigenvalues is modified in order to reduce the influence of mathematical constraints on the optimization process. This allows for a broader and more physically based selection of correction parameters and accordingly leads to more significant validation results. The performance of the method is demonstrated on a laboratory test structure using a simulated modal matrix and real experimental data from a ground vibration test.

Author

Finite Element Method; Iterative Solution; Mathematical Models; Convergence; Accuracy; Predictor-Corrector Methods; Optimization

19990050945 NASA Langley Research Center, Hampton, VA USA

Aerodynamic and Aeroelastic Insights using Eigenanalysis

Heeg, Jennifer, NASA Langley Research Center, USA; Dowell, Earl H., Duke Univ., USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 403-414; In English; See also 19990050911; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper presents novel analytical results for eigenvalues and eigenvectors produced using discrete time aerodynamic and aeroelastic models. An unsteady, incompressible vortex lattice aerodynamic model is formulated in discrete time; the importance of several modeling parameters is examined. A detailed study is made of the behavior of the aerodynamic eigenvalues both in discrete and continuous time. The aerodynamic model is then incorporated into aeroelastic equations of motion. Eigenanalyses of the coupled equations produce stability results and modal characteristics which are valid for critical and non-critical velocities. Insight into the modeling and physics associated with aeroelastic system behavior is gained by examining both the eigenvalues and the eigenvectors. Potential pitfalls in discrete time model construction and analysis are examined.

Author

Eigenvalues; Eigenvectors; Unsteady Aerodynamics; Aeroelasticity; Dynamic Models; Equations of Motion; Dynamic Structural Analysis

19990051007 Texas Technological Univ., Graduate Faculty, Lubbock, TX USA

Functional Techniques for Data Analysis

Tomlinson, John R., Texas Technological Univ., USA; December 1997; 58p; In English

Contract(s)/Grant(s): NAG2-899; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This dissertation develops a new general method of solving Prony's problem. Two special cases of this new method have been developed previously. They are the Matrix Pencil and the Osculatory Interpolation. The dissertation shows that they are instances of a more general solution type which allows a wide ranging class of linear functional to be used in the solution of the problem. This class provides a continuum of functionals which provide new methods that can be used to solve Prony's problem.

Author

Functional Analysis; Interpolation; Functionals

19990051028 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Plane Smoothers for Multiblock Grids: Computational Aspects *Final Report*

Llorente, Ignacio M., Universidad Complutense, Spain; Diskin, Boris, Institute for Computer Applications in Science and Engineering, USA; Melson, N. Duane, NASA Langley Research Center, USA; May 1999; 28p; In English

Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-1999-209331; NAS 1.26:209331; ICASE-99-17; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Standard multigrid methods are not well suited for problems with anisotropic discrete operators, which can occur, for example, on grids that are stretched in order to resolve a boundary layer. One of the most efficient approaches to yield robust methods is the combination of standard coarsening with alternating-direction plane relaxation in the three dimensions. However, this approach may be difficult to implement in codes with multiblock structured grids because there may be no natural definition of global lines or planes. This inherent obstacle limits the range of an implicit smoother to only the portion of the computational domain in the current block. This report studies in detail, both numerically and analytically, the behavior of blockwise plane smoothers in order to provide guidance to engineers who use block-structured grids. The results obtained so far show alternating-direction plane smoothers to be very robust, even on multiblock grids. In common computational fluid dynamics multiblock simulations, where the number of subdomains crossed by the line of a strong anisotropy is low (up to four), textbook multigrid convergence rates can be obtained with a small overlap of cells between neighboring blocks.

Author

Multiblock Grids; Multigrid Methods; Partial Differential Equations; Anisotropy; Smoothing; Structured Grids (Mathematics)

19990051030 Research Inst. for Advanced Computer Science, Moffett Field, CA USA

A Bayesian Approach to High Resolution 3D Surface Reconstruction from Multiple Images

Cheeseman, Peter, Research Inst. for Advanced Computer Science, USA; Smelyanskiy, Vadim N., Caelum Research Corp., USA; Maluf, David A., Caelum Research Corp., USA; May 1999; In English; Higher-Order Statistics, Jun. 1999; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): NCC2-1006

Report No.(s): RIACS-TR-99-02; No Copyright; Avail: Issuing Activity (Research Inst. for Advanced Computer Science, NASA Ames Research Center, Moffett Field, CA 94035-1000), Hardcopy, Microfiche

We present a radically different approach to the recovery of the three dimensional geometric and reflectance properties of a surface from image data. We pose the problem in a Bayesian framework, and proceed to infer the parameters of the model describing the surface. This allows great flexibility in the specification of the model, in terms of how both the geometrical properties and surface reflectance are specified In the usual manner for Bayesian approaches it requires that we can simulate the data that would have been recorded for any state of the model in order to infer the model. The theoretical aspects are thus very general. We present results for one type of surface geometry (the triangular mesh) and for the Lambertian model of light scattering. Our framework also allows the easy incorporation of data from multiple sensing modalities.

Author

Bayes Theorem; High Resolution; Surface Properties; Spectral Reflectance; Light Scattering

19990052706 Wales Univ., Dept. of Mechanical Engineering, Swansea, UK

Finite Element Model Updating using Experimental Vibration Data: Parameterisation and Regularisation

Friswell, Michael I., Wales Univ., UK; Mottershead, John E., Liverpool Univ., UK; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 821-830; In English; See also 19990052675; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Two critical issues in model updating are deciding how a finite element model should be parameterised and estimating the unknown parameters from the resulting ill-conditioned equations. A lack of understanding of these issues will lead to updated models without physical meaning. This paper outlines the authors' approach to parameterisation, using physical, geometric and generic element parameters. It also applies useful methods of regularisation, namely parameter constraints, the singular value decomposition, 'L' curves and cross validation to model updating.
Author
Finite Element Method; Ill-Conditioned Problems (Mathematics); Mathematical Models; Parameterization

19990052707 NASA Langley Research Center, Hampton, VA USA
Optimal System Realization in Frequency Domain
Juang, Jer-Nan, NASA Langley Research Center, USA; Maghami, Peiman G., NASA Langley Research Center, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 2, pp. 831-846; In English; See also 19990052675; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Several approaches are presented to identify an experimental system model directly from frequency response data. The formulation begins with a matrix-fraction description as the model structure. Frequency weighting such as exponential weighting is introduced to solve a weighted least-squares problem to obtain the coefficient matrices for the matrix-fraction description. A multi-variable state-space model can then be formed using the coefficient matrices of the matrix-fraction description. An approach is introduced to fine-tune the model using non-linear programming methods to minimize the desired cost function. The method deals with the model in the real Schur or modal form and reassigns a subset of system poles using a nonlinear optimizer. At every optimization step, the input and output influence matrices are refined through least-squares procedures. The proposed approaches are used to identify an analytical model for a NASA testbed from experimental data.
Author
Frequency Domain Analysis; System Identification; Mathematical Models; Frequency Response; Optimization; Nonlinear Programming

19990053414 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA
Boundary Conditions for Magnetic Field Gradients Inside a Source-Free Volume ***Final Report***
Holmes, John J.; Apr. 01, 1999; 15p; In English
Report No.(s): AD-A362760; NSWCCD-TR-1999/007; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Magnetic potentials, potential gradients, and combinations of the two serve as boundary conditions for solutions to Laplace's equation. From these boundary conditions unique solutions for magnetic potential and field are obtained inside the volume of space that is enclosed by the boundary. In this paper, sufficiency boundary conditions are derived that ensure unique solutions for gradients in magnetic field inside the bounded volume. The derived general boundary conditions are expressed in terms of directional derivatives of magnetic field.
DTIC
Magnetic Fields; Finite Element Method; Boundary Value Problems; Potential Fields; Boundary Conditions

65
STATISTICS AND PROBABILITY

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

19990053299 Auburn Univ., AL USA
Adaptive Inventory Control for Non-Stationary Demand with Partial Information
Treharne, James Thomas, Auburn Univ., USA; Jun. 11, 1999; 145p; In English
Report No.(s): AD-A363083; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This dissertation presents optimal and suboptimal procedures to solve inventory control problems that have non-stationary demand and partial information. In each period, the underlying demand distribution may change according to a known Markov process. The problem is characterized as partial information because some parameter of the demand probability distribution is not known with certainty; however, there is a known prior distribution for the unknown parameter. In one case, there is a probability density function for the demand that has at least one unknown parameter, but this parameter has a known probability distribution. In another case, there is a set of candidate demand probability distributions. The parameter which indicates which demand is in effect at any given time is unknown, but has a known probability mass function. The control strategies are adaptive because the controllers learn information about these unknown parameters over time and adapt accordingly. Because of the complexity

of these problems, managers often estimate the unknown parameters and make decisions assuming the estimate is correct. The computational results presented in this dissertation demonstrate that there exist efficient and effective optimal and sub optimal procedures to solve these problems that potentially provide large cost savings compared with this current practice. The control strategies include open loop feedback and limited look ahead control for a finite horizon problem, which are compared to optimal and certainty equivalence control policies. A grid approximation and upper and lower bounds for an infinite horizon problem are also developed.
DTIC
Adaptive Control; Inventory Controls; Mathematical Models; Optimal Control; Control Theory

66
SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

19990052871 Royal Inst. of Tech., Dept. of Mathematics, Stockholm, Sweden
Stability in the Monetary Roommate Game
Eriksson, K.; Karlander, J.; Mar. 1998; 22p; In English
Report No.(s): PB99-150666; TRITA-MAT-98-MA-17; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The roommate problem (Gale and Shapley, 1962) is the problem of matching a number of people into disjoint pairs such that the matching is stable in the sense that no unmatched pair prefer each other to their current partners. The authors consider here a monetary roommate game, where people can pay each other to obtain a preferred match, and the authors characterize stable matchings in terms of forbidden minors. The authors also study the general n-person game with transferible utilities and arbitrary group sizes.
NTIS
Matching; Fitting; Statistical Analysis; Probability Theory; Combinatorial Analysis

19990053237 Naval War Coll., Newport, RI USA
"Winning MOOTW's in 2010" The Future Relationship Between the U.S. Military and Nongovernmental Organizations (NGO's) ***Final Report***
Dour, Christopher A.; Feb. 05, 1999; 26p; In English
Report No.(s): AD-A363212; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Military operations other than war (MOOTW) have gained prominence since the end of the Cold War and are taking their toll on the military services. Cooperation with nongovernmental organizations (NGO's) will become essential in order for the U.S. military to achieve their objectives during these operations. Joint Vision 2010 (JV 2010) attempts to set the stage for how the military should be conducting business in the next decade. Presidential decision directive 56 (PDD 56) was passed in 1997 in an attempt to steer an interagency process of cooperation across U.S. governmental institutions but does not include NGO's in the formal process. This paper offers three recommendations on how the U.S. military should engage, cooperate and interact with NGO's now in order to fulfill JV 2010 as well as carry out the direction given in PDD 56 - (1) use a compatible communication system during these operations, preferably a cell phone satellite network, (2) begin an orientation program for NGO's so that they may become familiar with military structure, hardware and operations and (3) establish an NGO joint task force which can train with NGO's and deploy to a particular region without the ambiguity currently encountered by military forces.
DTIC
Foreign Policy; Decision Making; Satellite Networks; Politics; Organizations; Commerce

19990053238 Naval War Coll., Newport, RI USA
The USAF Aerospace Expeditionary Force: Flying into the 21st Century ***Final Report***
Reid, John R.; Feb. 05, 1999; 22p; In English
Report No.(s): AD-A363209; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The DoD-wide drawdown over the last decade has eliminated or relocated two-thirds of forward-based USAF force structure back to the USA. During this time, however, the Air Force has been repeatedly called upon to respond to all levels of crises throughout the world. These sporadic, unpredictable, and demanding crises have taken a toll on Air Force personnel who have been overextended by the challenging OPTEMPO. to meet the needs of present and future military strategy and to provide personnel stability, the Air Force has developed the Aerospace Expeditionary Force (AEF). The AEF is a force restructure providing tailorable, mobile, and responsive airpower to the combatant CINC within 48 - 72 hours. The AEF evolved from a small combat-ori-

ented force package into a complete airpower package incorporating the full spectrum of combat and support assets. Two significant AEF shortfalls need to be remedied. Current Joint Chiefs of Staff Operational Plans (OPLANs) do not incorporate the AEF employment concepts, and AEF structure does not yet include strategic airlift or other ”high demand, low density” assets. Failure to address these shortfalls could negate anticipated AEF benefits.
DTIC
Support Systems; Strategy; Stability

19990053241 Naval War Coll., Newport, RI USA
A Reexamination of the Joint Force Air Component Commander (JFACC) Concept for the 21st Century ***Final Report***
Morgan, David J.; Feb. 05, 1999; 19p; In English
Report No.(s): AD-A363183; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The U.S. military’s Joint Force Air Component Commander (JFACC) construct is the current method of theater level air power employment. JFACC doctrine largely reflects U.S. Air Force history and procedures. Despite its successes, the JFACC concept has a number of problems. These include doctrinal mismatches among the services, additional layers in the chain of command, lack of responsiveness, and large manpower requirements. This paper examines those issues and proposes technological and organizational changes to the JFACC. These changes would result in a flatter, more networked organization that would give the Joint Force Commander (JFC) increased flexibility and effectiveness in theater air power employment.
DTIC
Organizations; Manpower

19990053479 Naval War Coll., Newport, RI USA
The Airborne Forces of the USA Army: Cornerstone of Force Projection ***Final Report***
White, Randolph C., Jr; Feb. 05, 1999; 22p; In English
Report No.(s): AD-A363187; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

USA Army Airborne units will become increasingly important now that this country has transitioned to a national military strategy based on crisis response and force projection. The forced entry capability of an airborne force is unequaled and airborne units will play a major role in all contingency planning for the forseeable future. The capabilities of airborne units are understood in the army at large. However, contingency planning and execution necessitate that the joint service planner be clearly informed as to the unique capabilities and options that airborne units can provide in support of national objectives at the strategic and operational levels of war. This paper looks at the unique advantages that an airborne force can provide to the strategic and operational level planner and commander. Additionally, the limitations of the airborne force are examined in the spirit of keeping potential joint planners fully informed. Finally, the principle Mission Essential Task of the airborne force, the airfield seizure, is discussed using the elements of combat power as a guide.
DTIC
Military Operations; Combat; Strategy

19990053480 Naval War Coll., Newport, RI USA
Use of Commercial Space Assets by the Joint Force Commander ***Final Report***
Dawson, Eric L.; Feb. 05, 1999; 18p; In English
Report No.(s): AD-A363150; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The commercial space industry has surpassed the military with more satellites on orbit. In the coming decade, it is projected that 1000 more commercial satellites will be launched. The USA Government is relaxing trade restrictions to stimulate private sector investment in commercial space systems. With more capital being funded into the commercial sector, the industry is at the start of a new evolution of space technologies available to private citizens and foreign governments alike. The evolution of technologies will bring smaller, lighter and more capable satellites for less money. The launch cost involved will also decrease and allow more entities to place systems in space. The USA military is already augmented to varying degrees with commercial systems. The commercialization of space will change the way the military is enhanced by space systems. As these new technologies become available to the market, the Joint Force Commander will need to continually assess their military utility in order to prevent the enemy from gaining an edge.
DTIC
Planning; Space Commercialization; Commercial Spacecraft; Aerospace Systems; Aerospace Engineering

19990053481 Naval War Coll., Newport, RI USA
Space as an Area of Responsibility (AOR), Is it the Right Solution ***Final Report***
Cudnohufsky, Aaron L.; Feb. 05, 1999; 23p; In English
Report No.(s): AD-A363149; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

USA Commander in Chief Space (USCINCSPACE) has advocated the need to designate space as an Area of Responsibility (AOR) in order for him to have the authority to fulfill his assigned responsibilities. However, upon examining the Unified Command Plan it becomes evident that designating space as an AOR provides USCINCSPACE no additional authority or ability to accomplish his assigned missions of space control, force protection, or conduct space operations. Designating space as an AOR would likely result in undesirable consequences. If space were designated an AOR it could be perceived by other countries as the U.S. intention of militarizing space, constituting a departure from decades old policy of using space for peaceful purposes. This action in turn could then instigate a space based weapons race or complicate the proliferation of weapons of mass destruction (WMD) to space. U.S. Space Command (USSPACECOM) can best ensure space control by non-space based weapons. Use of these types of weapons would ensure space protection and access for the U.S. and be capable of denying space access to enemies when needed, while avoiding the perception of militarizing space. to enhance USCINCSPACE's ability to meet his responsibilities, he needs the authority to better manage space personnel and space assets. U.S. Special Operations Command (USSOCOM) provides an ideal model that USSPACECOM should implement to achieve this. If implemented, it would give USSPACECOM the unique authority to manage space orientated personnel careers. It would also give him the authority to execute his own budget, providing increased authority to shape space forces, insure interoperability and provide the best possible space support to the war fighters.
DTIC
Spacecrews; Policies; Warfare; Strategy

19990053482 Naval War Coll., Newport, RI USA
Not to Foresee, But to Enable: The Promise and Pitfalls of Computer Simulations in Operational Planning ***Final Report***
Bell, James C.; Feb. 05, 1999; 22p; In English
Report No.(s): AD-A363148; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

While warfare's philosophers and theorists have long asserted the value of planning for war, practitioners have inevitably found military planning a devilishly difficult task. The advent of the communication age has made operational planning more, rather than less, difficult. The complexity of the world situation is increasing while the time available for planning is compressing. Fortunately for U.S. military planners, the forthcoming generation of computer simulation technology promises to provide powerful new planning tools. My analysis shows that systematic use and integration of computer simulations in the operational planning process will decrease planning time while simultaneously improving the quality of the plans produced. Operational commanders and staffs will be free to focus their brain power and precious time on the art of warfare while delegating much of the science to advanced computer simulation systems. Computer simulations are no panacea. They provide only partial solutions to some of planning's current shortfalls and in other, more intractable areas, may be of no help at all. Additionally, to reap the full benefits of what computer simulations have to offer we will need to more thoroughly network them with other automated planning systems. In the end we may even need to redesign our planning processes and products to realize all the benefits that computer simulations can offer.
DTIC
Computerized Simulation; Military Operations; Planning; Systems Simulation; Warfare

19990053496 Naval Postgraduate School, Monterey, CA USA
Iterative Algorithms for Two-Person Zero-Sum Games
Limsakul, Piya; Mar. 1999; 58p; In English
Report No.(s): AD-A362910; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In 1951, G.W. Brown proposed an iterative algorithm called fictitious play for solving two-person zero-sum games. Although it is an effective method, the fictitious play algorithm converges slowly to the value of the game. Recently, Gass, Zafra, and Qiu proposed a modification that applies to symmetric games, i.e., games with skew-symmetric payoff matrices. to solve non-symmetric games via their modification, the games must be made symmetric via a transformation. Gass, Zafra, and Qiu reported that their modified algorithm converges faster than the original fictitious play on a collection of randomly generated games. However, their results on non-symmetric games only apply to games whose values are near zero. When game values are far away from zero, this thesis empirically shows that the original fictitious play algorithm can outperform the modified one. Gass, Zafra, and Qiu's method is static, in that the symmetric transformation is done once prior to the start of their modified algorithm. However, they suggested

the exploration of dynamic methods where the transformation is periodically revised. This thesis proposes and investigates the convergence behavior of one dynamic transformation technique for solving general two-person zero-sum games.
DTIC
Game Theory; Algorithms; Convergence

67
THEORETICAL MATHEMATICS

Includes topology and number theory.

19990051029 Princeton Univ., Dept. of Mechanical and Aerospace Engineering, NJ USA
A Multi-Resolution Nonlinear Mapping Technique for Design and Analysis Applications
Phan, Minh Q., Princeton Univ., USA; [1998]; 28p; In English
Contract(s)/Grant(s): NAG1-1843; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report describes a nonlinear mapping technique where the unknown static or dynamic system is approximated by a sum of dimensionally increasing functions (one-dimensional curves, two-dimensional surfaces, etc.). These lower dimensional functions are synthesized from a set of multi-resolution basis functions, where the resolutions specify the level of details at which the nonlinear system is approximated. The basis functions also cause the parameter estimation step to become linear. This feature is taken advantage of to derive a systematic procedure to determine and eliminate basis functions that are less significant for the particular system under identification. The number of unknown parameters that must be estimated is thus reduced and compact models obtained. The lower dimensional functions (identified curves and surfaces) permit a kind of ”visualization” into the complexity of the nonlinearity itself.
Author
Nonlinear Systems; Nonlinearity; Neural Nets; Volterra Equations; Functions (Mathematics); Functional Integration

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.

19990049396 Princeton Plasma Physics Lab., Princeton, NJ USA
Finite Amplitude Instability in Takens-Bogdanov-type Dynamical Systems
X. Z. Tang,; Dec. 01, 1998; 877p; In English
Report No.(s): DE00-002384; PPPL-3332; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
A weakly nonlinear theory is given to treat the onset of a finite amplitude instability in a Takens-Bogdanov-type dynamical system. The theory is based on an asymptotic analysis.
NTIS
Dynamical Systems; Stability

19990052588 Sandia National Labs., Albuquerque, NM USA
Introduction to Wavelet Theory and Analysis
Miner, N. E.; Oct. 01, 1998; 1p; In English
Report No.(s): DE00-001896; SAND98-2265; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This report reviews the history, theory and mathematics of wavelet analysis. Examination of the Fourier Transform and Short-time Fourier Transform methods provides information about the evolution of the wavelet analysis technique. This overview is intended to provide readers with a basic understanding of wavelet analysis, define common wavelet terminology and describe wavelet amdysis algorithms. The most common algorithms for performing efficient, discrete wavelet transforms for signal analysis and inverse discrete wavelet transforms for signal reconstruction are presented. This report is intended to be approachable by non-mathematicians, although a basic understanding of engineering mathematics is necessary.
NTIS
Wavelet Analysis; Fourier Transformation

19990053310 Sandia National Labs., Albuquerque, NM USA

Surface Dependent Electron and Negative Ion Density in Inductively Coupled Discharges; Journal Vacuum Science Technology

Blain, M. G.; Hamilton, T. W.; Hebner, G. A.; Jarecki, R. L.; Nichols, C. A.; Jan. 18, 1999; 16p; In English

Report No.(s): DE00-003212; SAND99-0109J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Electron and negative ion density have been measured in a modified Applied Materials DPS metal etch chamber using gas mixtures of BCl3, Cl2 and Ar. Measurements were performed for four different substrate types to examine the influence of surface material on the bulk plasma properties; aluminum alumina, photoresist and 50 percent patterned aluminum / photoresist. Electron densities in the Cl2/BCl3 mixtures varied from 0.25 to 4 x 10(exp 11) cm(exp -3). Photodetachment measurements of the negative ion density indicate that the negative ion density was smaller than the electron density and that the electron to negative ion density ratio varied between 1 and 6. The presence of photoresist had a dominant influence on the electron and negative ion density compared to alumina and aluminum surfaces. In most cases, the electron density above wafers covered with photoresist was a factor of two lower while the negative ion density was a factor of two higher than the aluminum or alumina surfaces.

NTIS

Negative Ions; Ion Density (Concentration); Electron Density (Concentration); Electric Discharges

19990053311 Sandia National Labs., Albuquerque, NM USA

Effect of Electric Fields on Cathodoluminescence from Phosphors; Journal of Applied Physics

Seager, C. H.; Jan. 14, 1999; 16p; In English

Report No.(s): DE00-003211; SAND99-0097J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

When external electric fields are applied to phosphors the cathodoluminescence (CL) at low beam energies is strongly affected. This experiment has been carried out on a variety of common phosphors used in cathode ray tube applications, and the electron beam energy, beam current, and electric field dependence of the CL are thoroughly characterized. It is found that the general features of these effects, particularly the strong polarity and beam energy dependence, are consistent with a model which assumes that the main effect of the electric fields is to alter the populations of electrons and holes at the phosphor surface. This in turn, modulates the non-radiative energy losses that strongly affect the low-beam-energy CL efficiency. Because the external fields are applied without any direct contact to the phosphor material, the large changes seen in the CL decay rapidly as the beam-created electrons and holes polarize, shielding the externally applied bias. These results have important implications for designing phosphors which might be efficient at low electron energies.

NTIS

Electric Fields; Cathodoluminescence; Phosphors

71
ACOUSTICS

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

19990050921 NASA Langley Research Center, Hampton, VA USA

Vibro-Acoustics Modal Testing at NASA Langley Research Center

Pappa, Richard S., NASA Langley Research Center, USA; Pritchard, Jocelyn I., NASA Langley Research Center, USA; Buehrle, Ralph D., NASA Langley Research Center, USA; CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelasticity and Structural Dynamics 1999; June 1999, Pt. 1, pp. 101-114; In English; See also 19990050911; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper summarizes on-going modal testing activities at the NASA Langley Research Center for two aircraft fuselage structures: a generic ”aluminum testbed cylinder” (ATC) and a Beechcraft Starship fuselage (BSF). Subsequent acoustic tests will measure the interior noise field created by exterior mechanical and acoustic sources. These test results will provide validation databases for interior noise prediction codes on realistic aircraft fuselage structures. The ATC is a 12-ft-long, all-aluminum, scale model assembly. The BSF is a 40-ft-long, all-composite, complete aircraft fuselage. To date, two of seven test configurations of the ATC and all three test configurations of the BSF have been completed. The paper briefly describes the various test configurations, testing procedure, and typical results for frequencies up to 250 Hz.

Author

Aircraft Noise; Modal Response; Noise Measurement; Acoustics; Vibration Mode; Frequency Response; Noise Prediction (Aircraft)

19990052600 NASA Langley Research Center, Hampton, VA USA

A Mode Detection Method Using the Azimuthal Directivity of a Turbofan Model

Thomas, R. H., Virginia Polytechnic Inst. and State Univ., USA; Farassat, F., NASA Langley Research Center, USA; Clark, L. R., NASA Langley Research Center, USA; Gerhold, C. H., NASA Langley Research Center, USA; Kelly, J. J., Lockheed Martin Engineering and Science Services, USA; Becker, L. E., Lockheed Martin Engineering and Science Services, USA; 1999; In English; Aeroacoustics, 10-12 May 1999, Bellevue, WA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 99-1954; Copyright; Avail: Issuing Activity (American Inst. of Aeronautics and Astronautics, 1801 Alexander Bell Dr., Suite 500, Reston, VA 20191), Hardcopy, Microfiche

The azimuthal, far field directivity of a scale fan model was measured in high resolution. The model is a 12 inch diameter rotor with 16 blades followed by 40 stator vanes. The tests were conducted at the nominal 100% speed corresponding to a tip speed of 905 ft/sec. Measurement of the radiated sound field, for-ward of the fan, was made in an anechoic chamber

Author

Procedures; Acoustic Measurement; Detection; Scale Models; Performance Tests

19990052630 General Electric Co., Aircraft Engines, Cincinnati, OH USA

Acoustic Treatment Design Scaling Methods, Volume 4, Numerical Simulation of the Nonlinear Acoustic Impedance of a Perforated Plate Single-Degree-of-Freedom Resonator Using a Time-Domain Finite Difference Method

Kraft, R. E., General Electric Co., USA; April 1999; 50p; In English

Contract(s)/Grant(s): NAS3-26617; RTOP 538-03-12-02

Report No.(s): NASA/CR-1999-209120/VOL4; NAS 1.26:209120/VOL4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Single-degree-of-freedom resonators consisting of honeycomb cells covered by perforated facesheets are widely used as acoustic noise suppression liners in aircraft engine ducts. The acoustic resistance and mass reactance of such liners are known to vary with the intensity of the sound incident upon the panel. Since the pressure drop across a perforated liner facesheet increases quadratically with the flow velocity through the facesheet, this is known as the nonlinear resistance effect. In the past, two different empirical frequency domain models have been used to predict the Sound Pressure Level effect of the incident wave on the perforated liner impedance, one that uses the incident particle velocity in isolated narrowbands, and one that models the particle velocity as the overall velocity. In the absence of grazing flow, neither frequency domain model is entirely accurate in predicting the nonlinear effect that is measured for typical perforated sheets. The time domain model is developed in an attempt to understand and improve the model for the effect of spectral shape and amplitude of multi-frequency incident sound pressure on the liner impedance. A computer code for the time-domain finite difference model is developed and predictions using the models are compared to current frequency-domain models.

Author

Degrees of Freedom; Noise Reduction; Pressure Effects; Sound Intensity; Honeycomb Structures; Aircraft Engines; Grazing Flow; Noise (Sound)

19990052642 NASA Langley Research Center, Hampton, VA USA

Effect of Directional Array Size on the Measurement of Airframe Noise Components

Books, Thomas F., NASA Langley Research Center, USA; Humphreys, William M., Jr., NASA Langley Research Center, USA; 1999; In English; Aeroacoustics, 10-12 May 1999, Bellevue, WA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 99-1958; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A study was conducted to examine the effects of overall size of directional (or phased) arrays on the measurement of aeroacoustic components. An airframe model was mounted in the potential core of an open-jet wind tunnel, with the directional arrays located outside the flow in an anechoic environment. Two array systems were used; one with a solid measurement angle that encompasses 31.6 deg of source directivity and a smaller one that encompasses 7.2 deg. The arrays, and sub-arrays of various sizes, measured noise from a calibrator source and flap edge model setups. In these cases, noise was emitted from relatively small, but finite size source regions, with intense levels compared to other sources. Although the larger arrays revealed much more source region detail, the measured source levels were substantially reduced due to finer resolution compared to that of the sm0er arrays. to better understand the measurements quantitatively, an analytical model was used to define the basic relationships between array to source region sizes and measured output level. Also, the effect of noise scattering by shear layer turbulence was examined using the present data and those of previous studies. Taken together, the two effects were sufficient to explain spectral level differences between arrays of different sizes. An important result of this study is that total (integrated) noise source levels are retrievable and

the levels are independent of the array size as long as certain experimental and processing criteria are met. The criteria for both open and closed tunnels are discussed.
Author
Airframes; Aeroacoustics; Noise Measurement; Acoustic Properties; Emittance; Noise Generators

19990052728 NASA Glenn Research Center, Cleveland, OH USA
Emission of Sound From Turbulence Convected by a Parallel Mean Flow in the Presence of a Confining Duct
Goldstein, Marvin E., NASA Glenn Research Center, USA; Leib, Stewart J., Ohio Aerospace Inst., USA; May 1999; 44p; In English
Contract(s)/Grant(s): RTOP-282-10-08-07
Report No.(s): NASA/TM-1999-209171; E-11678; NAS 1.15:209171; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An approximate method for calculating the noise generated by a turbulent flow within a semi-infinite duct of arbitrary cross section is developed. It is based on a previously derived high-frequency solution to Lilley's equation, which describes the sound propagation in transversely-sheared mean flow. The source term is simplified by assuming the turbulence to be axisymmetric about the mean flow direction. Numerical results are presented for the special case of a ring source in a circular duct with an axisymmetric mean flow. They show that the internally generated noise is suppressed at sufficiently large upstream angles in a hard walled duct, and that acoustic liners can significantly reduce the sound radiated in both the upstream and downstream regions, depending upon the source location and Mach number of the flow.
Author
Sound Propagation; Emission; Computation; Turbulent Flow; Approximation

19990052758 Old Dominion Univ., Dept. of Aerospace Engineering, Norfolk, VA USA
Experimental and Numerical Analysis of Structural Acousticcontrol Interior Noise Reduction ***Final Report, Period ending 9 Jan. 1999***
Mei, Chuh, Old Dominion Univ., USA; Bevan, Jeffrey S., Old Dominion Univ., USA; June 1999; 52p; In English
Contract(s)/Grant(s): NAG1-1684
Report No.(s): ODURF-151651; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The research results contained in this technical report were performed under the NASA grant entitled "Experimental and Numerical Structural Acoustic Control for Interior Noise Reduction". The report is based essentially on partial progress of the Ph.D. dissertation prepared by Jeffrey S. Bevan under direct guidance of Dr. Chuh Mei. The document presents a finite element formulation and control of sound radiated from cylindrical panels embedded with piezoceramic actuators. The extended MIN6 shallow shell element is fully electrical-structural coupled. A piezoelectric modal actuator participation (PMAP) is defined which indicates the actuator performance to each of the offending modes. Genetic algorithm is also employed to validate the sensor and actuator locations determined by the PMAP criteria. The work was conducted at the Department of Aerospace Engineering, Old Dominion University. Mr. Travis L. Turner, Structural Acoustics Branch, NASA Langley Research Center is the technical monitor.
Author
Numerical Analysis; Experimentation; Noise Reduction; Acoustics; Actuators; Research; Finite Element Method

19990052767 Rohr Industries, Inc., Chula Vista, CA USA
Acoustic Treatment Design Scaling Methods, Volume 5, Analytical and Experimental Data Correlation
Chien, W. E., Rohr Industries, Inc., USA; Kraft, R. E., General Electric Co., USA; Syed, A. A., General Electric Co., USA; April 1999; 80p; In English
Contract(s)/Grant(s): NAS3-26617; RTOP 538-03-12-02
Report No.(s): NASA/CR-1999-209120/VOL5; NAS 1.26:209120/VOL5; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The primary purpose of the study presented in this volume is to present the results and data analysis of in-duct transmission loss measurements. Transmission loss testing was performed on full-scale, 1/2-scale, and 115-scale treatment panel samples. The objective of the study was to compare predicted and measured transmission loss for full-scale and subscale panels in an attempt to evaluate the variations in suppression between full- and subscale panels which were ostensibly of equivalent design. Generally, the results indicated an unsatisfactory agreement between measurement and prediction, even for full-scale. This was attributable to difficulties encountered in obtaining sufficiently accurate test results, even with extraordinary care in calibrating the instrumentation and performing the test. Test difficulties precluded the ability to make measurements at frequencies high enough to be repre-

sentative of subscale liners. It is concluded that transmission loss measurements without ducts and data acquisition facilities specifically designed to operate with the precision and complexity required for high subscale frequency ranges are inadequate for evaluation of subscale treatment effects.
Author
Aircraft Noise; Acoustics; Frequency Ranges; Ducts; Noise Reduction

19990053133 NASA Langley Research Center, Hampton, VA USA
Acoustic Characteristics of a Model Isolated Tiltrotor in DNW
Booth, Earl R., Jr., NASA Langley Research Center, USA; McCluer, Megan, NASA Ames Research Center, USA; Tadghighi, Hormoz, Boeing Co., USA; 1999; In English; 55th, 25-27 May 1999, Montreal, Quebec, Canada; Sponsored by American Helicopter Society, Inc., USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An aeroacoustic wind tunnel test was conducted using a scaled isolated tiltrotor model. Acoustic data were acquired using an in-flow microphone wing traversed beneath the model to map the directivity of the near-field acoustic radiation of the rotor for a parametric variation of rotor angle-of-attack, tunnel speed, and rotor thrust. Acoustic metric data were examined to show trends of impulsive noise for the parametric variations. BVISPL maximum noise levels were found to increase with mu for constant alpha and C(sub T), although the maximum BVI levels were found at much higher cc than for a typical helicopter. BVISPL levels were found to increase with mu for constant alpha and C(sub T). BVISPL was found to decrease with increasing C(sub T) for constant alpha and mu, although BVISPL increased with thrust for a constant wake geometry. Metric data were also scaled for M,i, to evaluate how well simple power law scaling could be used to correct metric data for M(sub tip) effects.
Author
Rotors; Acoustic Properties; Wind Tunnel Tests; Tilting Rotors; Sound Waves; Noise Intensity

19990053424 Rohr Industries, Inc., Chula Vista, CA USA
Acoustic Treatment Design Scaling Methods, Volume 3, Test Plans, Hardware, Results, and Evaluation
Yu, J., Rohr Industries, Inc., USA; Kwan, H. W., Rohr Industries, Inc., USA; Echternach, D. K., Rohr Industries, Inc., USA; Kraft, R. E., General Electric Co., USA; Syed, A. A., General Electric Co., USA; April 1999; 80p; In English
Contract(s)/Grant(s): NAS3-26617; RTOP 538-03-12-02
Report No.(s): NASA/CR-1999-209120/VOL3; NAS 1.26:209120/VOL3; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The ability to design, build, and test miniaturized acoustic treatment panels on scale-model fan rigs representative of the full-scale engine provides not only a cost-savings, but an opportunity to optimize the treatment by allowing tests of different designs. to be able to use scale model treatment as a full-scale design tool, it is necessary that the designer be able to reliably translate the scale model design and performance to an equivalent full-scale design. The primary objective of the study presented in this volume of the final report was to conduct laboratory tests to evaluate liner acoustic properties and validate advanced treatment impedance models. These laboratory tests include DC flow resistance measurements, normal incidence impedance measurements, DC flow and impedance measurements in the presence of grazing flow, and in-duct liner attenuation as well as modal measurements. Test panels were fabricated at three different scale factors (i.e., full-scale, half-scale, and one-fifth scale) to support laboratory acoustic testing. The panel configurations include single-degree-of-freedom (SDOF) perforated sandwich panels, SDOF linear (wire mesh) liners, and double-degree-of-freedom (DDOF) linear acoustic panels.
Author
Aircraft Noise; Acoustic Properties; Scale Models; Cost Reduction; Flow Resistance; Grazing Flow

19990053488 Boston Univ., Dept. of Aerospace and Mechanical Engineering, Boston, MA USA
Hybrid Asymptotic-Numerical Methods in Scattering ***Final Report***
Barbone, Paul E.; May 05, 1999; 299p; In English
Contract(s)/Grant(s): N00014-95-1-0719
Report No.(s): AD-A363046; AM-99-005; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

We have developed and studied hybrid asymptotic-numerical methods to compute the acoustic field scattered by a large object. The asymptotic approximation is based on a short wavelength expansion of the scattered field in the form of uniformly valid geometrical theory of diffraction. These were combined with two numerical methods: finite elements and boundary spectral strip methods. The coupling to finite elements was achieved with the introduction of a new variational principle to couple two incompatible approximations. The boundary spectral strip method is a spectral approximation applied to a boundary integral formulation of the boundary value problem. With this method, we have successfully evaluated diffraction coefficients, surface wave

excitation coefficients, and solved large scattering problems with several diffraction points. We have also studied the error introduced by joining the numerical and asymptotic approximations, and determined its properties and scalings.
DTIC
Acoustic Scattering; Variational Principles; Approximation; Wave Excitation; Spectral Methods

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

19990049394 Lawrence Livermore National Lab., Livermore, CA USA
Dissociative-recombination product states and the dissociation energy D< sub>0</sub> of Ne₂< sup>+</sup>
Hardy, K.; Peterson, J.; Ramos, G.; Sheldon, J.; Feb. 28, 1998; 903p; In English
Report No.(s): DE00-002395; UCRL-CR-130715; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Final product states of Ne<sub>2&lt ;/sub> <sup& gt;+</sup> dissociative recombination were studied using time-of-flight spectroscopy to determine the kinetic energies released. The dissociative recombination occurred in a sustained discharge in the presence of a variable magnetic field and discharge voltage, at pressures of 5-15 mTorr. Under different conditions various excited states were observed ranging from the lowest 3<i& gt;s</i> metastable states to higher Rydbcrg states within 0.000 54 eV of the dissociation limit. From their narrow widths, it is deduced that these higher states arose from Ne< sub>2</sub> ⁺ ions with subthermal energies. From two of these narrow distributions, we obtain an improved value for the dissociation limit D₀(Ne& lt;sub>2</sub& gt;⁺)= 1.260.02 eV.
NTIS
Heat of Dissociation; Kinetic Energy

19990049427 Sandia National Labs., Albuquerque, NM USA
Design Molecular Recognition Materials for Chiral Sensors, Separations and Catalytic Materials
Jia, S.; Nenoff, T. M.; Provencio, P.; Qiu, Y.; Shelnutt, J. A.; Nov. 01, 1998; 1p; In English
Report No.(s): DE00-002055; SAND98-2487; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The goal is the development of materials that are highly sensitive and selective for chid chemicals and biochemical (such as insecticides, herbicides, proteins, and nerve agents) to be used as sensors, catalysts and separations membranes. Molecular modeling methods are being used to tailor chiral molecular recognition sites with high affinity and selectivity for specified agents. The work focuses on both silicate and non-silicate materials modified with chirally-pure fictional groups for the catalysis or separations of enantiomerically-pure molecules. Surfactant and quaternary amine templating is being used to synthesize porous frameworks, containing mesopores of 30 to 100 angstroms. Computer molecule modeling methods are being used in the design of these materials, especially in the chid surface-modifying agents. Molecular modeling is also being used to predict the catalytic and separations selectivities of the modified mesoporous materials. The ability to design and synthesize tailored asymmetric molecular recognition sites for sensor coatings allows a broader range of chemicals to be sensed with the desired high sensitivity and selectivity. Initial experiments target the selective sensing of small molecule gases and non-toxic model neural compounds. Further efforts will address designing sensors that greatly extend the variety of resolvable chemical species and forming a predictive, model-based method for developing advanced sensors.
NTIS
Molecules; Chiral Dynamics; Catalysts; Catalysis; Detection; Pattern Recognition

19990053415 Massachusetts Inst. of Tech., Lab. of Electronics, Cambridge, MA USA
Optical Frequency Standard in Trapped Atomic Hydrogen ***Annual Report, 1 Apr. 1998 - 31 Mar. 1999***
Kleppner, Daniel; Apr. 30, 1999; 3p; In English
Contract(s)/Grant(s): N00014-96-1-0634; Proj-96PRO4688-00
Report No.(s): AD-A362776; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Our goal to improve the effectiveness of atom cooling by using radio-frequency evaporation was met early in the grant period, and we obtained temperatures and densities close to those needed for Bose-Einstein condensation. Consequently, we deferred our work on high resolution optical spectroscopy of hydrogen while we pursued BEC. We obtained BEC last June, using new spectroscopic methods to identify the onset of the transition and to characterize the condensate. Briefly, we found that the mean field

interaction at high densities measurably shifts the 1S-2S spectral line, and that the frequency shift can be used to measure the density in situ. From the point of creating an optical frequency standard, it is essential to know this frequency shift, since the density must be kept sufficiently low that the shift is not a source of error.
DTIC
Optical Properties; Hydrogen; Frequency Standards; Line Spectra; Radio Frequencies

74
OPTICS

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

19990052782 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
Analysis of a Synthetic Aperture Optical Instrument: Cophasing Methods and High Angular Resolution Imaging ***Analyse d'un Instrument a Synthese d'Ouverture Optique: Methode de Cophasage et Imagerie a Haute Resolution Angulaire***
Cassaing, Frederic, Office National d'Etudes et de Recherches Aerospatiales, France; 1998; ISSN 0078-3780; 290p; In Finnish
Report No.(s): ONERA-Publ-1998-5; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

Synthetic aperture optics consists in the interferometric combination of an array of telescopes in order to replace a large monolithic telescope. The evolution and the applications of this techniques are reviewed. Two main classes of instruments are to be distinguished. Correlators make a measurement of the degree of coherence between the apertures. Imaging systems combine beams in a common focal plane. These two classes of instruments share many specificities compared to monolithic classical instruments. First, their performance closely depends upon the telescopes' positions. Second, new types of aberrations, introduced by the array geometry or the differences between telescopes, must be considered. Last, new optical concepts and measurement algorithms are necessary to cophase the instrument, i.e. to correct aberrations, vibrations or atmospheric turbulence. I present a criterion and a search methodology to find optimum aperture configurations by evaluating under a unified framework influence of all aberrations, I show how the complexity of correlators and imaging systems increases with the field to resolution ratio. I also study phase and visibility measurement algorithms in monochromatic light, with an extension to polychromatic light for a stellar interferometer and to piston and tilt measurements on each aperture for an imaging system. These analysis have been successfully applied to two instruments. The first is the ASSI table, a cophasing system developed for the "interferometre a deux telescopes" at Observatoire de la Cote d'Azur, whose operation confirmed to theoretic turbulence model. The second is a wide field imaging system, which has been designed and simulated. I conclude that the choice between an imaging system and a correlator is a choice of instrumental complexity, and is a function of the complexity of the class of objects to be observed.
Author
Synthetic Apertures; Optical Measurement; Interferometry; Aberration; Telescopes; Apertures; Imaging Techniques

19990052890 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA
A Compact Polarization Imager
Thompson, Karl E., Johns Hopkins Univ., USA; Rust, David M., Johns Hopkins Univ., USA; Chen, Hua, Johns Hopkins Univ., USA; Johns Hopkins APL Technical Digest; 1995; Volume 16, No. 3, pp. 258-277; In English; Original contains color illustrations
Contract(s)/Grant(s): NAGw-2866; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A new type of image detector has been designed to analyze the polarization of light simultaneously at all picture elements (pixels) in a scene. The Integrated Dual Imaging Detector (IDID) consists of a polarizing beamsplitter bonded to a custom-designed charge-coupled device with signal-analysis circuitry, all integrated on a silicon chip. The IDID should simplify the design and operation of imaging polarimeters and spectroscopic imagers used, for example, in atmospheric and solar research. Other applications include environmental monitoring and robot vision. Innovations in the IDID include two interleaved 512 x 1024 pixel imaging arrays (one for each polarization plane), large dynamic range (well depth of 10(exp 6) electrons per pixel), simultaneous readout and display of both images at 10(exp 6) pixels per second, and on-chip analog signal processing to produce polarization maps in real time. When used with a lithium niobate Fabry-Perot etalon or other color filter that can encode spectral information as polarization, the IDID can reveal tiny differences between simultaneous images at two wavelengths.
Author
Polarized Light; Computer Vision; Dynamic Range; Environmental Monitoring; Imaging Techniques; Signal Processing

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see90 Astrophysics.

19990049387 Sandia National Labs., Albuquerque, NM USA
Inductively Coupled Plasma Etching of III-V Semiconductors in BCl(3)- Based Chemistries, Part 2, InP, InGaAs, InGaAsP, InAs and AlInAs; Applied Surface Science
Abernathy, C. R.; Han, J.; Hobson, W. S.; Hong, J.; Lambers, E. S.; Dec. 02, 1998; 1p; In English
Report No.(s): DE00-002086; SAND98-2705J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A parametric study of etch rates and surface morphologies of In-containing compound semiconductors (InP, InGaAs, InGaAsP, InAs and AlInAs) obtained by BCL-based Inductively Coupled Plasmas is reported. Etch rates in the range 1, 500-3,000 &min. are obtained for all the materials at moderate source powers (500 W), with the rates being a strong function of discharge composition, Radio Frequencies (RF) chuck power and pressure. Typical root-mean-square surface roughness of-5 nm were obtained for InP, which is worse than the values obtained for Ga-based materials under the same conditions (-1 run). The near surface of etched samples is typically slightly deficient in the group V element, but the depth of this deficiency is small (a few tens of angstroms).
NTIS
Plasmas (Physics); Plasma Physics; Plasma Etching; Semiconductors (Materials)

19990049390 Princeton Plasma Physics Lab., Princeton, NJ USA
Results from D-T Experiments on TFTR and Implications for Achieving an Ignited Plasma
Hawryluk, R. J.; Jul. 14, 1998; 262p; In English
Report No.(s): DE00-002554; PPPL-3318; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Progress in the performance of tokamak devices has enabled not only the production of significant bursts of fusion energy from deuterium-tritium plasmas in the Tokamak Fusion Test Reactor (TFTR) and the Joint European Torus (JET) but, more importantly, the initial study of the physics of burning magnetically confined plasmas. As a result of the worldwide research on tokamaks, the scientific and technical issues for achieving an ignited plasma are better understood and the remaining questions more clearly defined. The principal research topics which have been studied on TFTR are transport, magnetohydrodynamic stability, and energetic particle confinement. The integration of separate solutions to problems in each of these research areas has also been of major interest. Although significant advances, such as the reduction of turbulent transport by means of internal transport barriers, identification of the theoretically predicted bootstrap current, and the study of the confinement of energetic fusion alpha-particles have been made, interesting and important scientific and technical issues remain for achieving a magnetic fusion energy reactor. In this paper, the implications of the TFTR experiments for overcoming these remaining issues will be discussed.
NTIS
Tokamak Devices; Ignition; Plasma Physics; Deuterium Plasma

19990049391 Princeton Plasma Physics Lab., Princeton, NJ USA
Core Transport Reduction in Tokamak Plasmas with Modified Magnetic Shear
Bell, M. G.; Bell, R. E.; Efthimion, P. C.; Ernst, D. R.; Fredrickson, E. D.; Jul. 09, 1998; 146p; In English
Report No.(s): DE00-002552; PPPL-3319; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Spontaneous improvements of plasma confinement during auxiliary heating have been observed in many tokamaks when the q profile has been modified from its normal resistive equilibrium so that q is greater than 1 and the magnetic shear is reduced or reversed in a region near the magnetic axis. The effects on the overall plasma confinement result from the formation in the plasma interior of transport barriers, regions where the thermal and particle transport coefficients are substantially reduced. These internal barriers are sometimes tied to unique magnetic surfaces, such as the surface where the shear reverses. The reduction in transport appears to result from the suppression of turbulence by sheared plasma flow, which has now been measured in TFTR. Extensions of the theory for turbulence suppression show that this underlying paradigm may also explain other regimes of improved core confinement. The excitement generated by these discoveries must be tempered by the realization that transport and stability to pressure-driven Magnetohydrodynamic (MHD) instabilities are intimately linked in these plasmas through the bootstrap current and the effect of the resulting current profile on the transport. Thus the development of control tools and strategies is essential if these improved regimes of confinement are to be exploited to improve the prospects for fusion energy production.
NTIS
Transport Properties; Tokamak Devices; Plasmas (Physics); Fusion Reactors; Heat Transfer; Plasma Physics

19990049392 Princeton Plasma Physics Lab., Princeton, NJ USA

Alpha Particle Physics Experiments in the Tokamak Fusion Test Reactor

Budny, R. V.; Darrow, D. S.; Medley, S. S.; Nazikian, R.; Zweben, S. J.; Dec. 14, 1998; 1p; In English

Report No.(s): DE00-002545; PPPL-3333; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Alpha particle physics experiments were done on the Tokamak Fusion Test Reactor (TFTR) during its deuterium-tritium (DT) run from 1993-1997. These experiments utilized several new alpha particle diagnostics and hundreds of DT discharges to characterize the alpha particle confinement and wave-particle interactions. In general, the results from the alpha particle diagnostics agreed with the classical single-particle confinement model in magnetohydrodynamic (MHD) quiescent discharges. Also, the observed alpha particle interactions with sawteeth, toroidal Alfvn eigenmodes (TAE), and ion cyclotron resonant frequency (ICRF) waves were roughly consistent with theoretical modeling. This paper reviews what was learned and identifies what remains to be understood.

NTIS

Plasma Physics; Alpha Particles; Tokamak Devices; Reactor Physics; Fusion Reactors; Plasma Diagnostics

19990049395 Princeton Plasma Physics Lab., Princeton, NJ USA

Teaching Contemporary Physics Topics using Real-Time Data Obtained via the World Wide Web

Davis, W.; Grip, R.; McKay, M.; Pfaff, R.; Dec. 01, 1998; 166p; In English

Report No.(s): DE00-002385; PPPL-3334; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

As a teaching tool, the World Wide Web (WWW) is unprecedented in its ability to transmit information and enhance communication between scientist and student. Just beginning to be developed are sites that actively engage the user in the learning process and provide hands-on methods of teaching contemporary topics. These topics are often not found in the classroom due to the complexity and expense of the laboratory equipment and the WWW is an ideal tool for overcoming this difficulty. This paper presents a model for using the Internet to teach high school students about plasma physics and fusion energy. Students are given access to real-time data, virtual experiments, and communication with professional scientists via email. Preliminary data indicate that student collaboration and student-led learning is encouraged when using the site in the classroom.

NTIS

Plasma Physics; Real Time Operation; World Wide Web; Education

19990049401 Princeton Plasma Physics Lab., Princeton, NJ USA

Plasma Camp: A Different Approach to Professional Development for Physics Teachers

Dec. 01, 1998; 877p; In English

Report No.(s): DE00-002383; PPPL-3331; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Plasma Physics and Fusion Energy Institute ('Plasma Camp') was inaugurated in 1998 as a way to address two areas of concern in the professional development of high-school physics teachers: involving teachers in the theory and methods of a current area of research in physics and connecting the research experience back into the classroom. The Institute, run jointly by a scientist and a teacher, immersed high-school teachers from across the country in laboratory investigations and in pedagogical projects for two weeks at Princeton University's Plasma Physics Laboratory. The goals, structure, and initial outcomes of the Institute are discussed.

NTIS

Plasmas (Physics); Plasma Physics; Instructors

19990049402 Princeton Plasma Physics Lab., Princeton, NJ USA

Exploration of Spherical Torus Physics in the NSTX Device

Barnes, G.; Blanchard, W.; Kaye, S.; Ono, M.; Peng, M.; Nov. 01, 1998; 877p; In English

Report No.(s): DE00-002381; PPPL-3330; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The National Spherical Torus Experiment (NSTX) is being built at the Princeton Plasma Physics Laboratory to test the fusion physics principles for the Spherical Torus (ST) concept at the MA level. The NSTX nominal plasma parameters are R (sub 0) = 85 cm, a = 67 cm, R/a greater than or equal to 1.26, B (sub T) = 3 kG, I (sub p) = 1 MA, q (sub 95) = 14, elongation (kappa) less than or equal to 2.2, triangularity (delta) less than or equal to 0.5, and plasma pulse length of up to 5 sec. The plasma heating/current drive (CD) tools are High Harmonic Fast Wave (HHFW) (6 MW, 5 sec), Neutral Beam Injection (NBI) (5 MW, 80 keV, 5 sec), and Coaxial Helicity Injection (CHI). Theoretical calculations predict that NSTX should provide exciting possibilities for exploring a number of important new physics regimes including very high plasma beta, naturally high plasma elongation, high bootstrap

current fraction, absolute magnetic well, and high pressure driven sheared flow. In addition, the NSTX program plans to explore fully noninductive plasma start-up, as well as a dispersive scrape-off layer for heat and particle flux handling.
NTIS
Toruses; Plasma Physics; Spheromaks

19990049403 Princeton Plasma Physics Lab., Princeton, NJ USA
Role of Alfvn Instabilities in Energetic Ion Transport
Bell, M. G.; Bernabei, S.; Budny, R.; Darrow, D.; Fredrickson, E. D.; Nov. 01, 1998; 693p; In English
Report No.(s): DE00-002380; PPPL-3329; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Experiments of plasma heating at the ion cyclotron resonance of a minority specie have shown that the heating efficiency degrades above a certain power threshold. It is found that this threshold is due to the destabilization of a branch of shear Alfvn waves which causes a diffusive loss of fast ions, the Energetic Particle Modes. These modes not only play a fundamental role in the transport of the fast ions, but appear closely related to the formation of the giant sawteeth.
NTIS
Energetic Particles; Magnetohydrodynamic Waves; Ionic Waves

19990049404 Princeton Plasma Physics Lab., Princeton, NJ USA
Direct Observation of IBW Induced Poloidal Flow in TFTR
Bell, R. E.; Bernabei, S.; Hosca, J. C.; LeBlanc, B. P.; Majeski, R.; Nov. 01, 1998; 2p; In English
Report No.(s): DE00-002378; PPPL-3320; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Shearing of the plasma poloidal rotation velocity was observed during application of ion Bernstein wave (IBW) power in the Tokamak Fusion Test Reactor (TFTR) tokamak. The first evidence of corroboration between measured poloidal velocity shearing and actively induced Reynolds stress effects is presented. A model reproduces salient experimental features: The observed sheared flow occurs near the tritium fifth harmonic cyclotron resonance layer and depends strongly on the tritium density, in agreement with the model. Furthermore, the model reproduces the observed insensitivity of the induced rotation to the tritium density in the region between the third deuterium harmonic layer and the fifth tritium harmonic layer.
NTIS
Ionic Waves; Tokamak Devices; Shear Flow; Plasma Physics

19990049408 Princeton Plasma Physics Lab., Princeton, NJ USA
Distributions of Alpha Particles Escaping to the Wall because of Sawtooth Oscillations in TFTR
Kolesnichenko, Y.; Lutsenko, V. V.; White, R. B.; Yakovenko, Y. Z. S.J.; Nov. 01, 1998; 978p; In English
Report No.(s): DE00-002266; PPPL-3327; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
It has been observed experimentally in deuterium-tritium shots of the Tokamak Fusion Test Reactor (TFTR) that crashes of sawtooth oscillations may result in very inhomogeneous flux of alpha particles to the wall. Namely, measurements with four detectors installed at the wall at 20, 45, 60, and 90 below the midplane of the torus have shown that the alpha flux to the wall is strongly peaked at the 20 and 90 detectors and on the noise level at the 45 detector. to explain this phenomenon, both theoretical analysis and numerical simulation have been carried out. It is concluded that the 'crash-induced prompt loss,' i.e., the orbital loss of marginally trapped particles arising because of the crash-induced orbit transformation of circulating particles, is responsible for the flux to the 90 and 60 detectors, whereas the crash-induced stochastic diffusion of moderately trapped particles explains the large signal at the 20 detector. The calculated poloidal distributions of the integral alpha flux are in reasonable agreement with experimental data. In addition to the integral flux, the flux of particles with given energy was calculated. The energy spectrum of the escaping particles has also been calculated, which can be used for diagnostics of the crash type.
NTIS
Alpha Particles; Plasma Physics; Walls; Oscillations; Tokamak Devices

19990049418 Sandia National Labs., Albuquerque, NM USA
Comparison of ICL- and IBr-Based Plasma Chemistries for Inductively Coupled Plasma Etching of GaN, InN and AlN; Material Science Engineering B
Abernathy, C. R.; Cho, H.; Donovan, S. M.; Hahn, Y. B.; Han, J.; Dec. 01, 1998; 1p; In English
Report No.(s): DE00-002032; SAND98-2687J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
A parametric study of the etch characteristics of GaN, AIN and InN has been earned out with IC1/Ar and IBr/Ar chemistries in an Inductively Coupled Plasma discharge. The etch rates of InN and AIN were relatively independent of plasma composition, while GaN showed increased etch rates with interhalogen concentration. Etch rates for all materials increased with increasing

Radio Frequencies (RF) chuck power, indicating that higher ion bombardment energies are more efficient in enhancing sputter resorption of etch products. The etch rates increased for source powers up to 500 W and remained relatively thereafter for all materials, while GaN and InN showed maximum etch rates with increasing pressure. The etched GaN showed extremely smooth surfaces, which were somewhat better with IBr/Ar than with IC1/Ar. Maximum selectivities of- 14 for InN over GaN and >25 for InN over AIN were obtained with both chemistries.
NTIS
Plasmas (Physics); Plasma Etching; Gallium Nitrides; Indium Compounds; Aluminum Nitrides

19990050987 Sandia National Labs., Albuquerque, NM USA
Reactive Ion Beam Etching of GaAs and Related Compounds in an Inductively Coupled Plasma of Cl(2)-Ar Mixture; Journal of Vacuum Science and Technology B
Abernathy, C. R.; Hahn, Y. B.; Hays, D.; Lambers, E. S.; Lee, J. W.; Nov. 23, 1998; 1p; In English
Report No.(s): DE00-001999; SAND98-2616J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Reactive ion beam etching (RIBE) of GaAs, GaP, AlGaAs and GaSb was performed in a Cl2-Ar mixture using an Inductively Coupled Plasma (ICP) source. The etch rates and yields were strongly affected by ion energy and substrate temperature. The RIBE was dominated by ion-assisted etching at is less than 600 eV and by physical sputtering beyond 600 eV. The temperature dependence of the etch rates revealed three different regimes, depending on the substrate temperature: (1) sputtering-etch limited, (2) products-resorption limited, and (3) mass-transfer limited regions. GaSb showed the overall highest etch rates, while GaAs and AlGaAs were etched at the same rates. The etched features showed extremely smooth morphologies with anisotropic sidewalls.
NTIS
Ion Beams; Reactivity; Plasmas (Physics); Plasma Physics; Aluminum Gallium Arsenides; Gallium Phosphides; Gallium Antimonides; Plasma Etching

19990050988 Sandia National Labs., Albuquerque, NM USA
Inductively Coupled Plasma Etching in ICL- and IBr-Based Chemistries: Plasma Chemistries and Plasma Processes, Part 2, InP, InSb, InGaP and InGaAs
Abernathy, C. R.; Cho, H.; Hahn, Y. B.; Hays, D. C.; Hobson, W. S.; Nov. 23, 1998; 1p; In English
Report No.(s): DE00-001998; SAND98-2615J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
A parametric study of Inductively Coupled Plasma (ICP) etching of InP, InSb, InGaP and InGaAs has been carried out in ICl/Ar and IBr/Ar chemistries. Etch rates in excess of 3.1 pm/min for InP, 3.6 pm/min for InSb, 2.3 pm/min for InGaP and 2.2 pm/min for InGaAs were obtained in IBr/Ar plasmas. The ICP etching of In-based materials showed a general tendency: the etch rates increased substantially with increasing the ICP source power and Radio Frequencies (RF) chuck power in both chemistries, while they decreased with increasing chamber pressure. The IBr/Ar chemistry typically showed higher etch rates than ICl/Ar, but the etched surface morphologies were fairly poor for both chemistries.
NTIS
Plasma Etching; Plasmas (Physics); Plasma Physics; Indium Phosphides; Indium Antimonides; Indium Gallium Arsenides

19990050989 Sandia National Labs., Albuquerque, NM USA
Inductively Coupled Plasma Etching in ICL- and IBr-Based Chemistries: Plasma Chemistries and Plasma Processes, Part 1, GaAs, GaSb and AlGaAs
Abernathy, C. R.; Cho, H.; Hahn, Y. B.; Hays, D. C.; Hobson, W. S.; Nov. 23, 1998; 1p; In English
Report No.(s): DE00-001960; SAND98-2614J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
High density plasma etching of GaAs, GaSb and AlGaAs was performed in ICl/Ar and IBr/Ar chemistries using an Inductively Coupled Plasma (ICP) source. GaSb and AlGaAs showed maxima in their etch rates for both plasma chemistries as a function of interhalogen percentage, while GaAs showed increased etch rates with plasma composition in both chemistries. Etch rates of all materials increased substantially with increasing Radio Frequencies (RF) chuck power, but rapidly decreased with chamber pressure. Selectivities is greater than 10 for GaAs and GaSb over AlGaAs were obtained in both chemistries. The etched surfaces of GaAs showed smooth morphology, which were somewhat better with ICl/Ar than with IBr/Ar discharge. Auger Electron Spectroscopy analysis revealed equi-rate of removal of group III and V components or the corresponding etch products, maintaining the stoichiometry of the etched surface.
NTIS
Plasmas (Physics); Plasma Physics; Plasma Etching; Aluminum Gallium Arsenides; Gallium Antimonides

19990050996 Sandia National Labs., Albuquerque, NM USA
Electron-Anode Interactions in Particle-in-Cell Simulations of Applied-B Ion Diodes; Physics of Plasmas
Bailey, J. E.; Cuneo, M. D.; Johnson, D. J.; Mehlhorn, T. A.; Pointon, T. D.; Nov. 12, 1998; 1p; In English
Report No.(s): DE00-001953; SAND98-2556J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Particle-in-cell simulations of applied-B ion diodes using the QUICKSILVER code have been augmented with Monte Carlo calculations of electron-anode interactions (reflection and energy deposition). Extraction diode simulations demonstrate a link between the instability evolution and increased electron loss and anode heating. Simulations of radial and extraction ion diodes show spatial non-uniformity in the predicted electron loss profile leading to hot spots on the anode that rapidly exceed the 350-450 C range, known to be sufficient for plasma formation on electron-bombarded surfaces. Thermal resorption calculations indicate complete resorption of contaminants with 15-20 kcal/mole binding energies in high-dose regions of the anode during the power pulse. Comparisons of parasitic ion emission simulations and experiment show agreement in some aspects, but also highlight the need for better ion source, plasma, and neutral gas models.
NTIS
Plasma Physics; Anodes; Ion Sources; Electron Plasma; Thermionic Diodes; Computerized Simulation

19990052587 Sandia National Labs., Albuquerque, NM USA
Faraday Rotation Measurements on Z-Pinches *Final Report*
Greenley, J. B.; Oct. 01, 1998; 1p; In English
Report No.(s): DE00-001899; SAND98-2372; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Campus Executive Program sponsored this research at Cornell University. The research was directed toward the implementation of laser-based diagnostics for wire-array Z-pinches. Under this contract, we were able to carry out all the necessary preparations to setup the laser diagnostics to complement our x-ray backlighting measurements of the early phase of exploding wire z-pinch plasma formation.
NTIS
Plasmas (Physics); Plasma Physics; Faraday Effect; Zeta Pinch

19990052769 Instituto Nacional de Pesquisas Espacias, Lab. Associado de Plasma, Sao Jose dos Campos, Brazil
Pulsating Electrical System for Digital Control of Tokamak ETE (Experimental Tokamak Esferico) *Sistema Eletrico Pulsado Com Controle Digital do Tokamak ETE (Experimento Tokamak Esferico)*
deFariaPereiraWiltgenBarbosa, Luis Filipe, Instituto Nacional de Pesquisas Espacias, Brazil; DelBosco, Edson, Instituto Nacional de Pesquisas Espacias, Brazil; Ferreira, Julio Guimaraes, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 238p; In Portuguese
Report No.(s): INPE-6973-TAE/38; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This work, presented as a Msc dissertation in Electronic Engineering, compresis basically the development of several dedicated electrical systems for the spherical tokamak ETE (Experimento Tokamak Esferico), in special the capacitor bank circuit for plasma formation and heating (solenoid coils), the capacitor bank circuits for production of the toroidal and vertical magnetic fields for plasma confinement and equilibrium (toroidal and vertical coils), as well as, the control system which is based on personal computer with digital interface through CAMAC IEEE-583 modules and the safety system based on pneumatic components. The ETE is a machine to be used for experimental study of hot plasmas with fusion relevant parameters. The principal feature of the machine is the small aspect ratio parameter, A = R/a approx. 1,5, where R and a are the major and minor radii, respectively, of the plasma toroidal column. This machine is under construction at Laboratorio Associado de Plasma (LAP) of the Instituto Nacional de Pesquisas Espaciais (INPE) in Sao Jose dos Campos - S.P.
Author
Capacitors; Construction; Field Coils; Modules; Product Development; Solenoids; Tokamak Devices

19990053302 Los Alamos National Lab., NM USA
Advanced Oxidation and Reduction Processes in the Gas Phase Using Non-Thermal Plasmas
Rosocha, Louis A., Los Alamos National Lab., USA; Korzekwa, Richard A., Los Alamos National Lab., USA; Jan. 1998; 53p; In English
Report No.(s): AD-A363128; LA-UR-98-968; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In the past several years interest in gas-phase pollution control has increased, arising from a larger body of regulations and greater respect for the environment. Advanced oxidation technologies (AOTs), historically used to treat recalcitrant water pollutants via hydroxyl-radicals (OH), are now being applied to gas-phase pollutants using non-thermal plasmas (NTPs). These plasmas are useful for generating highly reactive species (e.g., free radicals) which readily decompose entrained pollutants in

atmospheric-pressure gas streams. Such plasmas can generate both oxidative and reductive radicals - showing promise for treating a wide variety of pollutants, in some cases simultaneously decomposing multiple species. In this paper, we will discuss NTPs views as an AOT; that is, a technique for free-radical-initiated pollutant decomposition. Our primary discussion topics are example applications of the technology, representative plasma reactors, reactive species generation, basic decomposition chemistry, simple analytical removal-scaling models, and the results of laboratory experiments and field trials on representative compounds.
DTIC
Phase Transformations; Oxidation; Pollution Control

19990053304 Los Alamos National Lab., NM USA
Cost Analysis and Economic Assessment of Proposed Electric-Discharge Non-Thermal Plasma Processes for NO(X) Removal in Jet-Engine Exhaust: White Paper for SERDP Project CP-1038
Rosocha, Louis A., Los Alamos National Lab., USA; Chang, Jen-Shih, Los Alamos National Lab., USA; Urashima, Kuniko, Los Alamos National Lab., USA; Kim, Seock J., Los Alamos National Lab., USA; Miziolek, Andrzej W., Los Alamos National Lab., USA; Oct. 29, 1998; 30p; In English; Prepared in collaboration with McMaster Univ., Hamilton (Ontario), Canada and Army Research Lab., Washington, DC.
Report No.(s): AD-A363161; LA-UR-98-4926; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Incentives for implementing new pollution-control technologies are both regulatory and economic. Given considerable regulatory pressure, new de-NO(x) technologies are being explored. One major reason for this is that conventional de-NO(x) methods will not work effectively for the low NO concentrations (e.g., is less than 50 ppm), high exhaust gas flow rates, and low gas temperatures characteristic of Jet Engines Test Cells (JETCs). This project is currently evaluating non-thermal plasma (NTP) technologies for treating jet-engine exhaust. In the past, economic analysis for NTP de-NO(x) has shown that it is not cost effective, compared to other techniques. One might accept a high-cost system, if it can provide a function or functions that other (conventional) technologies cannot. However, it would certainly be better if a new technology could function as well or better than a conventional technology and do so at competitive costs. In this White Paper, we have analyzed the costs of some NTP technologies for jet-engine emissions control. In some cases, these analyses have shown lower exhaust-gas treatment costs for NTP systems compared to a baseline standard de-NO(x) technology like SCR combined with wet scrubbing. Therefore, the main conclusion of this White Paper is that completing this project's work through the small field-pilot demonstration phase should proceed to provide further data and operating experience to more fully evaluate economic and performance projections for NTP de-NO(x) technology.
DTIC
Nitrogen Oxides; Air Pollution; Pollution Control; Pollution Monitoring; Thermal Plasmas; Exhaust Emission; Exhaust Gases; Jet Exhaust

19990053328 Los Alamos National Lab., NM USA
Development of Non-Thermal Plasma Reactor Technology for Control of Atmospheric Emissions: Interim Technical Report for SERDP Project CP-1038 (1998) ***Interim Report***
Rosocha, Louis A., Los Alamos National Lab., USA; Miziolek, Andrzej W., Los Alamos National Lab., USA; Huie, Robert E., Los Alamos National Lab., USA; Change, J. -S., Los Alamos National Lab., USA; Herron, John T., Los Alamos National Lab., USA; Dec. 01, 1998; 11p; In English
Report No.(s): AD-A363162; LA-UR-98-5553; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Incentives for implementing new pollution-control technologies for oxides of nitrogen (NO) and hazardous air pollutants (HAPs), including volatile organic compounds (VOCs), are both regulatory and economic. of immediate concern, given considerable regulatory pressure, e.g., the promulgation of a NESHAPS for NO(x) emissions in CY 2000, new de-NO(x) technologies are necessarily being explored. This project is currently emphasizing evaluations of non-thermal plasma (NTP) technologies for treating jet-engine exhaust and other HAPs. This report will summarize our technical progress for calendar year 1998; considerable further details of our work are contained in the reports and papers cited in the appendix. The literature on NTP de-NO(x) has been reviewed, laboratory measurements and modeling studies on NTP-initiated NO(x) removal have been carried out, adsorber performance for NO(x) removal aimed at hybrid systems have also been done, and scaling and optimization relationships and algorithms have been developed. We have completed cost analyses and economic assessments for various NTP reactor systems compared to conventional selective catalytic reduction (SCR) - wet scrubber technology and find that NTP technology is cost-competitive for jet-engine exhaust de-NO(x). We are now at the point where initial design options for NTP reactor systems for a field-pilot demo on CMTC exhaust at Tinker AFB (currently scheduled for September, 1999) have been completed.
DTIC
Nitrogen Oxides; Thermal Plasmas; Plasma Generators; Plasmas (Physics)

19990053329 Los Alamos National Lab., NM USA

Reactions of Oxides of Nitrogen (NO(x)) Leading to the Formation of Nitric Acid (HNO3) in Non-Thermal Plasmas (NTPs): White Paper for the Strategic Environmental Research and Development Program (SERDP) Compliance Project CP-1038,

Rosocha, Louis A., Los Alamos National Lab., USA; Miziolek, Andrzej W., Los Alamos National Lab., USA; Nusca, Michael J., Los Alamos National Lab., USA; Change, J.-S., Los Alamos National Lab., USA; Herron, John T., Los Alamos National Lab., USA; Aug. 20, 1998; 21p; In English; Prepared in collaboration with Army Research Lab., Washington, DC., McMaster Univ., Hamilton (Ontario), Canada, and National Inst. for Standards and Technology, Gaithersburg, MD

Report No.(s): AD-A363164; LA-UR-98-3598; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Electrical energy coupled into an NTP can be used to create highly reactive species, e.g., oxygen atoms O(3P), OH radicals, N-radicals, electrons, and other free radicals, ions, and active species in gaseous media at near-ambient temperatures and pressures. These active species subsequently react with entrained pollutants in the gas, converting them to non-hazardous compounds. Because NTP processing shows promise for simultaneously removing different types of pollutants (e.g., NO(x)/SO(x) and VOCs), it is particularly attractive for many present and future environmental applications. In a thermal process thousands of electron volts of energy are typically required to decompose one pollutant molecule, because it is a non-selective process. Compared to a thermal process, non-thermal plasmas typically require energies of order 10's - 100's eV per decomposed pollutant molecule, thus showing the benefits of selective chemistry. It has been decided that the primary targets for our work on NTP technology will be jet engine test cells (JETCs) and cruise missile test cells (CMTCs), which are stationary sources of air emissions. Therefore, we can exercise the option of converting the emitted NO(x) to HNO3 (or related acids) and scrub out the acid. In this white paper, we will show the primary paths of such conversions.

DTIC

Nitrogen Oxides; Sulfur Oxides; Thermal Plasmas; Plasma Generators; Plasmas (Physics)

19990053477 Los Alamos National Lab., NM USA

Economic Assessment of Proposed Electric-Discharge Non-Thermal Plasma Field-Pilot Demonstration Units for NO(x) Removal in Jet-Engine Exhaust: White Paper for SERDP Project CP-1038

Rosocha, Louis A., Los Alamos National Lab., USA; Chang, Jen-Shih, Los Alamos National Lab., USA; Urashima, Kuniko, Los Alamos National Lab., USA; Kim, Seock J., Los Alamos National Lab., USA; Miziolek, Andrzej W., Los Alamos National Lab., USA; Jan. 05, 1999; 26p; In English; Prepared in collaboration with McMaster Univ., Hamilton (Ontario), Canada and Army Research Lab., Washington, DC.

Report No.(s): AD-A363225; LA-UR-99-101; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project is currently evaluating non-thermal plasma (NTP) technologies for treating jet-engine exhaust arising from DoD test facilities. In the past, some economic analyses for NTP de-NO(x) have shown that it is not economical, compared to other techniques. The main reasons for this conclusion was that the previous analyses examined stand-alone, or less mature electrical-discharge reactors, or electron-beam based systems that incorporated both chemical additives and quite expensive (both in terms of capital and maintenance costs) electron accelerators. Also, in contrast to more recent developments, both the discharge and electron-beam techniques of the past did not extensively incorporate methods to increase the yields (energy efficiency) of active NO(x)-decomposing species. In an earlier White Paper and a Project Report, we have analyzed the costs of more mature NTP systems incorporating chemical additives and new-concept NTP technologies (namely, hybrid systems) jet-engine emissions control and have shown lower exhaust-gas treatment costs for NTP systems compared to baseline standard de-NO(x) technologies like Selective Catalytic Reduction (SCR) combined with a wet scrubber or SCR combined with an electrostatic precipitator (ESP). In this paper, we will examine our most-promising candidate NTP reactor systems for a field-pilot demonstration on jet-engine exhaust and discuss the economic analyses for these hybrid units, which show that the economics of the proposed candidate systems are more favorable than earlier NTP reactor economic-assessment conclusions for NO(x) removal.

DTIC

Air Pollution; Pollution Control; Nitrogen Oxides; Plasmas (Physics); Thermal Plasmas

19990053478 Los Alamos National Lab., NM USA

Feasibility Analysis Report for Hybrid Non-Thermal Plasma Reactors

Rosocha, Louis A., Los Alamos National Lab., USA; Jan. 15, 1998; 9p; In English

Report No.(s): AD-A363223; LA-UR-98-206; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The purpose of SERDP project CP-1038 is to evaluate and develop non-thermal plasma (NTP) reactor technology for DoD air emissions control applications. The primary focus is on oxides of nitrogen (NO(x)) and a secondary focus on hazardous air pollutants (HAPs), especially volatile organic compounds (VOCs). Because pollutant-containing air-emission streams within the

DoD frequently span a broad range of pollutant concentrations, flow rates, and gas conditions (e.g., temperature, humidity) a single type of NTP reactor is not expected to fit all types of emissions streams. Additionally, stand alone NTP reactors may provide neither an adequate means of pollutant removal nor an acceptable economic solution. Therefore, hybrid systems (combinations of different NTP reactor types or architectures), which employ adsorbents and/or catalytic media are being examined by researchers in this field. This report is intended to provide a preliminary summary analysis of a few representative hybrid systems as a means of introducing the hybrid or staged-system concept. For the purposes of this report, we will present qualitative, rather than quantitative, analyses of hybrid reactors. That is, primary discussing of relative advantages and/or disadvantages or example systems. Additional project work in FY98 will be required to present more quantitative data for hybrids.
DTIC
Nitrogen Oxides; Air Pollution; Pollution Control; Plasmas (Physics); Thermal Plasmas

76
SOLID-STATE PHYSICS

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

19990049383 Sandia National Labs., Albuquerque, NM USA
Multiscale Modeling of Recrystallization
Godfrey, A. W.; Holm, E. A.; Hughes, D. A.; Lesar, R.; Miodownik, M. A.; Dec. 07, 1998; 34p; In English, 30 Nov. - 4 Dec. 1998, Boston, MA, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE00-002184; SAND98-2734C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
We propose a multi length scale approach to modeling recrystallization which links a dislocation model, a cell growth model and a macroscopic model. Although this methodology and linking framework will be applied to recrystallization, it is also applicable to other types of phase transformations in bulk and layered materials. Critical processes such as the dislocation structure evolution, nucleation, the evolution of crystal orientations into a preferred texture, and grain size evolution all operate at different length scales. In this paper we focus on incorporating experimental measurements of dislocation substructures, orientation measurements of dislocation boundaries, and dislocation simulations into a mesoscopic model of cell growth. In particular, we show how feeding information from the dislocation model into the cell growth model can create realistic initial microstructure.
NTIS
Recrystallization; Mathematical Models

19990049384 Sandia National Labs., Albuquerque, NM USA
Stress and Defect Control in GaN Using Low Temperature Interlayers; Japanese Journal of Applied Physics
Akasaki, I.; Amano, H.; Chason, E.; Figiel, J.; Floro, J. A.; Dec. 04, 1998; 1p; In English
Report No.(s): DE00-002129; SAND98-2722J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
In organometallic vapor phase epitaxial growth of Gail on sapphire, the role of the low-temperature-deposited interlayers inserted between high-temperature-grown GaN layers was investigated by in situ stress measurement, X-ray diffraction, and transmission electron microscopy. Insertion of a series of low temperature GaN interlayers reduces the density of threading dislocations while simultaneously increasing the tensile stress during growth, ultimately resulting in cracking of the GaN film. Low temperature AIN interlayers were found to be effective in suppressing cracking by reducing tensile stress. The interlayer approach permits tailoring of the film stress to optimize film structure and properties.
NTIS
Gallium Nitrides; Crystal Defects; Interlayers; Tensile Stress

19990049393 Sandia National Labs., Albuquerque, NM USA
Microstructure of GaN Grown on (111) Si by MOCVD
Fleming, J. G.; Follstaedt, D. M.; Han, J.; Provencio, P.; Dec. 17, 1998; 903p; In English, 30 Nov. - 4 Dec. 1998, Boston, MA, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE00-002457; SAND98-2074C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Gallium nitride was grown on (111) Si by MOCVD by depositing an AIN buffer at 1080 C and then GaN at 1060 C. The 2.2 pm layer cracked along (1-100) planes upon cooling to room temperature, but remained adherent. We were able to examine the microstructure of material between cracks with TEM. The character and arrangement of dislocation are much like those of GaN grown on Al2O3: -2/3 pure edge and - 1/3 mixed (edge + screw), arranged in boundaries around domains of GaN that are slightly

disoriented with respect to neighboring material. The 30 nm AIN buffer is continuous, indicating that AIN wets the Si, in contrast to GaN on Al2O3.
NTIS
Microstructure; Gallium Nitrides; Silicon; Metalorganic Chemical Vapor Deposition; Crystal Growth

19990050985 Sandia National Labs., Albuquerque, NM USA
Initial Stages of Yield in Nanoindentation; Journal of Materials Research
Houston, J. E.; Jarausch, K. F.; Kiely, J. D.; Russell, P. E.; Nov. 24, 1998; 1p; In English
Report No.(s): DE00-002001; SAND98-2632J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We have used the Interracial Force Microscope to perform nanoindentations on Au single-crystal surfaces. We have observed two distinct regimes of plastic deformation which are distinguished by the magnitude of discontinuities in load relaxation. At lower stresses, relaxation occurs in small deviations from elastic behavior, while at the higher stresses, they take the form of large load drops often resulting in complete relaxation of the applied load. These major events create a relatively wide plastic zone that subsequently deepens more rapidly than it widens. We discuss these findings in terms of contrasting models of dislocation processes in the two regimes.
NTIS
Yield; Single Crystals; Gold

19990050995 Sandia National Labs., Albuquerque, NM USA
Redistribution of Implanted Dopants in GaN; Journal of Electronic Materials
Fu, M.; Gao, X. A.; Han, J.; Pearton, S. J.; Rieger, D. J.; Nov. 20, 1998; 1p; In English
Report No.(s): DE00-001957; SAND98-2591J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Donor (S, Se and Te) and acceptor (Mg, Be and C) dopants have been implanted into GaN at doses of 3-5 x 10(exp 14)/sq cm and annealed at temperatures up to 1450 C. No redistribution of any of the elements is detectable by Secondary Ion Mass Spectrometry, except for Be, which displays an apparent damage-assisted diffusion at 900 C. At higher temperatures, there is no further movement of the Be, suggesting that the point defect flux that assists motion at lower temperatures has been annealed. Effective diffusivities are is less than 2 X 10(exp 13)sq cm/sec at 1450 C for each of the dopants in GaN.
NTIS
Gallium Nitrides; Doped Crystals

19990053120 Alabama Univ., Center for Microgravity and Materials Research, Huntsville, AL USA
Nonlinear Response of Layer Growth Dynamics in the Mixed Kinetics-Bulk-Transport Regime
Vekilov, Peter G., Alabama Univ., USA; Alexander, J. Iwan D., Alabama Univ., USA; Rosenberger, Franz, Alabama Univ., USA; Physical Review E; December 1996; ISSN 1063-651X; Volume 54, No. 6, pp. 6650-6659; In English
Contract(s)/Grant(s): NAG8-950; NAG8-1168; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In situ high-resolution interferometry on horizontal facets of the protein lysozyme reveal that the local growth rate R, vicinal slope p, and tangential (step) velocity v fluctuate by up to 80% of their average values. The time scale of these fluctuations, which occur under steady bulk transport conditions through the formation and decay of step bunches (macrosteps), is of the order of 10 min. The fluctuation amplitude of R increases with growth rate (supersaturation) and crystal size, while the amplitude of the v and p fluctuations changes relatively little. Based on a stability analysis for equidistant step trains in the mixed transport-interface-kinetics regime, we argue that the fluctuations originate from the coupling of bulk transport with nonlinear interface kinetics. Furthermore, step bunches moving across the interface in the direction of or opposite to the buoyancy-driven convective flow increase or decrease in height, respectively. This is in agreement with analytical treatments of the interaction of moving steps with solution flow. Major excursions in growth rate are associated with the formation of lattice defects (striations). We show that, in general, the system-dependent kinetic Peclet number, Pe(sub k) , i.e., the relative weight of bulk transport and interface kinetics in the control of the growth process, governs the step bunching dynamics. Since Pe(sub k) can be modified by either forced solution flow or suppression of buoyancy-driven convection under reduced gravity, this model provides a rationale for the choice of specific transport conditions to minimize the formation of compositional inhomogeneities under steady bulk nutrient crystallization conditions.
Author
Kinetics; Interferometry; High Resolution; Stability Tests; Convective Flow; Crystal Defects; Nonlinearity

19990053307 Sandia National Labs., Albuquerque, NM USA

Surface Stoichiometry, Structure, and Kinetics of GaAs MOCVD

Baucom, K. C.; Creighton, J. R.; Moffat, H. K.; Jan. 29, 1999; 16p; In English, 1-6 Nov. 1998, Boston, MA, USA; Sponsored by Electrochemical Society, Inc., USA

Report No.(s): DE00-003236; SAND98-1932C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We have used reflectance-difference spectroscopy (RDS) to examine the surface phases of GaAs(100) during metalorganic chemical vapor deposition (MOCVD). Since the identities of two important surface phases were unknown, we determined their structure and stoichiometry using a variety of surface science techniques. The Type III phase is a newly characterized As-rich (1 X 2)-CH3 reconstruction. The Type II phase is a metastable derivative of the Type I phase. RDS also indicates that the surface during MOCVD has a considerable degree of heterogeneity. Deposition rates were measured over a similar range of conditions and the kinetically-limited regime was found to correlate with the Type III phase. A simple kinetic model was found to quantitatively describe the deposition rates.

NTIS

Metalorganic Chemical Vapor Deposition; Stoichiometry; Gallium Arsenides; Reaction Kinetics

19990053308 Sandia National Labs., Albuquerque, NM USA

Optical Properties of InGaAsN: A New 1eV Bandgap Material System

Allerman, A. A.; Fritz, I. J.; Jones, E. D.; Kurtz, S. R.; Modine, N. A.; Jan. 25, 1999; 16p; In English; Optoelectronics 1999, 23-29 Jan. 1999, San Jose, CA, USA; Sponsored by International Society for Optical Engineering, USA

Report No.(s): DE00-003234; SAND98-1625C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

InGaAsN is a new semiconductor alloy system with the remarkable property that the inclusion of only 2% nitrogen reduces the bandgap by more than 30%. In order to help understand the physical origin of this extreme deviation from the typically observed nearly linear dependence of alloy properties on concentration, we have investigated the pressure dependence of the excited state energies using both experimental and theoretical methods. We report measurements of the low temperature photohnninescence energy of the material for pressures between ambient and 110 kbar. We describe a simple, density-functional-theory-based approach to calculating the pressure dependence of low lying excitation energies for low concentration alloys. The theoretically predicted pressure dependence of the bandgap is in excellent agreement with the experimental data. Based on the results of our calculations, we suggest an explanation for the strongly non-linear pressure dependence of the bandgap that, surprisingly, does not involve a nitrogen impurity band. Addhionally, conduction-band mass measurements, measured by three different techniques, will be described and finally, the magnetoluminescence determined pressure coefficient for the conduction-band mass is measured.

NTIS

Optical Properties; Indium Gallium Arsenides; Nitrogen Compounds; Energy Gaps (Solid State); Conduction Bands

19990053309 Sandia National Labs., Albuquerque, NM USA

Band Structure of InGaAsN Alloys and Effects of Pressure; Physical Review Letters

Allerman, A. A.; Jones, E. D.; Kurtz, S. R.; Modine, N. A.; Tozer, S. T.; Jan. 20, 1999; 16p; In English

Report No.(s): DE00-003216; SAND99-0125J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

InGaAsN is a new semiconductor alloy system with the remarkable property that the inclusion of only 2% nitrogen reduces the bandgap by more than 30%. In order to help understand the physical origin of this extreme deviation from the typically observed nearly linear dependence of alloy properties on concentration, we have investigated the pressure dependence of state energies using both experimental and theoretical methods. We report measurements of the low temperature photoluminescence of the material for pressures between ambient and 110 kbar. We also describe a simple, density-functional-theory-based approach to calculating the pressure dependence of low lying excitation energies for low concentration alloys. The theoretically predicted pressure dependence of the bandgap is in excellent agreement with the experimental data. Based on the results of our calculations, we suggest an explanation for the strongly non-linear pressure dependence of the bandgap that, surprisingly, does not involve a nitrogen impurity state.

NTIS

Energy Gaps (Solid State); Indium Gallium Arsenides; Pressure Effects; Electronic Structure; Nitrogen Compounds

19990053319 Sandia National Labs., Albuquerque, NM USA

Coupled Simulations of Mechanical Deformation and Microstructural Evolution Using Polycrystal Plasticity and Monte Carlo Potts Models

Battaile, C. C.; Buchheit, T. E.; Holm, E. A.; Neilsen, M. K.; Wellman, G. W.; Jan. 12, 1999; 16p; In English, 30 Nov. - 4 Dec.

1998, Boston, MA, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE00-003271; SAND99-0106C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The microstructural evolution of heavily deformed polycrystalline Cu is simulated by coupling a constitutive model for polycrystal plasticity with the Monte Carlo Potts model for grain growth. The effects of deformation on boundary topology and grain growth kinetics are presented. Heavy deformation leads to dramatic strain-induced boundary migration and subsequent grain fragmentation. Grain growth is accelerated in heavily deformed microstructures. The implications of these results for the thermomechanical fatigue failure of eutectic solder joints are discussed.
NTIS
Deformation; Microstructure; Polycrystals; Plastic Properties; Monte Carlo Method; Computerized Simulation

19990053322 Auburn Univ., Dept. of Electrical Engineering, AL USA
CVD Diamond Grown by Microwave Plasmas in Mixtures of Acetone/Oxygen and Acetone/Carbon Dioxide ***Final Report, 1 May 1998 - 30 Apr. 1999***
Tzeng, Yonhua, Auburn Univ., USA; Chein, Tsan-Heui, Auburn Univ., USA; Apr. 30, 1999; 28p; In English
Contract(s)/Grant(s): N00014-98-1-0571
Report No.(s): AD-A362752; TR-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Diamond was deposited on silicon and molybdenum by microwave plasma enhanced chemical vapor deposition technique in acetone/oxygen and acetone/carbon dioxide mixtures. Diamond of good quality was deposited at rates exceeding 25 microns/hr. by the use of high-power-density microwave plasmas, diamond deposition using these two mixtures has been achieved at substrate temperatures up to 1300 C.
DTIC
Vapor Deposition; Diamond Films; Plasmas (Physics)

19990053409 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Condensation of Quasi-Two-Dimensional Biexcitons in a Single Heterojunction Quantum Well ***Final Report, Oct. 1996 - Jan. 1999***
Folkes, Patrick A.; Apr. 1999; 19p; In English
Report No.(s): AD-A362735; ARL-TR-1934; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Excitons that coexist with a degenerate two-dimensional electron gas in the same quantum well subband have been observed in the photoluminescence from the recombination of electrons with localized photoexcited holes, At a critical electron density, an abrupt decrease in the exciton radiative recombination rate is observed, along with the formation of biexcitons. With increased excitation intensity, photoluminescence spectra are observed that verify theory on the radiative renormalization of biexcitons and strongly indicate the occurrence of a Bose-Einstein condensation of biexcitons.
DTIC
Quantum Wells; Photoexcitation; Semiconductors (Materials); Excitons

19990053483 Pennsylvania State Univ., Materials Research Lab., University Park, PA USA
Resource for Piezoelectric Single Crystals ***Annual Report, 1 Apr. 1998 - 30 Mar. 1999***
Shrout, Thomas R.; Apr. 30, 1999; 133p; In English
Contract(s)/Grant(s): N00014-98-1-0527
Report No.(s): AD-A363144; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report documents work performed over the period of 01 April 1998 through 30 March, 1999 under the Office of Naval Research Contract N00014-98-1-0527. The program titled ”Resource for Piezoelectric Single Crystals” combines a critical number of interdisciplinary faculty to address the areas of innovative crystal growth, novel piezoelectric materials, crystallographic and domain engineering, while investigating new application opportunities in the area of MEMs and electrooptics. Accomplishments in the above areas include the following: Crystal growth of Pb(Zn(1/3)Nb(2/3))O3-PbTiO3 (PZN-PT) and Pb(Mg(1/3)Nb(2/3))O3-PbTiO3 (PMN-PT) relaxor-based ferroelectrics continues to utilize high temperature flux growth to synthesize high quality crystals with less than 1 mole% variance of PbTiO3 across 1-2 inch size crystals. Alternatively, the Bridgman growth technique has been implemented for growth of nearly congruently melting PMN-PT materials. The underlying phenomena of crystallographic and domain engineering of high piezoelectric activity in Relaxor-PT crystals was applied to non-PbO perovskites, including BaTiO3 and Zr-modified BaTiO3 crystals, the latter grown by solid state techniques. Crystallographic engineering of non-PbO systems resulted in piezoelectric d(33) coefficients ranging from 350-600 pC/N and electromechanical coupling coefficients k(33) approx. 75-85%, comparable to superior of present day polycrystalline PZT ceramics. Novel compositions being investigated in this program include (Pb(Yb(1/2)Nb(1/2))O3-PbTiO3 Na, BiTiO3-BaTiO3 and Bi(A)O3-PbTiO3 (A Sc,

Fe) systems, for the ultimate realization of high Tc piezoelectrics with enhanced acoustic power. Domain investigations under various E-field conditions have revealed that polarization fatigue may be crystallographic dependent with no fatigue for 001 oriented crystals.
DTIC
Piezoelectric Crystals; Crystal Growth; Barium Titanates; Electro-Optics; Coupling Coefficients

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.

19990049417 Sandia National Labs., Albuquerque, NM USA
Nuclear Spin Orientation Dependence of Magnetoconductance: A New Method for Measuring the Spin of Charged Excitations in the QHE; Physical Review Letters
Bowers, C. R.; Reno, J. L.; Simmons, J. A.; Vitkalov, S. A.; Dec. 01, 1998; 1p; In English
Report No.(s): DE00-002034; SAND98-2688J; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
A new method for measuring the spin of the electrically charged ground state excitations m the quantum Hall effect is proposed and demonstrated for the first time in GaAs/AIGaAs quantum wells. The method is based on the nuclear spin orientation dependence of the 2D dc conductivity y in the quantum Hall regime due to the nuclear hyperfine interaction. As a demonstration of this method the spin of the electrically charged excitations of the ground state is determined at filling factor v = 1.
NTIS
Nuclear Spin; Excitation; Nuclear Interactions; Hall Effect; Quantum Wells

80
SOCIAL SCIENCES (GENERAL)

Includes educational matters.

19990053086 NASA Goddard Space Flight Center, Greenbelt, MD USA
Materials Presented at the MU-SPIN Eighth Annual User's Conference
Harrington, James, Jr., NASA Goddard Space Flight Center, USA; Shukla, Pooja, ADNET Systems, Inc., USA; Brown, Robin, ADNET Systems, Inc., USA; April 1999; 306p; In English, 20-23 Oct. 1998, Albuquerque, NM, USA; Sponsored by NASA Goddard Space Flight Center, USA
Contract(s)/Grant(s): RTOP 933-00-00
Report No.(s): NASA/CP-1999-209204; Rept-99B00035; NAS 1.55:209204; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche
The goal of NASA's many outreach programs is to promote to the general public an understanding of how NASA makes significant contributions to American education systems and to institutions dedicated to improving science literacy. This newsletter provides one vehicle for reporting how applications and hardware used for space science and other NASA research and development can be adapted for use by teachers and their students and by non-NASA organizations.
Author
Conferences; Education; Minorities; American Indians; NASA Programs

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

19990052633 Small Business Administration, Office of Advocacy, Washington, DC USA
Federal Procurement from Small Firms: USA Summary, *FY 1998*
Mar. 1999; 84p; In English
Report No.(s): PB99-144255; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The study, also available state by state, has new data to help policymakers and small business leaders ask appropriate questions of procurement center leaders in their areas. The study ranks 2,235 federal procurement centers on their levels of prime contracting with small firms in fiscal year 1998.
NTIS
Government Procurement; Contract Management

19990052637 Committee on Science (U.S. House), Washington, DC USA
Unlocking Our Future: Toward a New National Science Policy
Sep. 24, 1998; 58p; In English
Report No.(s): PB99-144412; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The notion of state support for scientific research has existed for centuries; Francis Bacon called for such funding as far back as the early 1600s, and some monarchs and nobles responded to his call. It was not until 1862, however, when the Land Grant Colleges were established, that the USA began to organize and provide federal support for its science and engineering enterprise. Even so, it took until the outbreak of World War II for the Nation to fully grasp the benefits of substantial federal support for scientific research. It was at the culmination of that war, fresh from its lessons, that Vannevar Bush wrote his seminal document Science: The Endless Frontier.
NTIS
Congressional Reports; Policies; Science; Management Planning

19990052768 Florida International Univ., Dept. of Industrial and Systems Engineering, Miami, FL USA
SMART (Shop floor Modeling, Analysis and Reporting Tool Project *Final Report*
Centeno, Martha A., Florida International Univ., USA; Garcia, Maretys L., Florida International Univ., USA; Mendoza, Alicia C., Florida International Univ., USA; Molina, Louis A., Florida International Univ., USA; Correa, Daisy, Florida International Univ., USA; Wint, Steve, Florida International Univ., USA; Doice, Gregorie, Florida International Univ., USA; Reyes, M. Florencia, Florida International Univ., USA; Mar. 17, 1999; 21p; In English
Contract(s)/Grant(s): NAG10-150; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This document presents summarizes the design and prototype of the Shop floor Modeling, Analysis, and Reporting Tool (S.M.A.R.T.) A detailed description of it is found on the full documentation given to the NASA liaison. This documentation is also found on the A.R.I.S.E. Center web site, under a projected directory. Only authorized users can gain access to this site.
Author
Data Bases; Design Analysis; Prototypes

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.

19990049397 NASA Langley Research Center, Hampton, VA USA
NASA Thesaurus Supplement
July 1999; 22p; In English
Report No.(s): NASA/SP-1999-7501/SUPPL3; NAS 1.21:7501/SUPPL3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The NASA Thesaurus Supplement is a cumulative update to the 1998 edition of the NASA Thesaurus (NASA/SP-1998-7501). The Supplement, published every six months, includes all new terms and associated hierarchies added since the cutoff for the 1998 edition (December 1997). Parts 1 and 2 (Hierarchical Listing and Rotated Term Display) correspond to Volumes 1 and 2 of the 1998 printed edition. Definitions are included in Part 1; uppercase/lowercase forms are provided in both Parts 1 and 2. Part 3 is a list of deletions or changes to valid terms.
Author
Thesauri; Terminology; Aerospace Sciences; Dictionaries

19990052986 Military Academy, Operations Research Center, West Point, NY USA
Tradeoff Between Dwell Time and Frequency of Revisits of Sensors
Barr, Don; Aug. 1998; 39p; In English
Report No.(s): AD-A361098; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Department of Defense has expressed heightened interest in managing information processes related to combat operations. This has highlighted the analytic community's need for information-related analysis methods, which begs the question of how to measure combat information. One measure, called "information gain", has been developed and applied at the U.S. Military Academy in recent years. Information gain is based on modeling a tactical commander's uncertainty about his adversary's state (location of enemy units, for example) using probability distributions are "updated", using Bayes' formula and target movement characteristics. Information gain is defined to be the decrease in Shannon's entropy from the prior to the posterior situations. An impression can be gained of the growth in potential "situation awareness" of a commander by plotting cumulative information gain over time, as data from various sources are received. An issue related to the design architecture of certain sensor systems is the tradeoff between sensor dwell time and frequency of revisits of the sensor. We have implemented information gain analysis in a simple model of sensor coverage and target movement, and have examined the cumulative information gain over a sequence of time steps. The model is implemented in a simulation written in Visual Basic. It allows examination of the effects of changes in a variety of parameters of interest. We have examined effects on information gain of varying dwell times under a number of conditions. One results is an indication that larger dwell times may have an advantage over more frequent visits when targets are quite mobile.
DTIC
Information Systems; Bayes Theorem; Combat; Dwell; Probability Theory

19990052996 Hughes Aircraft Co., Tucson, AZ USA
Capturing Logistics Data from Simulations: DEPTH Technical Order Generation ***Interim Report***
Lane, K. W.; Metcalf, B. G.; Apr. 1998; 150p; In English
Contract(s)/Grant(s): F33615-91-C-0001; AF Proj. 2940
Report No.(s): AD-A359454; AFRL-HE-WP-TR-1998-0062; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

DEPTH uses a human figure model to visualize man-machine interaction and receive on-line human factors information simulations; such as simulating maintenance evaluations. The primary focus of the study is to investigate how DEPTH can support the automated generation of technical manuals in order to streamline the USAF technical order general process. DEPTH can produce text describing maintenance task steps suitable for Interactive Electronic Technical Manuals (IETMs). The language initially produced will consist of simple instructions, by using commercial IETM authoring tools.
DTIC
Computerized Simulation; Data Acquisition; Man Machine Systems; Manuals

19990053003 George Mason Univ., Krasnow Inst. for Advanced Studies, Fairfax, VA USA
Bioinformatics in the 21st Century
Jan. 1999; 42p; In English, 3-4 Feb. 1998, Fairfax, VA, USA
Report No.(s): PB99-144206; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

At the behest of the Research Resources and Infrastructure Working Group, established by the National Science and Technology Council's Subcommittee on Biotechnology, a panel of more than 20 experts in bioinformatics and related fields convened to discuss critical issues surrounding bioinformatics, identify problems and challenges, and offer potential solutions.
NTIS
Research and Development; Biotechnology; Information Systems; Conferences; Data Storage

19990053135 New Jersey State Library, Trenton, NJ USA
Reestablishment of Research Library Operations at the New Jersey Department of Transportation ***Final Report, Feb. 1998 - Feb. 1999***
Paszamant, C.; Apr. 1999; 80p; In English
Report No.(s): PB99-149171; REPT-99-004-TESC-1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In order to reopen its Research Library which had closed for several years upon the retirement of its operating clerk, the New Jersey Department of Transportation Research Unit undertook creation of a project funded by the USDOT Federal Highway Administration and conducted by the New Jersey State Library under a task order executed with Thomas Edison State College, the State Library's affiliate agency. The project's objective was to reestablish a research library and to improve upon its past operation as an information center. to proceed with this process, the State Library hired a professional librarian and, in the course of

a year, with much support from NJDOT and NJ State Library staffs, a consultant from Rutgers working on a related project, and colleagues from professional associations, the Research Library now physically exists within the Department as a working library with basic furnishings and equipment, services, and clientele. Its collection is undergoing reorganization with future plans for entry into the State Library's online catalog, and additional staff will be hired to hasten ongoing tasks and begin new ones.
NTIS
Libraries; Personnel; Catalogs (Publications)

19990053297 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA
Unclassified Publications of Lincoln Laboratory, *1 Jan. - 31 Dec. 1998*
Means, Patricia A., Massachusetts Inst. of Tech., USA; Seidel, Robert C., Massachusetts Inst. of Tech., USA; Dec. 31, 1998; 57p; In English
Contract(s)/Grant(s): F19628-95-C-0002
Report No.(s): AD-A363077; AFMC-ESC-TR-98-049; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Volume 24 of Unclassified Publications of Lincoln Laboratory lists reports published from January 1 to December 31, 1998, as well as updated information on earlier publications. Documents listed herein are generally no longer available from Lincoln Laboratory. Qualified Defense Technical Information Center (DTIC) users may purchase copies through normal DTIC channels. Others may purchase photocopies or microfiche from the U.S. Department of Commerce, National Technical Information Service, Springfield, Virginia 22161. When ordering, the six digit AD number should be cited. Subscriptions of the MIT Lincoln Laboratory Journal are free of charge, but provided only to qualified recipients (government employees and contractors, libraries, university faculty, and R & D laboratories).
DTIC
Electro-Optics; Documents

19990053331 Lawrence Livermore National Lab., Livermore, CA USA
Supporting large-scale computational science
Musick, R.; Feb. 19, 1998; 19p; In English; Very large databases
Report No.(s): DE98-058635; UCRL-JC-129903; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Business needs have driven the development of commercial database systems since their inception. As a result, there has been a strong focus on supporting many users, minimizing the potential corruption or loss of data, and maximizing performance metrics like transactions per second, or TPC-C and TPC-D results. It turns out that these optimizations have little to do with the needs of the scientific community, and in particular have little impact on improving the management and use of large-scale high-dimensional data. At the same time, there is an unanswered need in the scientific community for many of the benefits offered by a robust DBMS. For example, tying an ad-hoc query language such as SQL together with a visualization toolkit would be a powerful enhancement to current capabilities. Unfortunately, there has been little emphasis or discussion in the VLDB community on this mismatch over the last decade. The goal of the paper is to identify the specific issues that need to be resolved before large-scale scientific applications can make use of DBMS products. This topic is addressed in the context of an evaluation of commercial DBMS technology applied to the exploration of data generated by the Department of Energy's Accelerated Strategic Computing Initiative (ASCI). The paper describes the data being generated for ASCI as well as current capabilities for interacting with and exploring this data. The attraction of applying standard DBMS technology to this domain is discussed, as well as the technical and business issues that currently make this an infeasible solution.
NTIS
Computation; Large Scale Integration; Computers

19990053407 Alabama Univ., Research Inst., Huntsville, AL USA
Value Engineering/Operation and Support Cost Reduction Computer Based Program and VE Training Tool For Tech Loop Spare Parts Initiatives *Final Report, 26 Mar. 1997 - 30 Jun. 1998*
Aldijaili, Sharon S., Alabama Univ., USA; Maddux, Gary, Alabama Univ., USA; Jul. 1998; 81p; In English
Contract(s)/Grant(s): DAAH01-92-D-R006
Report No.(s): AD-A363337; UAHRITR--5-34734; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The Value Engineering (VE)/Operating and Support Cost Reduction (OSCR) Office of the Industrial Operations Division (IOD), Systems Engineering and Production Directorate (SEPD), Missile Research, Development, and Engineering Center (MRDEC), US Army Aviation and Missile Command (AMCOM) is responsible for performing system engineering cost analyses for weapon systems from design through full scale production. This effort includes evaluating reported cost analyses and performing appropriate modifications to information systems. This information is transferred monthly to the US Army Materiel Command

(AMC) Headquarters. Reporting requirement changes have resulted in the modification of the operational information system, and the development and integration of an upgraded information system for tracking VE and OSCR cost analyses. Data validation between the operational information system and the upgraded information system was required during development of the upgraded information system software package. The objective of this task was to provide engineering support in evaluating cost analyses for weapon systems and to develop, validate, and implement cost analyses report formats for required value engineering directives. The University of Alabama in Huntsville (UAH) Research Institute was tasked to: (1) analyze and document VE and OSCR information system operations; (2) verify and validate database formats for maintaining and reporting cost analyses information; (3) provide VE and OSCR system logic for the modification, development, and integration of a consolidated VE/OSCR information system; 4) make recommendations for computer hardware and software required to utilize the VE/OSCR information system; (5) provide training on the VE/OSCR information system; (6) support Technical Loop reporting activities.
DTIC
Management Information Systems; Data Base Management Systems; Data Management; Information Management; Value Engineering; Weapon Systems; Design Analysis; Cost Analysis; Cost Reduction

19990053501 State Univ. of New York, Albany, NY USA
Models for Action: Practical Approaches to Electronic Records Management and Preservation
Kelly, Kristine L.; Kowlowitz, Alan; Pardo, Theresa A.; Green, Darryl E.; Jul. 1998; 86p; In English
Report No.(s): AD-A362862; 98-1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The project described in this report was an attempt to develop a practical way to incorporate essential electronic records requirements into the design of new information systems. Funded in large part by a research grant from the National Historical Publications and Records Commission (NHPRC), the project was conducted from 1996 to 1998 through a partnership between the New York State Archives and Records Administration (SARA) and the Center for Technology in Government (CTG). The project team included staff of the NYS Adirondack Park Agency, eight corporate partners led by Intergraph Corporation, and University at Albany faculty and graduate students. In recent years, significant theoretical work has been done in the area of electronic records management; however, little has been translated into practical implementable solutions. This project was designed to bridge the gap between theory and practice by producing generalizeable tools that link business objectives to sound records management practices. This connection can be understood most readily at the business process level where workflow information flow and service delivery come together. The project integrated and built upon several existing bodies of knowledge: electronic recordkeeping and archival theory and practice, business process improvement and reengineering (BPI/BPR) methodologies, and system development methodologies.
DTIC
Information Systems; Documents; Records Management; Records; Models

19990053502 State Univ. of New York, Albany, NY USA
Dealing With Data: Seminar Summary. Using Information in Government Program Information Sharing Seminar Series, Seminar No. 1
Feb. 04, 1999; 19p; In English
Report No.(s): AD-A362861; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Center for Technology in Government, through the Using Information in Government (UIG) program, has worked during the past year with NYS agency project teams and partners from the public, private, and academic sectors to identify benefits of and strategies for integrating and using data for program planning, evaluation, and decision making. The policy, management, and technology issues identified through our work with the agency teams will be shared in a series of seminars focused on increasing the value of existing information to government programs. This report summarizes the presentations given at the first of the Using Information in Government seminar series, ”Dealing with Data” conducted on February 4, 1999.
DTIC
Information Systems; Management Systems; Governments; Project Planning

84
LAW, POLITICAL SCIENCE AND SPACE POLICY

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

19990052835 York Univ., Centre for International and Security Studies, Toronto, Ontario Canada
Non-Proliferation, Arms Control and Disarmament: Enhancing Existing Regimes and Exploring New Dimensions
Gizewski, Peter, Editor; 1998; 244p; In English, 13-14 Nov. 1997, Ottawa, Canada
Report No.(s): PB99-141202; ISBN 0-920231-27-6; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Contents include the following: Confidence-Building and Canadian Leadership; The Need to Know: Commercial Satellite Imagery and IAEA Safeguards; Diverse Interpretations of Confidence Building; A General Model of Confidence Building: Analysis and Implications; Information Management in NACD Regimes: A Comparative Analysis; Calculating Costs: A Critical Assessment of Verification Costs for a Fissile Material Cutoff Treaty; Arms Control Verification Costs: The Need for a Comparative Analysis; Practical Disarmament Measures to Consolidate Peace in Post-Conflict Environments; The United Nations Panel of Government Experts on Small Arms: A Canadian Perspective on Their Report; The Role of Civil Organizations in Monitoring the Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-personnel Mines and on Their Destruction: A Proposal for a Cooperative Compliance Mechanism; The Canadian Safeguards Support Program; Where to From Here: Future Directions for NACD Research.
NTIS
Disarmament; Leadership; Weapons

89
ASTRONOMY

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

19990052731 Space Telescope Science Inst., Baltimore, MD USA
An Reconnaissance of the 900 to 1200 A Spectra of Early O Stars in the Magellanic Clouds
Walborn, Nolan R., Space Telescope Science Inst., USA; Long, Knox S., Space Telescope Science Inst., USA; Lennon, Daniel J., Ludwig-Maximilians-Univ., Germany; Kudritzki, Rolf-Peter, Ludwig-Maximilians-Univ., Germany; Astrophysical Journal; Nov. 20, 1995; Volume 454, pp. L27-L30; In English
Contract(s)/Grant(s): NAG8-1076; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The first survey of the far UV (900-1200 Angstrom) spectra of O stars in the Magellanic Clouds, observed with the Hopkins Ultraviolet Telescope during the Astro-2 Mission is presented. Five objects in each cloud were obtained, including four of type O3 (one of which is the current candidate for the most massive star known) and a pair of O4 If supergiants with remarkably different relative CNO strengths. All of the SMC objects are in its largest H II region, NGC 346, and show strong effects of the systemic metal deficiency. The systematic spectral-type dependence of the numerous stellar -wind features in this relatively little-studied wavelength range, including those of O VI and S VI is illustrated and described. One of the LMC O3 stars with E(sub B-V) = .25 displays strong interstellar H2 features.
Author
H II Regions; Magellanic Clouds; Supergiant Stars; O Stars; Ultraviolet Astronomy

19990052766 Space Telescope Science Inst., Baltimore, MD USA
Multi-Wavelength Observations of Interactive Galaxies
Borne, Kirk D., Space Telescope Science Inst., USA; Colina, Luis, Madrid Univ., Spain; [1990]; In English
Contract(s)/Grant(s): NAG5-1920; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We are studying the optical, radio, and X-ray morphologies of interacting galaxies in which at least one member is also an active galaxy. Deformed gas distributions are seen in galaxies that also show optical evidence of tidal deformation, indicating significant gas redistribution in these interacting systems, thereby providing compelling evidence for a causal connection between tidal and nuclear activity in ”interactive” galaxies.
Author
Interacting Galaxies; Morphology; Deformation

19990052770 National Optical Astronomy Observatories, Tucson, AZ USA

Optical Light Curve of the Type Ia Supernova 1998bu in M96 and the Supernova Calibration of the Hubble Constant

Suntzeff, Nicholas B., Cerro Tololo Inter-American Observatory, Chile; Phillips, M. M., Las Campanas Observatory, Chile; Covarrubias, R., Cerro Tololo Inter-American Observatory, Chile; Navarrete, M., Cerro Tololo Inter-American Observatory, Chile; Perez, J. J., Cerro Tololo Inter-American Observatory, Chile; Guerra, A., Cerro Tololo Inter-American Observatory, Chile; Acevedo, M. T., Cerro Tololo Inter-American Observatory, Chile; Doyle, Laurance R., Search for Extraterrestrial Intelligence Inst., USA; Harrison, Thomas, New Mexico State Univ., USA; Kane, Stephen, Space Telescope Science Inst., USA; Long, Knox S., Space Telescope Science Inst., USA; Maza, Jose, Chile Univ., Chile; Miller, Scott, Maryland Univ., USA; December 1998; 28p; In English

Report No.(s): NOAO-Preprint-823; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present the UBV(RI)(sub KC) light curves of the Type Ia supernova SN 1998bu which appeared in the nearby galaxy M96 (NGC 3368). M96 is a spiral galaxy in the Leo I group which has a Cepheid-based distance. Our photometry allows us to calculate the absolute magnitude and reddening of this supernova. These data, when combined with measurements of the four other well-observed supernovae with Cepheid based distances, allow us to calculate the Hubble constant with respect to the Hubble flow defined by the distant Calan/Tololo Type Ia sample. We find a Hubble constant of 64.0 +/- 2.2(internal) +/- 3.5(external) km/s/Mpc, consistent with most previous estimates based on Type Ia supernovae. We note that the two well-observed Type Ia supernovae in Fornax, if placed at the Cepheid distance to the possible Fornax spiral NGC 1365, are apparently too faint with respect to the Calan/Tololo sample calibrated with the five Type Ia supernovae with Cepheid distances to the host galaxies.

Author

Galaxies; Supernovae; Stellar Evolution; Spiral Galaxies; Cepheid Variables; Hubble Constant

90
ASTROPHYSICS

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

19990050973 Toledo Univ., Dept. of Physics and Astronomy, OH USA

Laboratory Astrophysics Under the Ultraviolet, Visible, and Gravitational Astrophysics Research Program ***Final Report***

Federman, Steven R., Toledo Univ., USA; 1999; 4p; In English

Contract(s)/Grant(s): NAG5-6729; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Space-borne facilities, such as the Hubble Space Telescope, the recent ORFEUS-SPAS II Shuttle mission, and the soon-to-be launched Far Ultraviolet Spectroscopic Explorer, are providing data at ultraviolet wavelengths of unprecedented quality for spectroscopic studies of many astronomical environments. The first step in the analysis of these data involves the derivation of abundances. Obtaining accurate abundances is possible only when the correspondence between line strength and abundance is well known. The conversion of line strength to abundance relies on knowledge of transition probabilities and oscillator strengths, often obtained from mean lives branching fractions. For many ultraviolet transitions, the necessary atomic and molecular data are either relatively imprecise or not available. Our program addresses this need for accurate oscillator strengths; our focus is on transitions that probe the nature and composition of the interstellar medium.

Derived from text

Space Missions; Astrophysics; Ultraviolet Radiation; Far UV Spectroscopic Explorer; Space Transportation System Flights; Oscillator Strengths; Hubble Space Telescope

19990052882 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Telescope Scientist on the Advanced X-Ray Astrophysics Observatory ***Final Report, 13 Jan. 1990 - 12 Jan. 1999***

VanSpeybroeck, Leon, Smithsonian Astrophysical Observatory, USA; 1999; 54p; In English

Contract(s)/Grant(s): NAG8-792; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The most important activity during this reporting period was the calibration of the AXAF High Resolution Mirror Assembly (HRMA) and the analysis of the copious data which were obtained during that project. The calibration was highly successful, and will result in the AXAF being by far the best calibrated X-ray observatory ever flown, and more accurate results by all of its users. This period also included participation in the spacecraft alignment and assembly activities and final flight readiness reviews. The planning of the first year of Telescope Scientist AXAF observations also was accomplished. The Telescope Scientist team also

served as a technical resource for various problems which were encountered during this period. Many of these contributions have been documented in memoranda sent to the project.
Author
Calibrating; Telescopes; Alignment; High Resolution

19990053341 Copenhagen Univ., Physics and Astrophysics, Denmark
Collision-induced Absorption in the Infrared: A Data Base for Modelling Planetary and Stellar Atmospheres
Borysow, Aleksandra, Copenhagen Univ., Denmark; December 1998; 14p; In English
Contract(s)/Grant(s): NAG5-4534; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Accurate knowledge of certain collision-induced absorption continua of molecular pairs such as H2-H2, H2-He, H2-CH4, CO2-CO2, etc., is a prerequisite for most spectral analyses and modelling attempts of atmospheres of planets and cold stars. We collect and regularly update simple, state of the art computer programs for the calculation of the absorption coefficient of such molecular pairs over a broad range of temperatures and frequencies, for the various rotovibrational bands. The computational results are in agreement with the existing laboratory measurements of such absorption continua, recorded with a spectral resolution of a few wavenumbers, but reliable computational results may be expected even in the far wings, and at temperatures for which laboratory measurements do not exist. Detailed information is given concerning the systems thus studied, the temperature and frequency ranges considered, the rotovibrational bands thus modelled, and how one may obtain copies of the FORTRAN77 computer programs by e-mail.
Author
Collisions; Absorptivity; Data Bases; Planetary Atmospheres; Spectrum Analysis; Carbon Dioxide

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.

19990051019 Arizona State Univ., Dept. of Geology, Tempe, AZ USA
Laboratory Simulations of Martian and Venusian Aeolian Processes
Greeley, Ronald, Arizona State Univ., USA; May 01, 1999; 8p; In English
Contract(s)/Grant(s): NCC2-346; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objective of this work was to conduct research in the Planetary Aeolian Facility (PAF) at NASA-Ames Research Center as a laboratory for the planetary science community and to carry-out experiments on the physics and geology of particles moved by winds, and for the development of instruments and spacecraft components for planetary missions.
Derived from text
Planetary Geology; Mars Atmosphere; Particulates; Geology; Wind Effects; Space Missions; Pioneer Venus Spacecraft; Atmospheric Sounding

19990053344 Colorado Univ., Laboratory for Atmospheric and Space Physics, Boulder, CO USA
A Comprehensive Analysis of Io's Atmosphere and Torus *Final Report*
Schneider, Nicholas M., Colorado Univ., USA; [1999]; 3p; In English
Contract(s)/Grant(s): NAG5-4932; NAGw-2484; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This final report describes the results of our NASA/Planetary Atmospheres program studying the atmosphere of Jupiter's moon Io and the plasma torus which it creates. Io is the most volcanically active body in the solar system, and it is embedded deep within the strongest magnetosphere of any planet. This combination of circumstances leads to a host of scientifically compelling phenomena, including (1) an atmosphere out of proportion with such a small object, (2) a correspondingly large atmospheric escape rate, (3) a ring of dense plasma locked in a feedback loop with the atmosphere, and (4) a host of Io-induced emissions from radio bursts to UV auroral spots on Jupiter. This proposal seeks to continue our investigation into the physics connecting these phenomena, with emphasis on Io's atmosphere and plasma torus. The physical processes are clearly of interest for Io, and also other places in the solar system where they are important but not so readily observable.
Derived from text
Toruses; Io; NASA Programs; Toroidal Plasmas; Planetary Atmospheres; Jupiter (Planet); Moon

92
SOLAR PHYSICS

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

19990052598 NASA Langley Research Center, Hampton, VA USA

Validation of 1985-1997 Active Cavity Radiometer Spacecraft Measurements of Total Solar Irradiance Variability, *1985-1997*

Lee, Robert B., III, NASA Langley Research Center, USA; Wilson, Robert S., Science Applications International Corp., USA; International Society of Optical Engineering; July 1998; ISSN 0277-786X; Volume 3439, pp. 377-388; In English; Earth Observing Systems III, Jul. 1998, San Diego, CA, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Since 1978, long-term variations in the total solar irradiance (solar constant) have been monitored using spacecraft radiometers, at the 0.01% precision level. The irradiance measurements were performed from the Earth Radiation Budget Satellite [ERBS], Nimbus-7, Solar Maximum Mission [SMM], Upper Atmosphere Research Satellite [UARS], European Retrievable Carrier (EURECA), Solar and Heliospheric Observatory [SOHO], and the Space Shuttle Atmospheric Laboratory for Applications and Science [ATLAS] spacecraft platforms. Radiometer responses can drift or shift at precision levels of a few hundreds of a percent. In-flight calibration sources are not available to detect radiometer response changes at radiometric accuracy or precision levels near the 0.01% (0.1 W/sq m) level. Inconsistent trends among the sets were used to identify possible instrumental drifts or shifts which may be incorrectly interpreted as solar irradiance changes while consistent trends among the different measurement sets were used to detect long-term irradiance variability components. In this paper, 1991-1998 corresponding ERBS, UARS, SOHO, and ATLAS irradiance measurements are inter-compared with each other as well as with the ERBS empirical irradiance fit. The empirical irradiance fit is based upon 10.7-cm solar radio flux (F10) and photometric sunspot index (PSI), indices of solar magnetic activity. Analyses of recent data sets identified no long-term shifts and drifts in the ERBS, SOHO, or UARS data sets. The typical value of the total solar irradiance is approximately 1365 Watts per meter squared (W/sq m).

Author

Calibrating; Cavities; Radiometers; Irradiance; Solar Radiation; Earth Radiation Budget; Upper Atmosphere Research Satellite (UARS)

19990053338 San Jose State Univ., Moffett Field, CA USA

The Structure of the Solar Wind at Large Heliocentric Distances: CIRs and their Successors

Gazis, P. R., San Jose State Univ., USA; [1999]; 4p; In English

Contract(s)/Grant(s): NCC2-687; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Co-rotating interaction regions (CIRs) and their associated shock pairs are dominant structures in the solar wind between the heliocentric distances of 2 and 8 AU. At larger heliocentric distances, these structures undergo a qualitative change. Shocks decay to a point where they are often difficult to detect, and may have little influence on the dynamics of the solar wind. Interaction regions spread and merge, though they appear to retain their identity to surprisingly large distances from the Sun. Solar wind and IMF data from the Pioneer 10, Pioneer 11, and Voyager 2 spacecraft were used to conduct a comprehensive survey of CIRs and their successors between heliocentric distances of 1 and 55 AU over the last two solar cycles. The structure of the solar wind varied in a consistent fashion with heliocentric distance. Similar structures were observed at similar heliocentric distances by all three spacecraft during different portions of the solar cycle.

Author

Solar Wind; Distance; Pioneer 10 Space Probe; Pioneer 11 Space Probe; Solar Cycles

19990053439 Colorado Univ., Boulder, CO USA

Studies of Solar Flare and Interplanetary Particle Acceleration and Coordination of Ground-Based Solar Observations in Support of US and International Space Missions *Final Report*

Kiplinger, Alan L., Colorado Univ., USA; 1998; 5p; In English

Contract(s)/Grant(s): NAG5-4183; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A primary focus has been to conduct studies of particular types of hard X-ray evolution in solar flares and their associations with high energy interplanetary protons observed near Earth. Previously, two large investigations were conducted that revealed strong associations between episodes of progressive spectral hardening seen in solar events and interplanetary proton events (Kiplinger, 1995). An algorithm was developed for predicting interplanetary protons that is more accurate than those currently in use when hard X-ray spectra are available. The basic research on a third study of the remaining independent subset of Hard X-ray Burst Spectrometer (HXRBS) events randomly not selected by the original studies was completed. This third study involves independent analyses of the data by two analysts. The results echo the success of the earlier studies. of 405 flares analyzed, 12

events were predicted to have associated interplanetary protons at the Space Environment Service Center (SESC) level. of these, five events appear to be directly associated with SESC proton events, six other events had lower level associated proton events, and there was only one false alarm with no protons. Another study by Garcia and Kiplinger (1995) established that progressively hardening hard X-ray flares associated with interplanetary proton events are intrinsically cooler and not extremely intense in soft X-rays unless a ”contaminating” large impulsive flare accompanies the hardening flare.
Derived from text
Solar Flares; Interplanetary Space; Particle Acceleration; Solar Physics; Solar Observatories

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.

19990050998 Eril Research, Inc., San Rafael, CA USA
A Survey of Radiation Measurements Made Aboard Russian Spacecraft in Low-Earth Orbit
Benton, E. R., Eril Research, Inc., USA; Benton, E. V., Eril Research, Inc., USA; March 1999; 106p; In English
Contract(s)/Grant(s): NAS8-40294
Report No.(s): NASA/CR-1999-209256; M-920; NAS 1.26:209256; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The accurate prediction of ionizing radiation exposure in low-Earth orbit is necessary in order to minimize risks to astronauts, spacecraft and instrumentation. to this end, models of the radiation environment, the AP-8 trapped proton model and the AE-8 trapped electron model, have been developed for use by spacecraft designers and mission planners. It has been widely acknowledged for some time now by the space radiation community that these models possess some major shortcomings. Both models cover only a limited trapped particle energy region and predictions at low altitudes are extrapolated from higher altitude data. With the launch of the first components of the International Space Station with numerous constellations of low-Earth orbit communications satellites now being planned and deployed, the inadequacies of these trapped particle models need to be addressed. Efforts are now underway both in the U.S. and in Europe to refine the AP-8 and AE-8 trapped particle models. This report is an attempt to collect a significant fraction of data for use in validation of trapped radiation models at low altitudes.
Author
Radiation Dosage; Extraterrestrial Radiation; Ionizing Radiation; Low Earth Orbits; Particle Energy

19990051001 NASA Langley Research Center, Hampton, VA USA
Contribution of High Charge and Energy (HZE) Ions During Solar-Particle Event of September 29, 1989
Kim, Myung-Hee Y., National Academy of Sciences - National Research Council, USA; Wilson, John W., National Academy of Sciences - National Research Council, USA; Cucinotta, Francis A., NASA Johnson Space Center, USA; Simonsen, Lisa C., NASA Langley Research Center, USA; Atwell, William, Boeing North American, Inc., USA; Badavi, Francis F., Christopher Newport Univ., USA; Miller, Jack, California Univ., Lawrence Berkeley Lab., USA; May 1999; 18p; In English
Contract(s)/Grant(s): RTOP 199-45-16-12
Report No.(s): NASA/TP-1999-209320; L-17744; NAS 1.60:209320; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The solar-particle event (SPE) of September 29, 1989, produced an iron-rich spectrum with energies approaching 1 A GeV with an approximate spectral slope parameter of 2.5. These high charge and energy (HZE) ions challenge conventional methods of shield design and assessment of astronaut risks. In the past, shield design and risk assessment have relied on proton shielding codes and biological response models derived from X-ray and neutron exposure data. Because the HZE spectra decline rapidly with energy and HZE attenuation in materials is limited by their penetration power, details of the mass distributions about the sensitive tissues (shielding materials and the astronaut's body) are important determining factors of the exposure levels and distributions of linear energy transfer. Local tissue environments during the SPE of September 29, 1989, with its f= components are examined to analyze the importance of these ions to human SPE exposure. Typical space suit and lightly shielded structures leave significant contributions from HZE components to certain critical body tissues and have important implications on the models

for risk assessment. A heavily shielded equipment room of a space vehicle or habitat requires knowledge of the breakup of these ions into lighter components, including neutrons, for shield design specifications.
Author
Solar Flares; Solar Storms; Solar Corpuscular Radiation; Linear Energy Transfer (LET); Ions; Mass Distribution; Absorbers (Materials)

19990052668 California Univ., San Diego, La Jolla, CA USA
The Spectral Evolution of Gamma-Ray Bursts ***Final Report***
Band, David L., California Univ., San Diego, USA; May 03, 1999; 2p; In English
Contract(s)/Grant(s): NAG5-6743; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The proposed project was a continuation of our work on the spectral evolution of gamma-ray bursts begun when the Co-I on this proposal. Lyle Ford, was my graduate student. In the proposal we discussed two projects. The first was finishing and publishing the last chapter of Professor Ford's thesis. In this research effort we looked for correlations in the energies of pairs of counts recorded by the BATSE Spectroscopy Detectors within a short time of each other. A greater correlation within a short time would indicate that the observed broadband spectrum is really composed of narrowband spectral components which last for a short time and which rapidly sum to the observed spectrum. We did not find any evidence for such narrowband emission, and are setting limits on its presence. Professor Ford is revising the last chapter of his thesis for publication with my participation. The second project was a continuation of my study of the cross-correlations between the gamma-ray burst lightcurves in different energy bands. I published a first study with this technique (1997. Ap.J., 486, 928) which showed that "hard-to-soft" spectral evolution is prevalent both within and between the bursts' intensity spikes. I proposed to continue developing this technique. However, I have been somewhat disillusioned about using this methodology quantitatively since it averages the spectral evolution on a given timescale over the entire burst. Nonetheless, I have been applying the technique to new bursts which are scientifically interesting for other reasons. Attached I include the cross-correlations for the burst GRB 990123, the burst during which ROTSE discovered an optical transient. The solid curve is the autocorrelatl'on of BATSE's channel 3 (100-300 keV), while the dashed, dot-dashed and 3 dots-dashed curves are the crosscorrelations of channel 3 with channels 1 (25-50 keV), 2 (50-100 keV), and 4 (300-2000 keV). The order of, and separation between, the curves on the positive lag side indicate "hard-to-soft" evolution on all timescales, while the FWHM of the crosscorrelations shows that the intensity spikes are narrower at high energy than at low energy. I have also been participating with my colleague on the BATSE team on other spectral evolution studies. Note that while I continue as a member of the BATSE team, I no longer receive funding from the team. For example, Preece et al. (1998, Ap.J., 496, 849) showed that the high energy spectral index varies during a burst, usually following a "hard-to-soft" trend. In addition, we have just submitted a catalog (Preece et al. 1999, Ap. J., submitted) of time-resolved spectral fits.
Author
Gamma Ray Bursts; Spectra; Homogeneity; Cross Correlation; Energy Bands; Broadband

19990052762 Oxford Univ., Dept. of Astrophysics, Oxford, UK
Optical Spectroscopy of Two Overlapping, Flux-Density-Limited Samples of Radio Sources in the North Ecliptic Cap, Selected at 38MHz and 151MHz
Lacy, Mark, Oxford Univ., UK; Rawlings, Steve, Oxford Univ., UK; Hill, Gary J., McDonald Observatory, USA; Bunker, Andrew J., California Univ., USA; Ridgway, Susan E., Oxford Univ., UK; Stern, Daniel, California Univ., USA; May 27, 1999; In English
Report No.(s): OUAST/99/13; Copyright; Avail: Issuing Activity (Oxford Univ., Dept. of Physics, Astrophysics, Keble Rd., Oxford, OX1 3RH, England), Hardcopy, Microfiche

We present the results of optical spectroscopy of two flux-density-limited samples of radio sources selected at frequencies of 38 and 151 MHz in the same region around the North Ecliptic Cap, the 8C-NEC and 7C-III samples respectively. Both samples are selected at flux density levels approximately equal to 20 times fainter than samples based on the 3C catalogue. They are amongst the first low-frequency selected samples with no spectral or angular size selection for which almost complete redshift information has been obtained, and contain many of the lowest-luminosity zeta greater than 2 radio galaxies so far discovered. They will therefore provide a valuable resource for understanding the cosmic evolution of radio sources and their hosts and environments. The 151-MHz 7C-111 sample is selected to have S151 greater than or equal to 0.5Jy and is the more spectroscopically complete; out of 54 radio sources fairly reliable redshifts have been obtained for 44 objects. The 8C sample has a flux limit of S38 greater than or equal to 1.3Jy and contains 58 sources of which 46 have fairly reliable redshifts. We discuss possible biases in the observed redshift distribution, and some interesting individual objects, including a number of cases of probable gravitational lensing. Using the 8C-NEC and 7C-III samples in conjunction, we form the first sample selected on low-frequency flux in the rest-frame of the source, rather than the usual selection on flux density in the observed frame. This allows us to remove the bias associated with an increasing rest-frame selection frequency with redshift. We investigate the difference this selection makes to

correlations of radio source properties with redshift and luminosity by comparing the results from traditional flux-density selection with our new method. We show in particular that flux-density-based selection leads to an overestimate of the steepness of the correlation of radio source size with redshift.
Author
Radio Galaxies; Active Galaxies; Flux Density; Radio Physics; Ecliptic

19990052776 NASA Marshall Space Flight Center, Huntsville, AL USA
The Structure and Evolution of LOCBURST: The BATSE Burst Location Algorithm
Pendleton, Geoffrey N., Alabama Univ., USA; Briggs, Michael S., Alabama Univ., USA; Kippen, R. Marc, Alabama Univ., USA; Paciesas, William S., Alabama Univ., USA; Stollberg, Mark, Alabama Univ., USA; Woods, Pete, Alabama Univ., USA; Meegan, Charles A., NASA Marshall Space Flight Center, USA; Fishman, Gerald J., NASA Marshall Space Flight Center, USA; McCollough, Mike L., Universities Space Research Association, USA; Connaughton, Valerie, National Academy of Sciences - National Research Council, USA; Astrophysical Journal; Feb. 10, 1999; Volume 512, pp. 362-376; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The gamma-ray burst (GRB) location algorithm used to produce the BATSE GRB locations is described. The general flow of control of the current location algorithm is presented, and the significant properties of the various physical inputs required are identified. The development of the burst location algorithm during the releases of the BATSE IB, 2B, and 3B GRB catalogs is presented so that the reasons for the differences in the positions and error estimates between the catalogs can be understood. In particular, differences between the 2B and 3B locations are discussed for events that have moved significantly and the reasons for the changes explained. The locations of bursts located independently by the interplanetary network (IPN) are used to illustrate the effect on burst location accuracy of various components of the algorithm. IPN data and locations from other gamma-ray instruments are used to calculate estimates of the systematic errors on BATSE burst locations.
Author
Algorithms; Gamma Ray Bursts; Evolution (Development); Structural Analysis; Bursts

19990053007 Oxford Univ., Dept. of Astrophysics, Oxford, UK
A Complete Sample of Radio Sources in the North Ecliptic Cap, Selected at 38MHz, 3, Further Imaging Observations and the Photometric Properties of the Sample
Lacy, Mark, Oxford Univ., UK; Kaiser, Mary Elizabeth, McDonald Observatory, USA; Hill, Gary J., McDonald Observatory, USA; Rawlings, Steve, Oxford Univ., UK; Leyshon, Gareth, Wales Univ. Inst. of Science and Technology, UK; May 27, 1999; In English
Report No.(s): OUAST/99/12; Copyright; Avail: Issuing Activity (Oxford Univ., Dept. of Physics, Astrophysics, Keble Rd., Oxford, OX1 3RH, England), Hardcopy, Microfiche

Further imaging observations of a sample of radio sources in the North Ecliptic Cap are presented and a number of new identifications are made. Using redshifts from spectroscopic data presented in a companion paper, the photometric properties of the galaxies in the sample are discussed. It is shown that: (1) out to at least z approximately equals 0.6 radio galaxies are good standard candles irrespective of radio luminosity; (2) for 0.6 less than or approximately equal to zeta less than or approximately equal to 1 a large fraction of the sample have magnitudes and colours consistent with a non-evolving giant elliptical, and (3) at higher redshifts, where the R-band samples the rest-frame UV flux, most objects have less UV luminosity than expected if they form their stellar populations at a constant rate from a high redshift to z approximately 1 in unobscured star-forming regions (assuming an Einstein - de Sitter cosmology). The consequences of these observations are briefly discussed.
Author
Ecliptic; Luminosity; Photometry; Red Shift; Stars; Imaging Techniques; Radio Galaxies

Subject Term Index

A

ABERRATION, 154
ABSORBERS (MATERIALS), 176
ABSORPTIVITY, 173
ABUNDANCE, 101
ACCELERATED LIFE TESTS, 105
ACCELERATION MEASUREMENT, 45
ACCEPTOR MATERIALS, 61
ACCIDENT PREVENTION, 12
ACCURACY, 142
ACETIC ACID, 127
ACID RAIN, 108
ACOUSTIC EXCITATION, 91
ACOUSTIC MEASUREMENT, 150
ACOUSTIC PROPERTIES, 151, 152
ACOUSTIC SCATTERING, 153
ACOUSTICS, 149, 151, 152
ACTIVE CONTROL, 8, 20, 22, 29, 30, 31, 33, 34, 36, 85
ACTIVE GALAXIES, 177
ACTUATION, 33
ACTUATORS, 10, 37, 151
ADAPTATION, 126
ADAPTIVE CONTROL, 29, 36, 145
ADHESION, 59
ADJOINTS, 92
ADSORPTION, 59
ADVANCED MICROWAVE SOUNDING UNIT, 43, 46, 70, 74, 116
ADVANCED VERY HIGH RESOLUTION RADIOMETER, 102, 117
AERIAL PHOTOGRAPHY, 102
AEROACOUSTICS, 131, 151
AEROCAPTURE, 41
AERODYNAMIC BALANCE, 21
AERODYNAMIC CHARACTERISTICS, 8, 17, 28, 83
AERODYNAMIC CONFIGURATIONS, 3, 20
AERODYNAMIC DRAG, 2, 5
AERODYNAMIC FORCES, 4
AERODYNAMIC INTERFERENCE, 4, 7
AERODYNAMIC LOADS, 3, 7, 16, 20, 41, 91
AERODYNAMIC NOISE, 131
AERODYNAMIC STABILITY, 21, 27, 31, 35, 38, 52
AERODYNAMIC STALLING, 31
AERODYNAMICS, 1, 4, 8, 11, 68, 81, 90
AEROELASTIC RESEARCH WINGS, 30
AEROELASTICITY, 2, 3, 4, 6, 7, 15, 16, 18, 19, 20, 21, 23, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 41, 42, 51, 52, 71, 76, 77, 91, 93, 94, 140, 142
AERONAUTICAL ENGINEERING, 1
AERONAUTICS, 1
AEROSERVOELASTICITY, 8, 27, 29, 30
AEROSOLS, 46, 108, 110
AEROSPACE ENGINEERING, 23, 40, 146
AEROSPACE MEDICINE, 13, 124
AEROSPACE PLANES, 23
AEROSPACE SCIENCES, 167
AEROSPACE SYSTEMS, 146
AEROTHERMOELASTICITY, 34
AFTERBODIES, 82
AIR BREATHING BOOSTERS, 27
AIR BREATHING ENGINES, 27
AIR FLOW, 80
AIR NAVIGATION, 12
AIR POLLUTION, 105, 106, 107, 108, 111, 160, 161, 162
AIR QUALITY, 106, 107, 108, 109
AIR TRAFFIC CONTROL, 12, 13, 14, 25
AIR TRAFFIC CONTROLLERS (PERSONNEL), 13, 126
AIR TRANSPORTATION, 9, 10, 12, 23, 24
AIR WATER INTERACTIONS, 68, 118
AIRCRAFT ACCIDENTS, 12
AIRCRAFT BRAKES, 19, 88
AIRCRAFT CARRIERS, 37, 81
AIRCRAFT CONFIGURATIONS, 16
AIRCRAFT CONTROL, 32, 37
AIRCRAFT DESIGN, 9, 10, 11, 20, 21, 23, 24, 81, 128
AIRCRAFT ENGINES, 26, 150
AIRCRAFT HYDRAULIC SYSTEMS, 88
AIRCRAFT LANDING, 19
AIRCRAFT MAINTENANCE, 11, 24
AIRCRAFT MODELS, 3, 22, 94
AIRCRAFT NOISE, 149, 152
AIRCRAFT SAFETY, 14, 19, 25
AIRCRAFT STRUCTURES, 7, 8, 18, 22, 94
AIRFIELD SURFACE MOVEMENTS, 22, 38
AIRFOIL OSCILLATIONS, 94
AIRFOILS, 2, 16, 25, 76
AIRFRAMES, 151
AIRLINE OPERATIONS, 11
AIRPORTS, 39
AIRSPEED, 14
ALGORITHMS, 18, 44, 73, 128, 130, 131, 133, 135, 148, 177
ALIGNMENT, 173
ALPHA PARTICLES, 156, 157
ALTERNATIVES, 49
ALUMINUM ALLOYS, 60, 61, 62
ALUMINUM GALLIUM ARSENIDES, 158
ALUMINUM NITRIDES, 49, 158
ALUMINUM OXIDES, 54, 58, 59
AMERICAN INDIANS, 166
AMINO ACIDS, 63
AMORPHOUS MATERIALS, 62
ANALYSIS (MATHEMATICS), 141
ANALYTIC FUNCTIONS, 129
ANISOTROPY, 143
ANNEALING, 61
ANNUAL VARIATIONS, 100, 117, 119
ANODES, 159
ANODIZING, 44
ANOMALIES, 116
ANTENNA GAIN, 72
ANTENNAS, 72
ANTIMATTER, 49
ANTIPROTONS, 49
APERTURES, 154
APPLICATIONS PROGRAMS (COMPUTERS), 7, 15, 19, 20, 35, 46, 93, 131, 132, 137
APPROXIMATION, 91, 92, 151, 153
APTITUDE, 126
ARC WELDING, 88
ARCHITECTURE (COMPUTERS), 128, 130, 132, 136, 137, 138
ARCTIC REGIONS, 113
ARROW WINGS, 20
ARTIFICIAL INTELLIGENCE, 141
ASPECT RATIO, 93
ASTRONAUT PERFORMANCE, 45
ASTROPHYSICS, 172
ASYMPTOTIC PROPERTIES, 9
ASYNCHRONOUS TRANSFER MODE, 139
ATMOSPHERIC BOUNDARY LAYER, 80
ATMOSPHERIC CHEMISTRY, 110
ATMOSPHERIC CIRCULATION, 40

ATMOSPHERIC COMPOSITION, 46, 108
ATMOSPHERIC GENERAL CIRCULATION MODELS, 40
ATMOSPHERIC SOUNDING, 173
ATOMIC CLOCKS, 87
ATTACK AIRCRAFT, 15
ATTITUDE (INCLINATION), 14, 46, 136
AUGMENTATION, 46
AUTOMATIC FLIGHT CONTROL, 37, 138
AUTONOMOUS NAVIGATION, 37
AUTONOMY, 46
AVIONICS, 138
AXIAL STRESS, 93

B

B-2 AIRCRAFT, 19
BACTERIA, 85, 109
BANDWIDTH, 139
BARIUM TITANATES, 166
BASALT, 107
BAYES THEOREM, 143, 168
BEACON COLLISION AVOIDANCE SYSTEM, 14, 25
BEAMS (SUPPORTS), 51, 91
BELIEF NETWORKS, 141
BENDING MOMENTS, 36
BERING SEA, 120
BIBLIOGRAPHIES, 1
BIOGEOCHEMISTRY, 101
BIOSPHERE, 103
BIOTECHNOLOGY, 120, 168
BIRD-AIRCRAFT COLLISIONS, 14
BLADE TIPS, 95
BLOOD PLASMA, 124
BLUFF BODIES, 76
BODY-WING CONFIGURATIONS, 5, 7, 32, 93
BOUNDARY CONDITIONS, 69, 79, 144
BOUNDARY INTEGRAL METHOD, 83
BOUNDARY LAYER CONTROL, 4, 6
BOUNDARY LAYER FLOW, 77
BOUNDARY LAYER STABILITY, 2
BOUNDARY LAYER THICKNESS, 48
BOUNDARY LAYER TRANSITION, 4, 6
BOUNDARY LAYERS, 16, 77, 110, 113
BOUNDARY VALUE PROBLEMS, 144
BRAIDED COMPOSITES, 53
BRAKING, 88
BREADBOARD MODELS, 86
BREMSSTRAHLUNG, 87
BRIDGES (STRUCTURES), 31, 56
BRITTLENESS, 62
BROADBAND, 108, 176
BUBBLES, 83
BUCKLING, 92
BUFFETING, 35, 36, 42, 76
BUOYANCY, 54
BURNERS, 65
BURNING RATE, 55
BURSTS, 177
BYPASSES, 34

C

CALCIUM, 66
CALCIUM METABOLISM, 66
CALIBRATING, 46, 121, 173, 174
CAPACITORS, 75, 159
CARBON, 75
CARBON DIOXIDE, 173
CARBON FIBERS, 51
CARBON MONOXIDE, 110
CARBON-CARBON COMPOSITES, 89
CARTESIAN COORDINATES, 131
CATALOGS (PUBLICATIONS), 169
CATALYSIS, 153
CATALYSTS, 127, 153
CATHODOLUMINESCENCE, 149
CAVITATION FLOW, 48, 83
CAVITIES, 174
CELL DIVISION, 66
CELLS (BIOLOGY), 122
CENTRAL NERVOUS SYSTEM, 122
CEPHEID VARIABLES, 172
CERAMIC MATRIX COMPOSITES, 53, 54
CERAMICS, 63, 64, 65, 73
CHANNEL FLOW, 67
CHANNELS (DATA TRANSMISSION), 15
CHARGE COUPLED DEVICES, 86
CHARGE EFFICIENCY, 105
CHEMICAL ANALYSIS, 100, 106
CHEMICAL COMPOSITION, 65, 110
CHEMICAL COMPOUNDS, 109
CHEMICAL ENGINEERING, 128
CHEMICAL PROPERTIES, 109
CHEMICAL REACTIONS, 51
CHIPS (ELECTRONICS), 63
CHIRAL DYNAMICS, 153
CHLORIDES, 58
CHROMIUM ALLOYS, 58
CIRCUITS, 34
CLEANLINESS, 116
CLIENT SERVER SYSTEMS, 137, 139
CLIMATE, 118
CLIMATE CHANGE, 110
CLIMATE MODELS, 119
CLIMATOLOGY, 100, 107, 116, 119
CLOUD PHYSICS, 118
CLOUDS (METEOROLOGY), 110, 114
COASTAL ECOLOGY, 120
COASTS, 119
COATINGS, 62
CODING, 71
COEFFICIENTS, 107
COLLISIONS, 78, 173
COMBAT, 146, 168
COMBINATORIAL ANALYSIS, 145
COMBUSTION, 48
COMBUSTION CHAMBERS, 47, 48
COMBUSTION PRODUCTS, 66
COMMAND AND CONTROL, 72
COMMERCE, 145
COMMERCIAL AIRCRAFT, 11, 24
COMMERCIAL SPACECRAFT, 146
COMMUNICATION, 136
COMMUNICATION NETWORKS, 140
COMPARISON, 49
COMPATIBILITY, 68
COMPLEX COMPOUNDS, 57
COMPOSITE MATERIALS, 52, 64, 95
COMPOSITE STRUCTURES, 22, 51, 53, 91, 92, 93
COMPOSITE WRAPPING, 53
COMPRESSIBLE FLOW, 30
COMPUTATION, 82, 84, 115, 140, 151, 169
COMPUTATIONAL FLUID DYNAMICS, 4, 5, 7, 25, 79, 80, 81
COMPUTATIONAL GRIDS, 7, 78
COMPUTER AIDED DESIGN, 131
COMPUTER ASSISTED INSTRUCTION, 136
COMPUTER INFORMATION SECURITY, 133, 138, 139
COMPUTER NETWORKS, 73, 138, 139
COMPUTER PROGRAMMING, 128, 131, 132, 133
COMPUTER PROGRAMS, 22, 32, 52, 77, 128, 130, 133, 134
COMPUTER SYSTEMS DESIGN, 137
COMPUTER TECHNIQUES, 129, 131
COMPUTER VISION, 154
COMPUTERIZED SIMULATION, 31, 35, 36, 39, 56, 67, 71, 76, 77, 79, 81, 136, 141, 147, 159, 165, 168
COMPUTERS, 58, 169
CONCRETE STRUCTURES, 68
CONCRETES, 56, 68
CONDUCTION BANDS, 164

CONFERENCES, 2, 6, 68, 98, 100, 116, 166, 168
CONGRESSIONAL REPORTS, 167
CONNECTIVE TISSUE, 122
CONSTRUCTION, 159
CONTAINMENT, 26, 88
CONTAMINANTS, 22, 110
CONTAMINATION, 111, 116
CONTINUUM FLOW, 111
CONTINUUM MECHANICS, 92
CONTRACT MANAGEMENT, 167
CONTROL SIMULATION, 39
CONTROL SURFACES, 7, 27
CONTROL SYSTEMS DESIGN, 20, 22, 32, 37
CONTROL THEORY, 16, 31, 37, 145
CONTROLLABILITY, 27
CONTROLLERS, 27, 34
CONVECTIVE FLOW, 163
CONVECTIVE HEAT TRANSFER, 95, 115
CONVERGENCE, 7, 142, 148
COORDINATES, 78
CORE SAMPLING, 107
CORN, 117
CORRECTION, 7
CORROSION, 58
CORROSION PREVENTION, 56
CORROSION RESISTANCE, 59
COST ANALYSIS, 170
COST EFFECTIVENESS, 18
COST REDUCTION, 152, 170
COSTS, 14
COUETTE FLOW, 55
COUPLING COEFFICIENTS, 166
CRACK INITIATION, 66
CRACK PROPAGATION, 22, 26, 66
CRACKING (FRACTURING), 26, 52
CRASHES, 15
CREW PROCEDURES (INFLIGHT), 12, 43
CROP GROWTH, 117
CROSS CORRELATION, 96, 176
CRUDE OIL, 105
CRYOGENIC TEMPERATURE, 85
CRYOGENICS, 42, 64, 78
CRYSTAL DEFECTS, 162, 163
CRYSTAL GROWTH, 163, 166
CRYSTAL LATTICES, 104
CYBERNETICS, 141

D

DAMAGE, 51, 122
DAMPING, 94, 95
DATA ACQUISITION, 11, 38, 62, 64, 65, 90, 97, 99, 101, 119, 136, 137, 168
DATA BASE MANAGEMENT SYSTEMS, 170
DATA BASES, 3, 65, 77, 103, 120, 138, 167, 173
DATA COMPRESSION, 134
DATA INTEGRATION, 3
DATA MANAGEMENT, 3, 136, 138, 139, 170
DATA PROCESSING, 68, 112, 137
DATA RECORDERS, 15
DATA REDUCTION, 112
DATA STORAGE, 85, 120, 168
DATA SYSTEMS, 12, 97, 98, 99, 117
DEBRIS, 26, 42
DECISION MAKING, 145
DECISION SUPPORT SYSTEMS, 135
DECOMPOSITION, 48
DEFLECTION, 91
DEFORMATION, 17, 93, 95, 165, 171
DEGRADATION, 122
DEGREES OF FREEDOM, 150
DEICING, 42
DELAWARE BAY (US), 97
DELAWARE RIVER BASIN (US), 97
DELTA WINGS, 36
DESIGN ANALYSIS, 9, 11, 15, 17, 18, 20, 21, 23, 25, 32, 36, 91, 167, 170
DETECTION, 63, 85, 119, 122, 150, 153
DEUTERIUM PLASMA, 155
DIAGNOSIS, 96
DIAMOND FILMS, 62, 165
DICTIONARIES, 167
DIFFERENTIAL EQUATIONS, 128
DIFFRACTION, 134
DIGITAL DATA, 103
DIODES, 86
DIPOLE MOMENTS, 69
DISARMAMENT, 171
DISASTERS, 98
DISCONTINUITY, 92
DISCOVERY (ORBITER), 43
DISPLAY DEVICES, 74, 127
DISSOLVED GASES, 109
DISTANCE, 174
DISTRIBUTED INTERACTIVE SIMULATION, 71, 139
DISTRIBUTED MEMORY, 132
DISTRIBUTED PROCESSING, 132, 137, 138, 139, 140
DITCHING (LANDING), 13
DIURNAL VARIATIONS, 40
DIVERGENCE, 52
DOCUMENT MARKUP LANGUAGES, 70, 132, 133
DOCUMENTATION, 136
DOCUMENTS, 169, 170
DOPED CRYSTALS, 163
DRAG REDUCTION, 76
DROPS (LIQUIDS), 78
DUCTS, 152
DURABILITY, 56
DWELL, 168
DYNAMIC CHARACTERISTICS, 11, 28, 33, 82, 94
DYNAMIC MODELS, 3, 4, 42, 94, 142
DYNAMIC PRESSURE, 91
DYNAMIC RANGE, 154
DYNAMIC RESPONSE, 4, 15, 19, 30, 34, 35, 52, 91, 93, 94, 140
DYNAMIC STABILITY, 10
DYNAMIC STRUCTURAL ANALYSIS, 2, 6, 16, 19, 33, 35, 42, 77, 88, 91, 92, 93, 94, 142
DYNAMIC TESTS, 38
DYNAMICAL SYSTEMS, 31, 148

E

EARTH OBSERVING SYSTEM (EOS), 43, 46, 70, 116, 117
EARTH ORBITAL ENVIRONMENTS, 44
EARTH RADIATION BUDGET, 174
EARTH SCIENCES, 40
EARTHQUAKES, 98
ECLIPTIC, 177
ECOLOGY, 101
ECONOMIC IMPACT, 105
ECOSYSTEMS, 101, 109
EDUCATION, 39, 104, 156, 166
EGGS, 123
EIGENVALUES, 129, 142
EIGENVECTORS, 128, 129, 142
EJECTION SEATS, 61
EJECTORS, 78
ELASTIC BUCKLING, 93
ELASTIC DEFORMATION, 7
ELASTIC PROPERTIES, 92
ELASTIC WAVES, 70
ELASTOMERS, 63
ELECTRIC BATTERIES, 50, 75, 104, 126
ELECTRIC DISCHARGES, 149
ELECTRIC FIELDS, 149
ELECTRIC GENERATORS, 105
ELECTRIC MOTORS, 74
ELECTRIC NETWORKS, 95
ELECTRIC POTENTIAL, 105
ELECTRIC POWER, 75
ELECTRIC POWER SUPPLIES, 104, 105

ELECTRIC POWER TRANSMISSION, 75, 86
ELECTRIC PROPULSION, 74
ELECTRICAL RESISTIVITY, 61
ELECTRO-OPTICS, 166, 169
ELECTROCHEMISTRY, 58, 105
ELECTROMAGNETIC COMPATIBILITY, 70
ELECTROMAGNETIC FIELDS, 23, 25
ELECTROMAGNETIC NOISE, 44, 87
ELECTROMAGNETIC RADIATION, 25, 44, 70
ELECTROMAGNETIC SHIELDING, 14
ELECTRON DENSITY (CONCENTRATION), 149
ELECTRON PLASMA, 159
ELECTRONIC PUBLISHING, 140
ELECTRONIC STRUCTURE, 164
ELECTRONIC WARFARE, 139
ELECTROSTATICS, 69
ELIMINATION, 66
EMBRYOLOGY, 123
EMBRYOS, 123
EMISSION, 111, 151
EMITTANCE, 151
ENDEAVOUR (ORBITER), 45
ENERGETIC PARTICLES, 157
ENERGY BANDS, 176
ENERGY BUDGETS, 103
ENERGY CONSERVATION, 64
ENERGY CONVERSION, 104
ENERGY GAPS (SOLID STATE), 104, 164
ENERGY LEVELS, 53
ENERGY STORAGE, 104, 105
ENERGY TECHNOLOGY, 104
ENGINE CONTROL, 67
ENGINE DESIGN, 26, 69
ENGINE PARTS, 26
ENVIRONMENT SIMULATION, 118
ENVIRONMENT SIMULATORS, 123
ENVIRONMENTAL CLEANUP, 106
ENVIRONMENTAL ENGINEERING, 111
ENVIRONMENTAL MONITORING, 111, 154
ENVIRONMENTAL SURVEYS, 68, 96
EPOXY RESINS, 56
EQUATIONS OF MOTION, 9, 18, 20, 21, 23, 42, 95, 142
EQUATIONS OF STATE, 16
EROSION, 62
ERRORS, 13
ESTIMATING, 136, 142
ESTUARIES, 109
ETCHING, 49
ETHANE, 114
ETHERS, 50
EULER EQUATIONS OF MOTION, 27, 131
EVACUATING (TRANSPORTATION), 13
EVALUATION, 122
EVOLUTION (DEVELOPMENT), 177
EXCITATION, 94, 166
EXCITONS, 165
EXHAUST EMISSION, 67, 160
EXHAUST GASES, 67, 109, 160
EXHAUST NOZZLES, 5, 78
EXPERIMENT DESIGN, 82, 90
EXPERIMENTATION, 62, 112, 151
EXPERT SYSTEMS, 30
EXPOSURE, 123
EXTRACTION, 77, 107
EXTRATERRESTRIAL RADIATION, 175

F

F-18 AIRCRAFT, 35, 37
FABRICATION, 60, 64
FAILURE, 24, 141
FAILURE ANALYSIS, 24, 34, 52, 91, 93
FAIRINGS, 41
FAN BLADES, 90
FAR UV SPECTROSCOPIC EXPLORER, 172
FARADAY EFFECT, 159
FATIGUE (BIOLOGY), 13, 125
FATIGUE (MATERIALS), 22
FAULT TOLERANCE, 138
FEASIBILITY, 63, 90
FEASIBILITY ANALYSIS, 86
FEED SYSTEMS, 127
FEEDBACK CONTROL, 20, 27, 36, 37
FEEDFORWARD CONTROL, 37
FERTILITY, 123
FERTILIZATION, 66
FIBER COMPOSITES, 92
FIBER OPTICS, 56
FIBER STRENGTH, 51
FIBER-MATRIX INTERFACES, 51
FIELD COILS, 159
FINITE DIFFERENCE THEORY, 17, 131
FINITE DIFFERENCE TIME DOMAIN METHOD, 27
FINITE ELEMENT METHOD, 17, 18, 22, 23, 34, 42, 76, 91, 92, 94, 95, 124, 142, 144, 151
FINS, 35
FIRE EXTINGUISHERS, 12, 49, 57
FIRE FIGHTING, 12, 57
FIRE PREVENTION, 12, 57
FIRES, 57, 68
FISHERIES, 120
FISSION, 49
FITTING, 145
FIXED WINGS, 23
FLAME PROPAGATION, 55
FLAMES, 54
FLAT PLATES, 77
FLEXIBLE SPACECRAFT, 21
FLIGHT CONDITIONS, 119
FLIGHT CONTROL, 10, 39, 46
FLIGHT CREWS, 12, 13
FLIGHT ENVELOPES, 31
FLIGHT INSTRUMENTS, 63
FLIGHT MECHANICS, 9
FLIGHT OPERATIONS, 11
FLIGHT OPTIMIZATION, 9
FLIGHT PATHS, 12, 25
FLIGHT RECORDERS, 15
FLIGHT SAFETY, 14, 25
FLIGHT SIMULATION, 35
FLIGHT SIMULATORS, 39
FLIGHT TESTS, 2, 4, 6, 8, 30, 31, 78
FLOODS, 116
FLOORS, 56
FLORIDA, 100
FLOW CHARACTERISTICS, 78, 113
FLOW DISTRIBUTION, 77, 79, 80, 82
FLOW RESISTANCE, 152
FLOW THEORY, 83
FLOW VELOCITY, 36
FLOW VISUALIZATION, 79
FLUID DYNAMICS, 68
FLUID FLOW, 36, 50, 84, 121
FLUID MECHANICS, 83, 84, 129
FLUID-SOLID INTERACTIONS, 77
FLUORESCENCE, 50
FLUTTER, 7, 21, 27, 32, 33, 36, 52, 94
FLUTTER ANALYSIS, 2, 3, 4, 6, 16, 28, 29, 30, 31, 32, 33, 34, 35, 41, 51, 93, 140
FLUX (RATE), 48
FLUX DENSITY, 49, 177
FLUX TRANSFER EVENTS, 113
FLYBY MISSIONS, 40
FOAMS, 61
FOCI, 120
FORCED VIBRATION, 16
FORECASTING, 116
FOREIGN POLICY, 145
FOREST MANAGEMENT, 100, 101
FORESTS, 97, 101
FOSSILS, 41, 115

FOURIER TRANSFORMATION, 114, 148
FRACTURE STRENGTH, 60
FRACTURING, 96
FREE FLOW, 77, 79, 83, 84
FREE VIBRATION, 51
FREQUENCY ASSIGNMENT, 75
FREQUENCY DOMAIN ANALYSIS, 32, 144
FREQUENCY RANGES, 152
FREQUENCY RESPONSE, 131, 144, 149
FREQUENCY STANDARDS, 86, 154
FRESH WATER, 109
FRETTING, 62
FRICTION FACTOR, 118
FRICTION MEASUREMENT, 22, 38
FUEL INJECTION, 47
FUNCTIONAL ANALYSIS, 143
FUNCTIONAL DESIGN SPECIFICATIONS, 134
FUNCTIONAL INTEGRATION, 148
FUNCTIONALS, 143
FUNCTIONS (MATHEMATICS), 148
FUSELAGES, 16, 22
FUSION, 49
FUSION REACTORS, 155, 156
FUZZY SYSTEMS, 34

G

GALAXIES, 172
GALLIUM ANTIMONIDES, 158
GALLIUM ARSENIDES, 164
GALLIUM NITRIDES, 49, 61, 158, 162, 163
GALLIUM PHOSPHIDES, 158
GAME THEORY, 148
GAMMA RAY BURSTS, 176, 177
GAS ANALYSIS, 114
GAS COMPOSITION, 108
GAS GENERATORS, 48
GAS TRANSPORT, 114
GAS TURBINE ENGINES, 69
GAS TURBINES, 95
GEARS, 89
GENERAL AVIATION AIRCRAFT, 12, 39
GENERAL OVERVIEWS, 19
GENETIC ALGORITHMS, 94
GEOLOGICAL FAULTS, 98
GEOLOGICAL SURVEYS, 97, 98, 99, 107, 116
GEOLOGY, 173
GEOMORPHOLOGY, 102
GEOPHYSICS, 118
GLASS FIBERS, 52
GLOBAL POSITIONING SYSTEM, 14, 15
GLOVES, 127
GOLD, 163
GOVERNMENT PROCUREMENT, 167
GOVERNMENTS, 170
GRANULAR MATERIALS, 95
GRAPHICAL USER INTERFACE, 25
GRAPHITE-EPOXY COMPOSITES, 53
GRAVIMETRY, 107
GRAVITATION, 50, 67
GRAZING FLOW, 150, 152
GREAT LAKES (NORTH AMERICA), 100
GREENHOUSE EFFECT, 110
GRID GENERATION (MATHEMATICS), 131
GRINDING (MATERIAL REMOVAL), 59
GROUND EFFECT (AERODYNAMICS), 9, 10, 23
GROUND EFFECT MACHINES, 8, 9, 10, 23, 24, 82
GROUND HANDLING, 22, 38
GROUND TESTS, 22, 38
GROUND WATER, 97, 98, 99, 100, 101
GROUND WIND, 117
GROWTH, 97
GUIDANCE (MOTION), 40
GUST LOADS, 11

H

H II REGIONS, 171
H-INFINITY CONTROL, 27, 37
HALL EFFECT, 166
HALOCARBONS, 49
HARMONIC EXCITATION, 91
HARRIER AIRCRAFT, 15
HAZARDOUS MATERIALS, 66
HEAT FLUX, 48, 57, 100
HEAT MEASUREMENT, 57
HEAT OF DISSOCIATION, 153
HEAT RESISTANT ALLOYS, 53, 60
HEAT TRANSFER, 48, 78, 95, 155
HEAT TRANSFER COEFFICIENTS, 95
HEAT TRANSMISSION, 84
HEATING, 115
HELICOPTER CONTROL, 79
HELICOPTERS, 81
HETERODYNING, 84
HETEROGENEITY, 55
HIGH ALTITUDE, 2
HIGH ASPECT RATIO, 19
HIGH FREQUENCIES, 72, 115
HIGH RESOLUTION, 143, 163, 173
HIGH REYNOLDS NUMBER, 4
HIGH SPEED, 73, 76
HIGH SPEED PHOTOGRAPHY, 42
HIGH TEMPERATURE, 56
HOLOGRAPHY, 85
HOMOGENEITY, 176
HOMOLOGY, 130
HONEYCOMB STRUCTURES, 150
HOT ELECTRONS, 84
HOT-WIRE ANEMOMETERS, 57
HOVERING, 17
HUBBLE CONSTANT, 172
HUBBLE SPACE TELESCOPE, 172
HULLS (STRUCTURES), 83
HUMAN FACTORS ENGINEERING, 125, 127
HUMAN PERFORMANCE, 126
HUMIDITY, 65
HYDROCARBONS, 107
HYDROCYANIC ACID, 114
HYDRODYNAMIC COEFFICIENTS, 83
HYDRODYNAMICS, 8, 10, 37, 82, 83
HYDROFOIL CRAFT, 37, 69, 82
HYDROFOILS, 9, 37, 69, 82
HYDROGEN, 65, 154
HYDROGEN FUELS, 65
HYDROGRAPHY, 103
HYDROLOGY, 97, 98, 99, 100, 101
HYDROMECHANICS, 8
HYDROMETEOROLOGY, 116
HYDROPLANES (VEHICLES), 37, 69, 82
HYPERSONIC FLOW, 34
HYPERSONIC SPEED, 29
HYPERSONIC VEHICLES, 21
HYPERSONICS, 21
HYPERTEXT, 132, 133

I

ICE, 38
ICE PREVENTION, 42
IGNITION, 55, 155
ILL-CONDITIONED PROBLEMS (MATHEMATICS), 144
IMAGE PROCESSING, 64, 102, 117
IMAGERY, 134
IMAGING SPECTROMETERS, 102
IMAGING TECHNIQUES, 46, 86, 154, 177
IMMUNOASSAY, 111
IMP, 86
IMPACT DAMAGE, 53
IMPACT VELOCITY, 67

INCOMPRESSIBLE BOUNDARY LAYER, 76
INCOMPRESSIBLE FLUIDS, 83
INDEXES (DOCUMENTATION), 1
INDICATORS, 96
INDIUM ANTIMONIDES, 158
INDIUM COMPOUNDS, 49, 158
INDIUM GALLIUM ARSENIDES, 104, 158, 164
INDIUM PHOSPHIDES, 158
INDUSTRIES, 105
INFORMATION, 103
INFORMATION DISSEMINATION, 138
INFORMATION MANAGEMENT, 170
INFORMATION RESOURCES MANAGEMENT, 133
INFORMATION RETRIEVAL, 132
INFORMATION SYSTEMS, 117, 132, 138, 168, 170
INFORMATION TRANSFER, 132, 133, 139
INFRARED LASERS, 86
INFRARED RADIATION, 114
INJECTORS, 47
INJURIES, 125
INLET NOZZLES, 49
INORGANIC CHEMISTRY, 11
INORGANIC COATINGS, 59
INSTRUCTORS, 156
INTEGRAL EQUATIONS, 83
INTEGRATED CIRCUITS, 130
INTERACTING GALAXIES, 171
INTERACTIONAL AERODYNAMICS, 16
INTERFACES, 75
INTERFEROMETRY, 154, 163
INTERLAMINAR STRESS, 93
INTERLAYERS, 162
INTERMETALLICS, 57
INTERNAL COMBUSTION ENGINES, 89
INTERNATIONAL SPACE STATION, 45
INTERNATIONAL TRADE, 72
INTERNETS, 135, 137
INTERPLANETARY SPACE, 175
INTERPOLATION, 143
INVARIANCE, 129
INVENTORIES, 103
INVENTORY CONTROLS, 145
INVISCID FLOW, 82
IO, 173
IODINE COMPOUNDS, 49
ION BEAMS, 49, 158
ION DENSITY (CONCENTRATION), 149
ION SOURCES, 159
IONIC WAVES, 157
IONIZING RADIATION, 175
IONS, 176
IRRADIANCE, 174
ISOMERIZATION, 123
ISOTOPE SEPARATION, 86
ISOTOPIC ENRICHMENT, 86
ISOTROPIC TURBULENCE, 78
ISOTROPY, 55
ITERATIVE SOLUTION, 142

J

JANUS, 40
JAVA (PROGRAMMING LANGUAGE), 137
JET EXHAUST, 160
JET FLOW, 76
JOINING, 89
JUPITER (PLANET), 173

K

K-EPSILON TURBULENCE MODEL, 5
KAPTON (TRADEMARK), 62
KERNEL FUNCTIONS, 4
KINEMATICS, 17, 29, 81
KINETIC ENERGY, 153
KINETICS, 96, 163

L

LABORATORIES, 112
LAMINAR BOUNDARY LAYER, 4, 6, 77
LAMINAR FLOW, 4, 6, 78
LAMINATES, 52, 93
LAND USE, 39, 101
LANDFORMS, 103
LANDING GEAR, 19, 20, 88
LANDING SIMULATION, 8
LANDSAT SATELLITES, 102
LARGE SCALE INTEGRATION, 169
LARGE SPACE STRUCTURES, 72
LASER ABLATION, 111
LASER APPLICATIONS, 87
LASER OUTPUTS, 87
LASER PUMPING, 87
LASERS, 86
LAUNCH VEHICLE CONFIGURATIONS, 28
LAUNCH VEHICLES, 27, 42
LEADERSHIP, 171
LEADING EDGES, 6, 77
LEAST SQUARES METHOD, 44
LIBRARIES, 133, 169
LIFE (DURABILITY), 123
LIFT, 5, 7
LIFTING REENTRY VEHICLES, 5
LIGHT SCATTERING, 143
LIGHTNING, 115, 119
LINE OF SIGHT, 44
LINE SPECTRA, 154
LINEAR ENERGY TRANSFER (LET), 176
LINEAR EQUATIONS, 128
LINEAR VIBRATION, 35
LININGS, 26
LIQUID FLOW, 127
LIQUID OXYGEN, 48
LIQUID PHASE SINTERING, 63
LIQUID ROCKET PROPELLANTS, 47
LITHIUM, 75
LOAD CARRYING CAPACITY, 62
LOADS (FORCES), 17, 42, 75, 79, 96
LOGISTICS, 42
LONGITUDINAL STABILITY, 37
LOW EARTH ORBITS, 175
LOW REYNOLDS NUMBER, 2
LOW SPEED STABILITY, 38
LUBRICANTS, 61
LUBRICATION, 62
LUMINOSITY, 177

M

MACHINE LEARNING, 141
MACHINERY, 61
MACROMOLECULES, 63
MAGELLANIC CLOUDS, 171
MAGNETIC FIELDS, 112, 113, 144
MAGNETOHYDRODYNAMIC FLOW, 113
MAGNETOHYDRODYNAMIC WAVES, 157
MAGNETOPAUSE, 113
MAGNETOSHEATH, 113
MAINTENANCE, 26, 68
MAMMALS, 123
MAN MACHINE SYSTEMS, 168
MANAGEMENT INFORMATION SYSTEMS, 170
MANAGEMENT PLANNING, 167
MANAGEMENT SYSTEMS, 140, 170
MANEUVERABILITY, 17
MANIFOLDS (MATHEMATICS), 129
MANNED SPACE FLIGHT, 43
MANPOWER, 146
MANUALS, 168
MAPPING, 119
MARINE BIOLOGY, 109
MARINE ENVIRONMENTS, 109

MARS ATMOSPHERE, 41, 173
MARS MISSIONS, 40
MASS DISTRIBUTION, 176
MASS SPECTROSCOPY, 111
MASS TRANSFER, 50
MATCHING, 145
MATHEMATICAL MODELS, 2, 3, 4, 6, 16, 19, 20, 27, 29, 30, 33, 36, 52, 76, 77, 79, 82, 88, 92, 94, 96, 115, 128, 135, 141, 142, 144, 145, 162
MATHEMATICS, 129
MATRIX MATERIALS, 52
MATRIX THEORY, 129
MATTER-ANTIMATTER PROPULSION, 49
MEAN SQUARE VALUES, 44
MEASUREMENT, 129
MEASURING INSTRUMENTS, 110
MECHANICAL DEVICES, 13
MECHANICAL DRIVES, 89
MECHANICAL ENGINEERING, 89
MECHANICAL PROPERTIES, 58
MELTING, 49
MERCURY (PLANET), 40
MESOSCALE PHENOMENA, 115
METABOLISM, 122
METAL COMBUSTION, 55
METAL HYDRIDES, 65
METAL IONS, 75
METAL MATRIX COMPOSITES, 50, 54
METAL PARTICLES, 67
METALORGANIC CHEMICAL VAPOR DEPOSITION, 163, 164
METEOROLOGICAL PARAMETERS, 97, 100, 108, 118, 119
METEOROLOGICAL SATELLITES, 116, 118
METEOROLOGY, 110, 116
METROLOGY, 73
MICROELECTROMECHANICAL SYSTEMS, 48, 60
MICROGRAVITY, 45, 55, 66, 67, 122, 123
MICROMACHINING, 65
MICROMECHANICS, 52
MICROORGANISMS, 41
MICROSTRUCTURE, 54, 58, 61, 163, 165
MICROTHRUST, 48
MICROWAVE IMAGERY, 115
MILITARY OPERATIONS, 72, 146, 147
MINERALOGY, 101
MINERALS, 101, 106
MINORITIES, 166
MIR SPACE STATION, 45
MISSION PLANNING, 41
MIST, 57
MODAL RESPONSE, 91, 131, 149
MODELS, 134, 170
MODULES, 123, 134, 159
MODULUS OF ELASTICITY, 115
MOLDS, 60
MOLECULAR DYNAMICS, 56, 58, 61
MOLECULAR STRUCTURE, 61
MOLECULAR WEIGHT, 63
MOLECULES, 153
MONTE CARLO METHOD, 165
MOON, 173
MORPHOLOGY, 171
MOTION SIMULATION, 81
MOTION SIMULATORS, 39
MOVING TARGET INDICATORS, 71
MULTIBLOCK GRIDS, 36, 143
MULTIDISCIPLINARY DESIGN OPTIMIZATION, 3, 15, 20, 35, 93, 128
MULTIGRID METHODS, 143
MULTILAYER INSULATION, 64
MULTISENSOR FUSION, 90, 135
MUSCLES, 66
MUSCULOSKELETAL SYSTEM, 122, 123, 124, 125

N

NAPHTHALENE, 50
NASA PROGRAMS, 1, 40, 45, 166, 173
NATIONAL AIRSPACE SYSTEM, 12
NATIONAL AIRSPACE UTILIZATION SYSTEM, 12
NATURAL GAS, 69, 105
NAVIER-STOKES EQUATION, 2, 4, 5, 26, 77, 78, 79, 80
NAVIGATION, 40
NAVIGATION AIDS, 12
NEGATIVE IONS, 149
NEURAL NETS, 30, 140, 141, 148
NEUROMUSCULAR TRANSMISSION, 122, 124
NEUTRON DIFFRACTION, 59
NICKEL ALLOYS, 53
NICKEL HYDROGEN BATTERIES, 105
NIOBIUM ALLOYS, 58
NITROGEN, 109
NITROGEN ATOMS, 50
NITROGEN COMPOUNDS, 104, 164
NITROGEN OXIDES, 67, 109, 160, 161, 162
NOISE (SOUND), 150
NOISE GENERATORS, 151
NOISE INTENSITY, 152
NOISE MEASUREMENT, 149, 151
NOISE PREDICTION (AIRCRAFT), 149
NOISE REDUCTION, 150, 151, 152
NONINTRUSIVE MEASUREMENT, 11, 64
NONLINEAR PROGRAMMING, 36, 144
NONLINEAR SYSTEMS, 4, 71, 94, 148
NONLINEARITY, 19, 29, 31, 33, 35, 56, 76, 88, 115, 148, 163
NOZZLE DESIGN, 5
NOZZLE EFFICIENCY, 5
NOZZLE FLOW, 78
NUCLEAR INTERACTIONS, 166
NUCLEAR RADIATION, 87
NUCLEAR SPIN, 166
NUCLEAR WEAPONS, 87
NUMERICAL ANALYSIS, 8, 17, 76, 80, 84, 92, 112, 151
NUMERICAL INTEGRATION, 17

O

O STARS, 171
OBJECT-ORIENTED PROGRAMMING, 137
OCEAN COLOR SCANNER, 121
OCEAN DATA ACQUISITIONS SYSTEMS, 121
OCEAN DYNAMICS, 120
OCEAN SURFACE, 121
OCEANOGRAPHY, 120, 121
ON-LINE SYSTEMS, 117, 131, 132, 137, 139, 140
OPERATIONAL PROBLEMS, 11, 81, 82
OPTICAL DATA PROCESSING, 85
OPTICAL MEASUREMENT, 11, 64, 154
OPTICAL MEMORY (DATA STORAGE), 85
OPTICAL PROPERTIES, 54, 154, 164
OPTIMAL CONTROL, 145
OPTIMIZATION, 3, 7, 17, 18, 20, 21, 32, 36, 44, 51, 91, 93, 94, 142, 144
OREGON, 96
ORGANIC COMPOUNDS, 111
ORGANIZATIONS, 145, 146
ORIFICES, 127
ORTHOGONAL FUNCTIONS, 16
ORTHOTROPIC PLATES, 93
OSCILLATIONS, 11, 71, 88, 118, 157
OSCILLATOR STRENGTHS, 172
OXIDATION, 160
OXYGEN, 55, 109
OXYGEN ATOMS, 62

OZONE, 108
OZONE DEPLETION, 46

P

PACKET SWITCHING, 73
PALEONTOLOGY, 115
PANEL FLUTTER, 29, 34, 36, 41, 91
PANEL METHOD (FLUID DYNAMICS), 4
PARALLEL COMPUTERS, 135
PARALLEL PROCESSING (COMPUTERS), 79, 93
PARAMETER IDENTIFICATION, 29, 30
PARAMETERIZATION, 128, 144
PARTIAL DIFFERENTIAL EQUATIONS, 143
PARTICLE ACCELERATION, 175
PARTICLE ENERGY, 175
PARTICULATES, 107, 173
PATTERN RECOGNITION, 153
PAVEMENTS, 68
PAYLOADS, 123
PENETRATION, 54
PERFORMANCE TESTS, 43, 70, 105, 150
PERSONNEL, 169
PERTURBATION, 8
PERTURBATION THEORY, 32
PHASE TRANSFORMATIONS, 160
PHOSPHORS, 149
PHOTOEXCITATION, 165
PHOTOMETRY, 177
PHOTOVOLTAIC CELLS, 104, 105
PHYSICAL PROPERTIES, 56
PHYSIOLOGICAL EFFECTS, 122
PHYSIOLOGICAL RESPONSES, 122
PIERCING, 9
PIEZOELECTRIC CRYSTALS, 166
PIEZOELECTRICITY, 33, 34
PILOT INDUCED OSCILLATION, 10
PILOT TRAINING, 39
PILOTLESS AIRCRAFT, 37
PIONEER 10 SPACE PROBE, 174
PIONEER 11 SPACE PROBE, 174
PIONEER VENUS SPACECRAFT, 173
PISTON ENGINES, 89
PISTONS, 89
PITCH (INCLINATION), 28
PLANE STRAIN, 95
PLANETARY ATMOSPHERES, 173
PLANETARY GEOLOGY, 173
PLANETARY MAGNETOTAILS, 113
PLANFORMS, 17, 36
PLANNING, 146, 147
PLANTS (BOTANY), 101
PLASMA DIAGNOSTICS, 156
PLASMA ETCHING, 155, 158
PLASMA GENERATORS, 160, 161
PLASMA HEATING, 44
PLASMA PHYSICS, 155, 156, 157, 158, 159
PLASMAS (PHYSICS), 49, 113, 115, 155, 156, 158, 159, 160, 161, 162, 165
PLASTIC PROPERTIES, 165
PLUMES, 54
PLY ORIENTATION, 51
POINCARE SPHERES, 130
POLAR REGIONS, 112
POLARIZED LIGHT, 46, 154
POLICIES, 66, 147, 167
POLITICS, 145
POLLUTION CONTROL, 106, 108, 160, 161, 162
POLLUTION MONITORING, 106, 108, 160
POLYCRYSTALS, 165
POLYIMIDES, 62
POLYMERIZATION, 56
POLYMERS, 63
POLYPEPTIDES, 63
POSTLAUNCH REPORTS, 121
POTENTIAL FIELDS, 144
POTENTIAL FLOW, 3
POWDER (PARTICLES), 60
PRECIPITATION (METEOROLOGY), 119
PREDICTION ANALYSIS TECHNIQUES, 16, 22, 24, 29, 30, 135
PREDICTIONS, 14, 79
PREDICTOR-CORRECTOR METHODS, 27, 142
PREMIXED FLAMES, 55
PRESSURE DISTRIBUTION, 16, 48, 64, 84, 95
PRESSURE EFFECTS, 150, 164
PRESSURE MEASUREMENT, 11, 35, 48
PRIMATES, 122
PRINTED RESISTORS, 73
PROBABILITY DISTRIBUTION FUNCTIONS, 22
PROBABILITY THEORY, 145, 168
PROCEDURES, 43, 57, 85, 150
PRODUCT DEVELOPMENT, 63, 159
PROGRAM VERIFICATION (COMPUTERS), 131
PROGRAMMING ENVIRONMENTS, 133
PROGRAMMING LANGUAGES, 132, 133
PROJECT MANAGEMENT, 40
PROJECT PLANNING, 170
PROJECTILES, 83
PROJECTORS, 74
PROPELLANT COMBUSTION, 47
PROPELLANT GRAINS, 66
PROPELLANTS, 48
PROPELLERS, 16
PROPULSION SYSTEM CONFIGURATIONS, 47
PROPULSION SYSTEM PERFORMANCE, 47
PROTECTIVE COATINGS, 56
PROTOCOL (COMPUTERS), 137, 139
PROTOTYPES, 127, 167
PROVING, 112, 133
PSYCHOMOTOR PERFORMANCE, 124

Q

QUALITY CONTROL, 106, 124
QUANTUM WELLS, 87, 165, 166
QUEUEING THEORY, 141

R

RADAR, 71, 119
RADIANCE, 108, 121
RADIANT FLUX DENSITY, 108
RADIATION DOSAGE, 175
RADIATION EFFECTS, 87
RADIATION SHIELDING, 14
RADIATIVE HEAT TRANSFER, 55
RADIO FREQUENCIES, 154
RADIO GALAXIES, 177
RADIO PHYSICS, 177
RADIO WAVES, 115
RADIOACTIVE AGE DETERMINATION, 115
RADIOACTIVE WASTES, 111
RADIOMETERS, 121, 174
RAIL TRANSPORTATION, 59
RAILS, 59
RAMAN SPECTROSCOPY, 56
RANDOM VIBRATION, 35
RARE GASES, 49
RATS, 122, 123
REACTING FLOW, 55
REACTION KINETICS, 127, 164
REACTION TIME, 56
REACTIVITY, 158
REACTOR PHYSICS, 156
REAL TIME OPERATION, 56, 71, 137, 156
RECEIVERS, 46
RECORDS, 170

RECORDS MANAGEMENT, 170
RECRYSTALLIZATION, 162
RECTANGLES, 67
RECTANGULAR PLATES, 33, 91
RECTANGULAR WINGS, 36
RECURSIVE FUNCTIONS, 29
RED SEA, 121
RED SHIFT, 177
REDUCTION (CHEMISTRY), 67
REENTRY VEHICLES, 5
REFORESTATION, 100
REFRACTORIES, 59
REFRIGERATORS, 45
REGRESSION ANALYSIS, 14, 126
RELATIONAL DATA BASES, 133
RELIABILITY, 65
RELIABILITY ANALYSIS, 91, 135
RELUCTANCE, 74
REMOTE SENSING, 102, 103, 115, 118, 121
REMOTE SENSORS, 121
REMOTELY PILOTED VEHICLES, 37
RENEWABLE ENERGY, 105
RESEARCH, 62, 63, 118, 123, 151
RESEARCH AND DEVELOPMENT, 1, 104, 168
RESIDUAL STRESS, 59
RESOURCES MANAGEMENT, 140
REST, 125
RETRACTABLE EQUIPMENT, 83
RETURN TO EARTH SPACE FLIGHT, 43
RIVER BASINS, 97
ROCKET NOZZLES, 48
ROTARY STABILITY, 11, 88
ROTARY WING AIRCRAFT, 23, 24
ROTARY WINGS, 24, 38, 79, 80
ROTATION, 88
ROTOR AERODYNAMICS, 16, 28
ROTOR BLADES (TURBOMACHINERY), 18
ROTORS, 16, 23, 80, 152
RUNWAY CONDITIONS, 22, 38
RUNWAYS, 38

S

SAFETY, 12
SAFETY MANAGEMENT, 12
SANDS, 95
SATELLITE ATTITUDE CONTROL, 44
SATELLITE COMMUNICATION, 73
SATELLITE CONTROL, 45
SATELLITE IMAGERY, 102, 117, 118
SATELLITE NETWORKS, 45, 145
SATELLITE OBSERVATION, 118
SATELLITE ORIENTATION, 44
SATELLITE-BORNE INSTRUMENTS, 121
SCALE MODELS, 150, 152
SCALING LAWS, 30
SCIENCE, 167
SCREENING, 126
SEA LAUNCHING, 83
SEA ROUGHNESS, 81
SEA URCHINS, 66
SEA-VIEWING WIDE FIELD-OF-VIEW SENSOR, 121
SEASONS, 100
SEAT BELTS, 13
SEISMOLOGY, 98, 115
SELECTIVE DISSEMINATION OF INFORMATION, 133
SEMICONDUCTOR DEVICES, 134
SEMICONDUCTOR LASERS, 86, 87
SEMICONDUCTORS (MATERIALS), 73, 84, 155, 165
SEMISPAN MODELS, 7
SENSITIVITY, 92
SEQUENTIAL COMPUTERS, 135
SERVOMECHANISMS, 29, 44
SHAPE FUNCTIONS, 128
SHAPES, 17
SHARP LEADING EDGES, 6
SHEAR FLOW, 78, 157
SHEAR STRENGTH, 61
SHEAR STRESS, 17
SHIPS, 8, 68, 69, 79, 80, 81, 127
SHOCK, 96
SHROUDS, 41
SIGNAL ANALYZERS, 74
SIGNAL PROCESSING, 31, 71, 74, 135, 154
SILICON, 56, 163
SILICON CARBIDES, 51, 89
SIMULATION, 26, 40, 56, 87, 96, 113
SINGLE CRYSTALS, 86, 163
SLEEP, 125
SLEEP DEPRIVATION, 125
SLENDER BODIES, 83
SLENDER WINGS, 19
SLIDING FRICTION, 62
SMART STRUCTURES, 34
SMOOTHING, 143
SNOW, 103
SNOW COVER, 103
SOFIA (AIRBORNE OBSERVATORY), 84
SOFTWARE DEVELOPMENT TOOLS, 131
SOFTWARE ENGINEERING, 38, 64, 77, 133, 135
SOLAR CELLS, 104
SOLAR CORPUSCULAR RADIATION, 176
SOLAR CYCLES, 174
SOLAR ENERGY, 103
SOLAR FLARES, 175, 176
SOLAR OBSERVATORIES, 175
SOLAR PHYSICS, 175
SOLAR PLANETARY INTERACTIONS, 113
SOLAR RADIATION, 174
SOLAR STORMS, 176
SOLAR TERRESTRIAL INTERACTIONS, 113
SOLAR WIND, 113, 174
SOLENOIDS, 159
SOLID PROPELLANT ROCKET ENGINES, 66
SOLID PROPELLANTS, 66
SOLIDIFICATION, 49, 60
SOLIDIFIED GASES, 48
SOLVENTS, 66
SOOT, 54
SOUND INTENSITY, 150
SOUND PROPAGATION, 151
SOUND WAVES, 152
SOUTHERN HEMISPHERE, 110
SPACE COMMERCIALIZATION, 146
SPACE MISSIONS, 42, 46, 172, 173
SPACE PLASMAS, 44
SPACE SHUTTLE MISSIONS, 45
SPACE SHUTTLE PAYLOADS, 42
SPACE SHUTTLES, 42, 78, 123
SPACE TRANSPORTATION SYSTEM, 45
SPACE TRANSPORTATION SYSTEM FLIGHTS, 114, 172
SPACEBORNE EXPERIMENTS, 1
SPACECRAFT CONTROL, 137
SPACECRAFT INSTRUMENTS, 108
SPACECRAFT LAUNCHING, 27
SPACECRAFT POWER SUPPLIES, 105
SPACECRAFT PROPULSION, 48
SPACECRAFT RECOVERY, 141
SPACECRAFT STRUCTURES, 96
SPACECREWS, 43, 45, 147
SPATIAL DISTRIBUTION, 134
SPECTRA, 176
SPECTRAL METHODS, 153
SPECTRAL REFLECTANCE, 143
SPECTROMETERS, 84
SPECTRUM ANALYSIS, 173
SPEED CONTROL, 89
SPHEROMAKS, 157
SPHINX, 61
SPIRAL GALAXIES, 172

SPRAYERS, 67
STABILITY, 75, 76, 146, 148
STABILITY AUGMENTATION, 28
STABILITY TESTS, 163
STABILIZATION, 37
STARS, 177
STATIC PRESSURE, 2
STATIC STABILITY, 10
STATISTICAL ANALYSIS, 107, 145
STEADY STATE, 80, 141
STEELS, 62
STELLAR EVOLUTION, 172
STIFFNESS, 18, 42
STIFFNESS MATRIX, 17, 92
STOCHASTIC PROCESSES, 71
STOICHIOMETRY, 164
STRATEGY, 146, 147
STRATIFIED FLOW, 121
STRATOSPHERE, 113
STRATOSPHERIC WARMING, 113
STREAMS, 96
STRESS (PHYSIOLOGY), 125, 126
STRESS MEASUREMENT, 59
STRESS-STRAIN RELATIONSHIPS, 52
STRING THEORY, 129
STRONTIUM, 107
STRUCTURAL ANALYSIS, 18, 27, 129, 177
STRUCTURAL DESIGN, 7, 15, 22, 69, 91, 93
STRUCTURAL DESIGN CRITERIA, 11
STRUCTURAL ENGINEERING, 117
STRUCTURAL FAILURE, 21, 26
STRUCTURAL PROPERTIES (GEOLOGY), 102
STRUCTURAL RELIABILITY, 22, 91
STRUCTURAL STABILITY, 42
STRUCTURAL VIBRATION, 19
STRUCTURED GRIDS (MATHEMATICS), 143
SUBMERGING, 83
SUBSONIC FLOW, 5
SUBSONIC FLUTTER, 30
SUBSONIC SPEED, 2, 19
SUBURBAN AREAS, 117
SUCTION, 4, 6
SULFUR, 111
SULFUR OXIDES, 161
SUPERCONDUCTORS (MATERIALS), 130
SUPERGIANT STARS, 171
SUPERGRAVITY, 129
SUPERNOVAE, 172
SUPERSONIC AIRFOILS, 20, 35
SUPERSONIC FLOW, 4, 35
SUPERSONIC FLUTTER, 29
SUPERSONIC SPEED, 29
SUPPORT SYSTEMS, 146
SURFACE DEFECTS, 58
SURFACE EFFECT SHIPS, 8, 82
SURFACE ENERGY, 100
SURFACE LAYERS, 49, 118
SURFACE PROPERTIES, 38, 55, 134, 143
SURFACE REACTIONS, 50, 55, 56
SURFACE TREATMENT, 65
SURFACE WATER, 97, 98, 99, 100, 107
SURVEYS, 136
SWEPT WINGS, 52
SYNCHRONISM, 140, 141
SYNTHESIS (CHEMISTRY), 50, 63, 123
SYNTHETIC APERTURES, 154
SYNTHETIC METALS, 142
SYSTEM IDENTIFICATION, 71, 94, 144
SYSTEMS ANALYSIS, 25
SYSTEMS ENGINEERING, 75
SYSTEMS SIMULATION, 139, 147

T

TABS (CONTROL SURFACES), 31
TAIL SURFACES, 36
TAILLESS AIRCRAFT, 11
TAKEOFF, 81
TARGET ACQUISITION, 71
TASKS, 126
TECHNOLOGIES, 66
TECHNOLOGY ASSESSMENT, 57, 86
TECHNOLOGY UTILIZATION, 1, 62
TELECOMMUNICATION, 70
TELEMETRY, 137
TELESCOPES, 154, 173
TEMPERATURE EFFECTS, 29, 64
TEMPERATURE MEASUREMENT, 85
TEMPERATURE SENSORS, 85
TENSILE STRESS, 162
TENSORS, 129
TERMINOLOGY, 167
TEST STANDS, 38
TESTS, 87
TEXTILES, 53
THEMATIC MAPPERS (LANDSAT), 102
THEOREM PROVING, 131
THEOREMS, 133
THERMAL BUCKLING, 91
THERMAL CONDUCTIVITY, 50, 57
THERMAL DIFFUSION, 67
THERMAL ENERGY, 61
THERMAL INSULATION, 64
THERMAL PLASMAS, 160, 161, 162
THERMAL PROTECTION, 127
THERMAL STRESSES, 52
THERMIONIC DIODES, 159
THERMOGRAPHY, 53
THESAURI, 167
THESES, 135
THICKNESS, 95
THIN FILMS, 59
THREE AXIS STABILIZATION, 44
THREE DIMENSIONAL BOUNDARY LAYER, 76
THREE DIMENSIONAL COMPOSITES, 53
THREE DIMENSIONAL MODELS, 18, 26
THROATS, 5
THRUST CHAMBERS, 48
TILT ROTOR AIRCRAFT, 16, 17, 18, 28, 29
TILTING ROTORS, 152
TIMBER INVENTORY, 100
TIME DOMAIN ANALYSIS, 91
TIME MARCHING, 77
TIME MEASUREMENT, 115
TISSUES (BIOLOGY), 120
TITANIUM ALLOYS, 58, 62
TOKAMAK DEVICES, 155, 156, 157, 159
TOPOGRAPHY, 121
TOROIDAL PLASMAS, 173
TORUSES, 157, 173
TOXICITY, 68
TOXICOLOGY, 124
TRAILING EDGE FLAPS, 35
TRAJECTORIES, 40
TRAJECTORY ANALYSIS, 26
TRANSFER OF TRAINING, 39
TRANSIENT LOADS, 34
TRANSIENT RESPONSE, 16, 23
TRANSITION POINTS, 60
TRANSMISSION LINES, 71, 73
TRANSMISSIONS (MACHINE ELEMENTS), 89
TRANSMITTANCE, 73
TRANSMITTER RECEIVERS, 86
TRANSMITTERS, 86
TRANSONIC FLUTTER, 28, 31
TRANSPONDERS, 86
TRANSPORT AIRCRAFT, 13, 23
TRANSPORT PROPERTIES, 155
TRANSVERSE LOADS, 17
TREES (PLANTS), 97, 101
TRIBOLOGY, 62
TRMM SATELLITE, 115

TROPICAL REGIONS, 114
TROPOSPHERE, 114
TRUSSES, 94
TUNGSTEN FLUORIDES, 56
TUNING, 131
TURBINE BLADES, 95
TURBINE ENGINES, 85
TURBINE PUMPS, 48
TURBINES, 26
TURBOMACHINERY, 25
TURBULENCE, 48, 113
TURBULENCE MODELS, 4, 8, 76
TURBULENT FLOW, 76, 78, 151
TURBULENT MIXING, 78
TWINNING, 57

U

ULTRAVIOLET ASTRONOMY, 171
ULTRAVIOLET RADIATION, 172
UNITED STATES, 107
UNIVERSITIES, 104
UNSTEADY AERODYNAMICS, 2, 3, 4, 6, 7, 9, 16, 19, 23, 27, 29, 31, 32, 33, 41, 93, 142
UNSTEADY FLOW, 17, 79, 80, 82, 83
UPPER ATMOSPHERE, 108
UPPER ATMOSPHERE RESEARCH SATELLITE (UARS), 174
USER MANUALS (COMPUTER PROGRAMS), 52, 136

V

VALUE ENGINEERING, 170
VANES, 26
VAPOR DEPOSITION, 165
VARIANCE (STATISTICS), 134
VARIATIONAL PRINCIPLES, 153
VARIATIONS, 59
VATOL AIRCRAFT, 37
VEGETATION GROWTH, 101
VEHICLES, 69
VELOCITY DISTRIBUTION, 79, 84
VELOCITY MEASUREMENT, 8
VERTICAL TAKEOFF AIRCRAFT, 37
VERY LOW FREQUENCIES, 115
VESSELS, 88
VIBRATION, 24, 88
VIBRATION DAMPING, 7, 20, 30, 31, 32, 33, 34, 42
VIBRATION MODE, 7, 131, 149
VIBRATION TESTS, 28
VIBRATIONAL SPECTRA, 56
VIRTUAL REALITY, 127, 136, 142
VISCOUS FLOW, 3, 6, 16, 19, 77
VISUAL PERCEPTION, 142
VOLATILITY, 111
VOLTAGE CONVERTERS (DC TO DC), 75
VOLTERRA EQUATIONS, 4, 148
VORTEX BREAKDOWN, 35, 36, 64
VORTEX LATTICE METHOD, 7
VORTICES, 35, 113
VORTICITY, 77

W

WAKES, 77, 79, 80, 81
WALLS, 157
WARFARE, 72, 147
WASTE DISPOSAL, 111
WATER, 57
WATER FLOW, 109
WATER LANDING, 13
WATER MANAGEMENT, 99
WATER POLLUTION, 106, 107
WATER QUALITY, 97, 98, 99, 100, 106
WATER RESOURCES, 97, 98, 99, 100
WATER SAMPLING, 99, 100, 106
WATER VAPOR, 108
WATER VEHICLES, 8
WAVE EXCITATION, 153
WAVE PROPAGATION, 131
WAVELENGTHS, 70
WAVELET ANALYSIS, 30, 31, 71, 134, 148
WEAPON SYSTEMS, 170
WEAPONS, 171
WEAPONS DEVELOPMENT, 15
WEAR RESISTANCE, 62
WEATHER, 119
WEATHER FORECASTING, 116
WEATHER STATIONS, 116
WEIBULL DENSITY FUNCTIONS, 89
WETTING, 55
WHEEL BRAKES, 19, 88
WIDE AREA NETWORKS, 139
WIND DIRECTION, 119
WIND EFFECTS, 173
WIND TUNNEL TESTS, 3, 11, 28, 31, 35, 38, 152
WIND TURBINES, 105
WIND VELOCITY, 8, 79, 80, 81, 119
WINDPOWERED GENERATORS, 105
WING LOADING, 27
WING OSCILLATIONS, 19, 36, 140
WING PLANFORMS, 15, 92
WING PROFILES, 21
WING TIPS, 7, 36
WING-FUSELAGE STORES, 7, 32
WINGS, 3, 8, 9, 17, 20, 33, 37, 71
WINTER, 38
WORK-REST CYCLE, 125
WORLD WIDE WEB, 137, 138, 139, 140, 156
WOVEN COMPOSITES, 53

X

X RAY DIFFRACTION, 101
X RAYS, 87

Y

YIELD, 163

Z

ZEOLITES, 106
ZETA PINCH, 159
ZINC COATINGS, 59

Personal Author Index

A

Abarbanel, Henry, 24
Abate, A., 31
Abbud-Madrid, Angel, 55
Abdel-Motagaly, K., 29, 91
Abernathy, C. R., 49, 155, 157, 158
Abraham, Martin, 126
Abrams, M. C., 114
Acevedo, M. T., 172
Aframeev, E. A., 23
Akasaki, I., 162
Akiyama, Yasunobu, 56
Alberts, Jeffrey, 123
Albone, C. M., 80
Aldijaili, Sharon S., 169
Aldridge, D. F., 70
Alexander, J. Iwan D., 163
Allen, C. B., 80
Allerman, A. A., 104, 164
Alshibli, Khalid A., 94
Amano, H., 162
Ameri, Ali A., 25, 95
Ananth, Ramagopal, 57
Anderson, C., 100
Anderson, J. A., 108
Angell, J. K., 107
Antoun, Tarabay H., 96
Apprill, J. M., 59
Arduini, R. F., 113, 114
Arimo, Hirofumi, 67
Arpasi, M., 110
Asbury, Scott C., 5
Ashby, J. V., 134
Atcitty, S., 104
Atwell, William, 175
Augustynowicz, S. D., 63
Ault, J. P., 59
Aust, Jeffrey F., 56
Avanov, L. A., 112
Avva, V. S., 53
Ayliffe, J. K., 71
Azevedo, Joao L. F., 41

B

Back, Christina A., 87
Back, Dwight D., 65
Back, G. G., 49
Badavi, Francis F., 175
Badir, Ashraf, 93
Bailey, J. E., 159
Bailey, Jeremy C., 95
Bailey, Larry L., 125
Baker, Myles L., 7
Baker, R. L., 41
Bakker, N. H., 127
Balakumar, Ponnampalam, 76
Baldwin, M. D., 59
Ballantyne, D., 97
Ballard, W. P., 61
Banas, J. J., 104
Band, David L., 176
Banerjee, J. R., 51
Bansal, Narottam P., 51
Barbie, D. L., 98
Barbone, Paul E., 152
Barbour, J. C., 58
Barkstrom, Bruce R., 107
Barlow, Joel W., 64
Barnes, G., 156
Barnes, Robert A., 120, 121
Barney, P., 103
Barr, Don, 168
Barron, M. L., 26
Bartholomay, Roy C., 107
Baruffo, M., 30
Battaile, C. C., 164
Baucom, K. C., 164
Baum, B. A., 113, 114
Baumann, Jane, 77
Beaman, Joseph J., 64
Becker, L. E., 150
Bednarcyk, Brett A., 52
Beedlow, P., 100
Bell, James C., 147
Bell, M. G., 155, 157
Bell, R. E., 155, 157
Benham, R., 96
Bennett, Robert, 2
Benton, E. R., 175
Benton, E. V., 175
Beresford, S. T., 117
Bernabei, S., 157
Bernard, Douglas E., 141
Bernardini, G., 3
Bettoli, A., 70
Betz, A. L., 84
Beutler, D. E., 61
Bevan, Jeffrey S., 151
Beyler, C. L., 49
Biggar, Stuart F., 120
Bishnoi, K. D., 65
Blain, M. G., 149
Blair, W. D., 139
Blake, D., 12
Blanchard, C. L., 109
Blanchard, Laurie A., 127
Blanchard, W., 156
Blando, Guillermo D., 91
Blondeau, C., 29
Blum, Rick S., 134
Blumenthal, D. L., 108
Bogicevic, A., 58
Bolter, Jay D., 133
Bookout, Paul S., 42
Books, Thomas F., 150
Booth, Earl R., Jr., 152
Boreiko, R. T., 84
Borne, Kirk D., 171
Borysow, Aleksandra, 173
Bourell, David L., 64
Bowers, C. R., 166
Branch, Melvyn C., 55
Brand, P. C., 59
Brandon, E., 88
Breaks, Jeffrey, 38
Brenizer, Marshall, 48
Brennan, T. S., 98
Brenner, Marty, 31
Bridger, Alison F. C., 40
Briggs, Michael S., 177
Briley, W. Roger, 17
Britt, R. T., 19
Brown, Robin, 166
Brown, S., 100
Bruce, N. L., 96
Bucharles, A., 29
Buchheit, T. E., 164
Budnik, E. Yu., 113
Budny, R., 157
Budny, R. V., 156
Buehrle, Ralph D., 149
Buffinger, D. R., 104
Bugby, David, 77
Bulgarelli, U. P., 82
Bunker, Andrew J., 176
Bunker, Ronald S., 95
Bunyk, P., 130
Burch, J. L., 112
Burns, A. R., 61
Burt, M., 61
Bushaw, B. A., 110

Butler, R., 51
Buxton, D. E., 97
Byelinskyy, V. G., 8

C

Cady, C. M., 58
Caffrey, Robert T., 121
Cairns, M., 100
Camparo, James C., 87
Campbell, H. M. K., 96
Campbell, J. A., 110
Campbell, Spencer J., 126
Cao, X. A., 61
Cardinal, M., 75
Carey, C., 116
Carff, Paul F., 140
Carlos, Juan, 74
Carlson, M. D., 98
Carretta, Thomas R., 39
Carskadon, Mary A., 125
Casey, Michael P., 135
Cassaing, Frederic, 154
Cattarius, J., 6
Centeno, Martha A., 167
Cesnik, Carlos E. S., 18
Chamis, C. C., 52
Chamis, Christos C., 22
Chang, Craig F., 88
Chang, D.-E., 115
Chang, Jen-Shih, 160, 161
Change, J. -S., 160
Change, J.-S., 161
Changnon, S. A., 117
Chao, W., 130
Chao, Winston C., 118
Chapa, Michael, 10
Chason, E., 162
Chatfield, R. B., 109
Chattopadhyay, Aditi, 18
Chattot, J. J., 16
Chaturvedi, A. K., 124
Cheeseman, Peter, 143
Chein, Tsan-Heui, 165
Chen, Baode, 118
Chen, Hua, 154
Chen, K. C., 58
Chen, P. C., 32
Chen, R., 29
Cheney, B. T., 80
Chengming, Pei, 30
Cherniy, Dmytro I., 83
Chien, W. E., 151
Cho, H., 49, 157, 158
Christenson, T., 60
Ciancaleoni, E., 15
Clark, L. R., 150
Coe, H. H., 89
Coffer, John G., 87
Coffin, J. E., 100
Cohen, J., 107
Colbourne, Jason, 32
Colello, Joseph J., 107
Coleman, C. J., 71
Colina, Luis, 171
Colson, S. D., 110
Comaskey, B., 86
Comiskey, Michele D., 52
Connaughton, Valerie, 177
Conner, L., 105
Connew, P. M., 113
Cook, J. A., 120
Cooper, J. E., 30
Cooper, John, 56
Cooper, John E., 108
Cooper, Jonathan E., 91, 94
Cooper, Michael, 38
Corral, E., 54
Correa, Daisy, 167
Corso, Lawrence M., 28
Cosper, D. K., 13
Courts, M. L., 98
Covarrubias, R., 172
Cowan, Richard S., 24
Crawford, K. B., 46
Crawford, Richard H., 64
Creighton, J. R., 164
Critchfield, Anna, 136
Crommelynck, Dominique A. H., 108
Crowe, Kenneth e., 73
Crowfoot, R. M., 96
Crowther, W. J., 30
Cucinotta, Francis A., 175
Cudnohufsky, Aaron L., 147
Cui, Zhenqian, 72
Cullimore, Brent, 77
Cuneo, M. D., 159
Curran, Donald R., 96
Curtis, Scott, 118

D

d, 117
Dai, S., 73
Dai, Z., 54
Daily, John W., 55
Damilano, J. G., 41
Darrow, D., 157
Darrow, D. S., 156
Daugherty, Robert H., 19
Davis, John F., 87
Davis, W., 156
Dawson, Eric L., 146
Debonis, James R., 78
Decker, Christopher D., 87
Deere, Karen A., 5
deFariaPereiraWiltgenBarbosa, Luis Filipe, 159
deFerrier, Bernard, 36, 81
Degnan, John J., 86
deGroot, Wilhelmus A., 48
Delaney, R. A., 25
DelBosco, Edson, 159
Delgado III, Raymond R., 119
DellaRocco, P. S., 12
Demboski, J. R., 120
Dempsey, D. L., 112
Denegri, Charles M., Jr., 140
Desopper, A., 8
Dessi, D., 33
DeWoody, Yssa, 124
Diallo, Abdouramane, 93
Dibb, J. E., 110
Dimos, D., 73
DiNenno, P. J., 49
DiSciuva, M., 51
Diskin, Boris, 143
Dixit, Sham, 87
Doice, Gregorie, 167
Dolan, Kriten J., 72
Donovan, S. M., 49, 157
Doreswamy, C. V., 43
Dotson, K. W., 41
Dour, Christopher A., 145
Dowell, Earl H., 142
Doyle, Laurance R., 172
Dozier, J., 116
Dreim, D. R., 19
Drela, Mark, 2
Duan, B., 91
Dudley, K. J., 61
Dugas, Michael, 20
Dugger, M. T., 61, 64
Duggins, B., 96
Dunlap, Ronald D., 39
Dunn, S. A., 94
Durlach, Nathaniel I., 136
Durlin, R. R., 101
Dye, T. S., 108
Dykhuizen, R. C., 67
Dykman, John R., 16
Dyment, A., 83
Dyson, Rodger William, Jr., 130
Dyva, Ronnie Roger, 14
Dzygadlo, Z., 34

E

Eardley, Doug, 24
Early, Edward E., 121
Eaton, W. P., 64
Ebenfelt, P., 129
Eblen, L., 116
Echternach, D. K., 152
Edson, James, 118
Edwards, Craig D., 38
Edwards, S., 16
Efthimion, P. C., 155
Eldridge, Jeffrey I., 51
Elgas, James A., 45
Ellefson, B. R., 99
Ellerby, D., 54
Elliott, James R., 14, 24
Elsaadawy, Ehab, 33
Emery, William J., 116
Engler, Harold, 138
Eplee, Robert E., Jr., 120, 121
Epps, J. A., 67
Eriksson, K., 145
Ernst, D. R., 155
Esquerre, J. P., 3
Estes, John E., 102
Evrard, T., 51
Ewsuk, K., 54

F

Faeth, G. M., 54
Fahrenholtz, B., 54
Faltinsen, Odd M., 82
Fantacci, G., 9
Farago, T., 110
Farassat, F., 150
Farhat, Nabil H., 141
Farschon, C. L., 59
Fay, M., 116
Federman, Steven R., 172
Fedorov, A. O., 113
Ferguson, D. C., 44
Ferreira, Jose Olimpio, 140
Ferreira, Julio Guimaraes, 159
Fesmire, J. E., 63
Figiel, J., 162
Filippov, T., 130
Firestone, Elaine R., 120, 121
Fischer, Bernd, 133
Fischer, Hanno, 10
Fisher, John W., 126
Fishman, Gerald J., 177
Fitz-Simons, T., 107
Fleming, J. G., 162
Fletcher, W. L., 100
Flick, Eric, 10
Flodrops, J. P., 83
Floro, J. A., 162
Floto, Richard, 71
Fobes, J. L., 126
Folkes, Patrick A., 165
Follstaedt, D. M., 162
Fontaine, E., 83
Forssell, E. W., 49
Fowler, R. F., 134
Fox, John H., 2
Fox, Robert A., 122
Frankenberger, C. E., III, 26
Frazer, G., 71
Frediani, A., 3
Fredrickson, E. D., 155, 157
Freudinger, Lawrence C., 31
Friedman, P. P., 30
Friedmann, P. P., 20
Frink, L. J. D., 54
Friswell, Michael I., 143
Fritz, I. J., 164
Fu, M., 61, 163
Fujii, Motoo, 57
Fujiwara, Seiji, 57
Fuller, C. W., 104
Funk, J. D., 80

G

Galbraith, Robert W., 2
Galofaro, J. T., 43
Gandara, S. C., 98
Gao, X. A., 163
Garcia, Maretys L., 167
Garino, T. J., 60
Gazis, P. R., 174
Gdoulos, E. E., 66
Gebelein, Jennifer, 102
Gee, J. M., 104
Gennaretti, M., 15
George, M., 13
Georgiadis, Nicholas J., 78
Gerhold, C. H., 150
Gern, Frank H., 36
Gerrish, H. P., 48
Geurts, Evert, 2
Ghiringhelli, G. L., 28
Gibson, S. D., 67
Gifford, Robert K., 126
Gilbert, N. E., 80
Gilchrist, Robert N., 105
Gillard, William J., 11
Gilmore, D. L., 67
Gizewski, Peter, 171
Glenn, P., 134
GM Sverdrup,, 69
Gnaeupel-Herold, T., 59
Godfrey, A. W., 162
Goldberg, Robert K., 52
Goldman, A., 114
Goldstein, Marvin E., 151
Golos, Freddy N., 35
Gooley, K. W., 71
Gordnier, Raymond E., 77
Gordon, E. M., 104
Goss, Larry P., 10
Gotsis, P. K., 52
Gowdy, V., 13
Grabietz, Michael, 20
Grandhi, Ramana V., 90
Gray, E. M., 70
Gray-Fenner, A., 104
Greco, M., 82
Greeley, Ronald, 173
Green, Darryl E., 170
Greenley, J. B., 159
Greenough, C., 134
Greer, Donald, 1
Grihon, S., 3
Grip, R., 156
Grisval, Jean-Pierre, 75
Groot, Donald, 119
Grun, Jacob, 87
Guedj, R. A., 138
Guerra, A., 172
Gunson, M. R., 113, 114
Guo, Z., 109
Guo, Zhigong, 93
Gustafson, G. B., 117
Gutierrez, D. J., 46

H

Haberle, Robert M., 40
Hadaegh, Fred, 40
Hagler, Diane, 65
Hahn, Y. B., 49, 157, 158
Haigh, R., 43
Hall, David L., 90
Hambli, N., 129
Hamilton, T. W., 149
Hammons, B. E., 104
Hamory, Phil, 1
Han, J., 49, 61, 155, 157, 162, 163
Hansen, R., 49
Happer, Will, 24

Haraway, Sandra W., 139
Hardier, G., 37
Hardy, K., 153
Harned, S., 116
Harrand, Vincent J., 35
Harrington, James, Jr., 166
Harris, Clyde, 138
Harris, D. L., 52
Harrison, Thomas, 172
Hartley, Tom T., 128
Hartman, Kathy, 39
Harvey, Michael Stephen, 18
Hasegawa, S., 48
Hashimoto, T., 48
Hattam, P., 71
Hawryluk, R. J., 155
Hayat-Legrand, C., 129
Hays, D., 158
Hays, D. C., 158
Heather, Frederick W., 22
Hebner, G. A., 149
Hecht, J. H., 46
Heeg, Jennifer, 142
Heidmann, James D., 25
Heil, Michael C., 125
Henderson, D. O., 104
Henshaw, Micahel J. deC., 2
Hepner, T. A., 136
Herrett, T. A., 98
Herron, John T., 160, 161
Hess, W. P., 110
Hesselink, Lambertus, 76
Hester, Patricia Y., 122
Hickman, R. E., 97
Hill, Gary J., 176, 177
Hobson, W. S., 155, 158
Hodges, Dewey H., 18
Hogan, D. B., 117
Hogsett, B., 100
Holm, E. A., 162, 164
Holmes, Alan W., 120
Holmes, John J., 144
Holmes, V. P., 136
Holmquist, T. J., 65
Holmstrom, B. K., 99
Hong, J., 155
Hooker, Stanford B., 120, 121
Hornlein, J. F., 99
Horta, Lucas G., 19
Hosca, J. C., 157
Houston, J. E., 61, 163
Hrovat, Kenneth, 45
Hu, Hurang, 93
Huang, R. F., 73
Huang, XingZhong, 2
Hubbard, L. E., 98
Huffman, George, 118
Hughes, D. A., 162
Hughes, S. W., 51
Huie, Robert E., 160
Humbert, M., 29
Humphreys, William M., Jr., 150
Hunchak-Kariouk, K., 97
Huse, T., 116

I

Icardi, U., 51
Iemma, U., 15
Iliff, Kenneth W., 5
Imaishi, Nobuyuki, 56, 67
Ingersoll, D., 103
Ingram, W. J., 70
Inman, D. J., 6
Irion, F. W., 114
Irwin, L. W., 64
Ishmuratov, F., 4
Isogai, Koji, 20
Ivaldi, C. F., 117
Iwamiya, Toshiyuki, 93

J

Jacobson, S. B., 19
Jan W. Nowok,, 50
Jana, R., 139
Jana, Rittwik, 137
Janke, Erik, 76
Jankovsky, Robert S., 47
Jarausch, K. F., 163
Jarecki, R. L., 149
Jarrell, G. H., 120
Jennison, D. R., 58
Jensen, Brian J., 56
JG DeSteese,, 69
Jia, S., 153
Jiang, X., 67
Jits, Roman, 41
John P. Hurley,, 59, 89
John P. Kay,, 89
Johnson, B. Carol, 121
Johnson, D. J., 159
Johnson, E. C., 53
Johnson, Michael R., 140
Jones, E. D., 104, 164
Jordan, Jeff D., 10
Joseph, Kurt M., 125
Juang, Jer-Nan, 144
Jung, S. Y., 93
Jungst, R., 103

K

Kaiser, Mary Elizabeth, 177
Kakimoto, Koichi, 56
Kameda, Y., 130
Kanda, Atsushi, 28
Kandil, Osama A., 35
Kane, Stephen, 172
Kang, Hao, 23
Kapper, R., 46
Kare, Jordin T., 85
Karlander, J., 145
Karpel, Moti, 7
Katnik, Gregory N., 42
Kato, Nobuo, 123
Katz, N., 46
Kaye, S., 156
Kaynes, Ian W., 2
Keller, Jonathan A., 23
Kelley, T., 116
Kelly, J. J., 150
Kelly, Kristine L., 170
Kelm, Roland, 20
Kennedy, E. J., 114
Keskinen, M. J., 114
Keye, Stefan, 142
Kiely, J. D., 163
Kim, Byunghoon, 56
Kim, Myung-Hee Y., 175
Kim, Seock J., 160, 161
Kimura, Toshiya, 93
King, R. D., 75
Kiplinger, Alan L., 174
Kippen, R. Marc, 177
Kleb, William L., 77
Klein, Christian, 64
Kleppner, Daniel, 153
Klimov, S. I., 113
Knight, S., 73
Kobel, Mark, 77
Kogan, M. N., 77
Koiro, M. J., 25
Kolesnichenko, Y., 157
Kopia, Leonard P., 108
Korai, Yozo, 75
Korolyov, V. I., 37
Korzekwa, Richard A., 159
Kotula, P. G., 58
Kouzmin, V., 4
Kouzmina, S., 4
Kowlowitz, Alan, 170
Kraabel, Darren, 10

Kraft, R. E., 150, 151, 152
Krake, Keith, 1
Krile, Thomas F., 85
Kroliczek, Edward, 77
Ku, Cha-Hun, 75
Ku, Jentung, 77
Kubo, Kanji, 50
Kudritzki, Rolf-Peter, 171
Kummer, S., 37
Kun, Zhai, 30
Kunz, Donald, 34
Kurtz, S. R., 164
Kwan, H. W., 152

L

Lacock, D. L., 98
Lacy, Mark, 176, 177
Lahoz, W. A., 113
Lake, R. C., 131
Lambers, E. S., 155, 158
Landrini, M., 82
Lane, J., 71
Lane, K. W., 168
Langlois, Bernard, 36, 81
Langston, Jim, 136
Laprise, Bradley S., 127
Lau, May Yuen, 21
Lawrence, R. Wes, 108
LeBlanc, B. P., 157
Lecce, L., 30
Lee, B. H. K., 29, 93
Lee, J. W., 158
Lee, Robert B., III, 107, 174
Lefaudeux, Francois, 68
Lehmann, A. K., 98
Leib, Stewart J., 151
Lennon, Daniel J., 171
Lesar, R., 162
Letourneau, Matthew, 10
Leung, Andrew Y. T., 91
Levy, Yuval, 7
Lewis, Nate, 24
Leyshon, Gareth, 177
Li, Chiping, 57
Liauzin, Cedric, 75
Librescu, L., 51
Librescu, Liviu, 36
Liebeskind, Susan, 133
Likharev, Konstantin K., 130
Limsakul, Piya, 147
Lind, Rick, 27, 31, 37
Linebarger, J. M., 136
Liszewski, Michael J., 107
Little, M. C., 133, 137
Liu, Jingmei, 79
Liu, L., 93
Livne, Eli, 7, 16, 17, 36, 91, 92
Llorente, Ignacio M., 143
Lloyd, F. T., 97
Loehman, R., 54
Loeser, Thomas, 2
Lofgren, B. M., 100
Loftis, D. L., 100
Long, Knox S., 171, 172
Long, Lyle N., 79
Loomis, M. B., 110
Lopez, G. P., 61
Lorenzo, Carl F., 128
Luber, Wolfgang G., 88
Lugni, C., 82
Lund, D., 74
Lutsenko, V. V., 157
Luzzi, David E., 57
Lyne, James Evans, 41

M

Macklin, S. A., 120
Maddux, Gary, 169
Maghami, Peiman G., 144
Maguire, M. C., 59
Maguire, W., 126
Mahieu, E., 114
Majeski, R., 157
Maluf, David A., 143
Manney, G. L., 113
Mantegazza, P., 28
Marcus, Harris L., 64
Markley, F. Landis, 44
Marr, Gregory C., 40
Martin, J. J., 48
Martin, Terry W., 74
Martinez, Daniel A., 122
Martinson, Veloria J., 19
Masarati, P., 28
Maskalik, A. I., 9, 23
Maslov, Anatoly A., 5
Maslov, L. A., 81
Mason, J. P., 97
Mastroddi, F., 15, 33, 70
Mastroianni, Lee S., 60
Matjasic, Klaus, 10
Matveev, S., 129
Mauro, M. E., 58
Maury, Abigail H., 136
Mayer, T. M., 61
Mayes, R., 96
Maza, Jose, 172
Mazzocato, Maria Eugenia, 102
McCabe, D. E., 60
McCarrick, M., 114
McCarthy, M. I., 110
McCarthy, Thomas R., 18
McCluer, Megan, 152
McCollough, Mike L., 177
McEwan, Matthew I., 91
McGill, R. N., 67
McGowan, Anna-Maria Rivas, 33
McKay, M., 156
McKenzie, D. L., 46
McLean, G. A., 13
McPherson, John W., 139
McPherson, Kevin, 45
Means, Patricia A., 169
Medley, S. S., 156
Meegan, Charles A., 177
Meerbergen, K., 128
Mehlhorn, T. A., 159
Mehrl, David J., 85
Mei, C., 91
Mei, Chuh, 29, 151
Melson, N. Duane, 143
Melville, Reid B., 77
Mendoza, Alicia C., 167
Menon, Suresh, 55
Merkle, Charles L., 47
Merkle, J. G., 60
Metcalf, B. G., 168
Meyer, K. J., 48
Michelsen, H. A., 114
Miller, D. J., 136
Miller, D. T., 97
Miller, Jack, 175
Miller, S. L., 64
Miller, Scott, 172
Miller, W. M., 64
Milosavljevic, Radomir, 92
Mineau, David, 36
Miner, N. E., 148
Minnetyan, L., 52
Minnis, P., 114
Miodownik, M. A., 162
Missert, N., 58
Miszkiel, M. E., 59
Mitlitsky, Fred, 85
Miyoshi, K., 62
Miziolek, Andrzej W., 160, 161
Mochida, Isao, 75
Mocko, David M., 102
Modi, Anirudh, 79
Modine, N. A., 164
Moffat, H. K., 164

Molina, Louis A., 167
Molnar, S., 110
Mook, D. T., 6
Moore, Jonathan E., 74
Morales, C. A., 115
Morgan, David J., 146
Mori, Akira, 123
Morian, D. A., 67
Morino, L., 3, 15, 33
Moriyama, Shinya, 67
Moses, Robert W., 35
Mosounov, V., 4
Mottershead, John E., 143
Moulijn, Joost C., 82
Mouyon, P., 36
Mueller, Karl, 46
Mukhopadhyay, Vivek, 31
Mulks, R. L., 99
Mullen, Stephen P., 127
Muscettola, Nicola, 141
Musick, R., 169
Myers, R. A., 25

N

Nagchaudhuri, Abhijit, 44
Nakanishi, Kohji, 123
Naudin, Pierre, 2
Navarrete, M., 172
Naylor, Steven, 94
Nazikian, R., 156
ND Malcosky,, 69
Ndubizu, Chuka C., 57
Nebylov, A. V., 9
Neely, M. P., 136
Neiderman, E. C., 126
Neilsen, M. K., 164
Neiser, R. A., 67
Nelkin, Eric, 118
Nelson, Douglas, 115
Nenoff, T. M., 153
Newchurch, M. J., 114
Newman, Brett A., 21
Newman, S. J., 79
Ng, Daniel, 84
Nichols, C. A., 149
Nicolosi, F., 30
Nield, George C., 45
Nikolaeva, N. S., 113
Nixon, M. W., 28
Nixon, Mark W., 28
Nokes, J. P., 53
Noorbergen, H. H. S., 103
Northam, G. Burton, 88
Nowotarski, I., 34
Nusca, Michael J., 161
Nyden, M. R., 68
Nydick, I., 20

O

O, 98, 103
Ogle, K. M., 97
Olejnik, A., 34
Oliver, Margaret A., 134
Olmo, Frank J., 72
Olsen, Frederik, 115
Olson, D. L., 99
Olson, W. S., 115
Omar, Hanafy M., 34
Omoto, Mineko, 123
ONeill, A., 113
Onishi, Ryoichi, 93
Ono, M., 156
Oskam, B., 9
Ozoe, Hiroyuki, 56, 84

P

Paciesas, William S., 177
Paez, T. L., 103
Palac, Donald T., 26
Paliwoda, L., 70
Palvoelgyi, T., 110
Pandey, Dhirendra K., 108
Pappa, Richard S., 149
Paquet, J. B., 83
Pardo, Theresa A., 170
Parker, Terry, 10
Paszamant, C., 168
Patil, Mayuresh J., 18
Patricia L. Kleven,, 59
Pavli, Albert J., 47
Pearce, Cliff P., 115
Pearton, S. J., 61, 163
Pell, Barney, 141
Pendleton, Geoffrey N., 177
Peng, M., 156
Pennywitt, Kirk, 133
Perala, Rodney A., 14, 24
Perez, J. J., 172
Peterson, Chariya, 46
Peterson, J., 153
Pfaff, R., 156
Phan, Minh Q., 148
Phillips, M. M., 172
Piatak, David J., 28
Pidugu, S. B., 76
Pigeonneau, Franck, 78
Pincombe, A., 71
Platt, R., 43
Pohlchuck, B., 62
Pointon, T. D., 159
Ponzi, Claudio, 32
Poole, J. E., 98
Pope, David P., 57
Popelka, David A., 28
Prasad, Kuldeep, 57
Prask, H. J., 59
Pratt, Lawrence, 121
Preidikman, S., 6
Presente, E., 30
Presley, K. L., 26
Preston, J., 114
Price, C., 99
Pritchard, Jocelyn, 19
Pritchard, Jocelyn I., 149
Provencio, P., 153, 162
Prudhomme, S., 29
Putnam, J. E., 98

Q

Qiu, Y., 153

R

Rajadas, John N., 18
Rajendran, a. M., 65
Ramirez, J. A., 55
Ramos, G., 153
Ranade, S., 104
Ranno, F., 132
Rao, Gopalakrishna M., 105
Raveh, Daniella E., 7
Rawlings, Steve, 176, 177
Ray, S. E., 108
Raynolds, Robert, 115
Reboulet, C., 36
Reed, Brian D., 48
Reed, D., 116
Reid, John R., 145
Reiff, P. H., 113
Renk, T. J., 49
Reno, J. L., 166
Reuther, J., 16
Revak, James, 111
Reyes, M. Florencia, 167
Richards, T., 99
Richardson, Lance E., 109
Ricks, Ed, 42
Ridgway, Susan E., 176

Rieger, D. J., 61, 163
Rigby, David L., 25
Rijckenberg, G. J., 103
Rinsland, C. P., 113, 114
Ritz, G. F., 96
Ritzer, Darren R., 126
Ro, Jeng-Jong, 33
Roberts, P. T., 108
Roberts, S., 101
Rodden, William P., 7, 16
Rodriguez, M. A., 73
Rodriguez, P., 114
Roeder, Roland C., 63
Rogers, J. L., 137
Romanov, S. A., 113
Rosenberger, Franz, 163
Rosentreter, Jeffrey J., 107
Rosocha, Louis A., 159, 160, 161
Rotar, P., 116
Rowe, John, 46
Rowland, James H., III, 142
Rozhdestvensky, K. V., 8, 9
Rubadeux, K. L., 89
Ruiz-Calavera, Luis P., 2
Runck, A. M., 120
Ruppert, G. P., 98
Rushby, John, 138
Russell, C. T., 112, 113
Russell, P. E., 163
Rust, David M., 154
Rustenburg, John W., 11

S

Said, Jamil C., 41
Sakaguchi, Seiji, 50
Sako, B. H., 41
Sakurai, Tadamitsu, 50
Salas, A. O., 137
Salasoo, L., 75
Salawitch, R. J., 114
Salinger, A. G., 54
Saltzman, Edwin J., 5
Samareh, Jamshid A., 128
Sampath, S., 67
Samples, L. M., 55
Sanders, J. H., 62
Sangras, R., 54
Santee, William R., 127
Santoro, Robert J., 47
Saravanos, Dimitris A., 95
Sato, Tsuneyuki, 67
Savage, M., 89
Savchenko, V. T., 82
Savchenko, Y. N., 84
Savin, S. P., 113
Sawyer, Scott R., 141
Schaffstall, W. P., 101
Schatten, Heide, 66
Scheibner, K. F., 86
Schlain, Ed, 119
Schmidt, G. R., 48
Schneider, D. R., 98
Schneider, Nicholas M., 173
Schroeder, David J., 125
Schultz, P. A., 69
Schulze, Silvio, 27
Schumacher, Henry Jerry, 139
Schwartz, J., 75
Schweiger, Johannes, 32
Scott, J. A., 128
Seager, C. H., 149
Seaman, Lynn, 96
Seidel, Robert C., 169
Selvaggi, E., 30
Settle-Raskin, A., 73
Shah, Gautam H., 35
Shapovalov, V. I., 59
Shaw, M. J., 86
Sheldon, J., 153
Shelnutt, J. A., 153
Shen, Thomas C., 63
Sheta, Essam F., 35
Shiao, Michael C., 22
Shivakumar, K. N., 53
Shivastava, S. K., 132
Shrivastava, S. K., 132, 137
Shrout, Thomas R., 165
Shukla, Pooja, 166
Shumilkin, V. G., 77
Siegel, John M., Jr., 35
Silling, S. A., 92
Silva, Walter A., 3
Simmermacher, T., 96
Simmons, J. A., 166
Simonsen, Lisa C., 175
Sinapius, J. M., 131
Sinitsyn, D. N., 9, 23
Skaggs, S. R., 68
Skalsky, A. A., 112
Skinn, Donald, 11
Slater, Philip N., 120
Sleight, David W., 92
Smelyanskiy, Vadim N., 143
Smirnov, V. N., 112
Smith, Benjamin, 141
Smith, Edward C., 23
Smith, G. A., 48
Smith, G. Louis, 107
Smith, Timothy D., 47
Snyder, Aaron, 62
Snyder, D. B., 44
Snyder, M., 126
Soliman, M. M., 80
Son, K., 58
Stanley, Robert, 65
Steinheimer, J. T., 96
Stern, Daniel, 176
Stollberg, Mark, 177
Stratton, Jock, 119
Street, Kenneth W., 62
Stringer, J. W., 100
Stringer, T. A., 61
Striz, A. G., 93
Sture, Stein, 94
Sud, Y. C., 102
Suenaga, Hidetoshi, 56
Sun, Gregory, 87
Sundaresan, M. J., 53
Suntzeff, Nicholas B., 172
Surace, Giuseppe, 34
Sweetman, E., 71
Swinbank, R., 113
Syed, A. A., 151, 152
Syms, G. F., 80
Szabo, C. O., 99

T

Tadghighi, Hormoz, 152
Taghizad, A., 8
Tai, Tsze C., 79
Takacs, T., 110
Takeshita, Hitoshi, 123
Talbot, R. W., 110
Tamayama, Masato, 2
Tao, Wen Quan, 84
Tatem, Patricia A., 57
Tattersall, P., 80
Taylor, A., 135
Taylor, Richard, 137
Tebbutt, J. M., 131
Tedrow, Christine A., 13
Templeton, D. W., 65
Thoma, D. J., 58
Thomas, R. H., 150
Thomas, Susan, 108
Thome, Kurtis J., 120
Thompson, Homer H., 45
Thompson, Karl E., 154
Thompson, Richard C., 125
Tipps, Daniel O., 11
Tiwari, S. N ., 76

Todd, Emily N., 2, 6
Togna, A. P., 111
Tomlinson, John R., 143
Tozer, S. T., 164
Treharne, James Thomas, 144
Tseng, L. K., 54
Tulin, M. P., 83
Tungate, A. M., 98
Tzeng, Yonhua, 165

U

Udrescu, Radu, 34
Ueda, Tetsuhiko, 28
Ulstein, Tore, 82
Unruh, J. W., 96
Urashima, Kuniko, 160, 161
Uribe, R. M., 104
Urquhart, A. L., 113
Urry, Dan W., 63
Ustinov, M. V., 77

V

Vailas, Arthur C., 122
Vaisberg, , 112
Valentine, John N., 126
Valuev, N. O., 81
vanBeek, C. M., 9
vandenBroek, A. C., 103
Vandewart, R. L., 136
vanLeer, Bram, 77
vanPersie, M., 103
VanSpeybroeck, Leon, 172
Vardi, I., 71
Vayner, B. V., 43
Vekilov, Peter G., 163
Venturini, E., 60
Verbeke, C., 8
Viani, R., 101
Vitkalov, S. A., 166
Voevodin, A. a., 62
Voit-Nitschmann, Rudolf, 20
Vorobiev, Pavel Mikhailovich, 45
Voth, Gregory A., 58
Vuong, Hugh, 119

W

Waite, J. H., Jr., 112
Wakefield, N. H., 79
Walberg, Gerald, 41
Walborn, Nolan R., 171
Wall, F. D., 58
Wallin, K., 60
Wang, J. X. L., 107
Wang, K. Charles, 5
Wang, Liping, 90
Wang, P.-H., 113, 114
Watanabe, M., 48
Watanabe, Y., 48
Wawersik, W. R., 112
Wayland, M., 107
Webster, Todd S., 111
Weidow, David, 39
Weinman, J. A., 115
Wellman, G. W., 164
Welsberg, Andrew, 85
Wercinski, Paul, 41
Werkhoven, P. J., 127
Wheater, S. M., 132, 133
Whirley, J. Don, 139
White, D. L., 97
White, R. B., 157
White, Randolph C., Jr, 146
Whitfield, David L., 17
Whitlow, Jr., Woodrow, 6
Wikstrom, J. P., 63
Wilcox, D., 73
Wilder, J. G., 86
Wilkinson, C. H., 80
Williams, Clara A., 125
Williams, Ellen, 24
Williams, Kevin W., 14
Wilson, John W., 175
Wilson, P. A., 79
Wilson, Robert S., 174
Winer, Ward O., 24
Winstanley, D., 117
Wint, Steve, 167
Wise, Kent L., 56
Wong, Catherine R., 60
Wong, T. K. S., 29
Wong, Y. S., 29, 93
Wood, William A., 77
Woodard , Stanley E., 44
Woodard, Dan, 66
Woodrow Whitlow, Jr., 2
Woods, Pete, 177
Woolverton, J., 99
Worley, Jody A., 125
Wright, Darrell, 138
Wright, Jan R., 91, 94
Wu, R. L. C., 62

X

X. Z. Tang,, 148

Y

Yager, Thomas J., 22, 38
Yakovenko, Y. Z. S.J., 157
Yang, Mo, 84
Yang, Yonghua, 111
Yang, Zhi, 35
Yermolaev, I., 113
Yoder, Dennis A., 78
Yoshida, M., 48
Yu, J., 152

Z

Zabinski, J. S., 62
Zajd, H. J., 99
Zalewski, Edward F., 120
Zan, S. J., 80
Zander, R., 114
Zavadil, K. R., 58
Zdenek, Johan, 75
Zelenyi, L., 113
Zhang, W., 129
Zhang, Xing, 57
Zharinov, A. V., 81
Zhigalko, E. T., 9
Zhigulev, S. V., 77
Zhihua, Qiu, 30
Zhou, X-W., 113
Zhu, Y., 100
Zieschang, H., 129
Zinchuk, P. I., 8
Ziyad, Nigel, 46
Zurek, R. W., 113
Zweben, S. J., 156