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STAR

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Langley Research Center

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

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

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

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Subject Divisions

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H. Physics
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J. Space Sciences
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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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Subject Categories of the Division A. Aeronautics

01 Aeronautics (General) 1

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

02 Aerodynamics 2

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery. For related information, see also *34 Fluid Mechanics and Heat Transfer.*

03 Air Transportation and Safety 8

Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in *09 Research and Support Facilities (Air)*. Air traffic control is covered in *04 Aircraft Communications and Navigation*. For related information see also *16 Space Transportation and Safety*; and *85 Technology Utilization and Surface Transportation*.

04 Aircraft Communications and Navigation 10

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

05 Aircraft Design, Testing and Performance 11

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*. For land transportation vehicles, see *85 Technology Utilization and Surface Transportation*.

07 Aircraft Propulsion and Power 20

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 26

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

09 Research and Support Facilities (Air) 26

Includes airports, runways, hangers, and aircraft repair and overhaul facilities, wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport

ground equipment and systems. For airport ground operation see *03 Air Transportation and Safety.* For astronautical facilities see *14 Ground Support Systems and Facilities (Space).*

Subject Categories of the Division B. Astronautics

12 Astronautics (General) 28

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration, see *91 Lunar and Planetary Science and Exploration*.

15 Launch Vehicles and Launch Operations 29

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing, and Performance; and 20 Spacecraft Propulsion and Power.*

16 Space Transportation and Safety 32

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 *15 Launch Vehicles and Launch Vehicles,* 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 33

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

18 Spacecraft Design, Testing and Performance 34

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

19 Spacecraft Instrumentation and Astrionics 37

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

20 Spacecraft Propulsion and Power 38

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

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23 Chemistry and Materials (General) 41

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 24 through 29*. For astrochemistry see category *90 Astrophysics*.

24 Composite Materials 43

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

25 Inorganic, Organic, and Physical Chemistry 45

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

26 Metals and Metallic Materials 50

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

27 Nonmetallic Materials 52

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 57

Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

29 Space Processing 58

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

Subject Categories of the Division D. Engineering

31 Engineering (General) 60

Includes general research topics to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

32 Communications and Radar 62

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

33 Electronics and Electrical Engineering 70

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment. and microelectronics and integrated circuitry. For related information see also *60 Computer Operations and Hardware;* and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar.*

34 Fluid Mechanics and Thermodynamics 77

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics.*

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 Avionics and Aircraft Instrumentation;* and *19 Spacecraft Instrumentation*.

36 Lasers and Masers 89

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

37 Mechanical Engineering 91

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

38 Quality Assurance and Reliability 95

Includes approaches to, and methods for reliability analysis and control, inspection, maintainability, and standardization.

39 Structural Mechanics 95

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structure. For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

Subject Categories of the Division E. Geosciences

42 Geosciences (General) 98

Includes general research topics related to the Earth sciences, and the specific areas of petrology, minerology, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

43 Earth Resources and Remote Sensing 100

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

44 Energy Production and Conversion 120

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

45 Environment Pollution 123

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

46 Geophysics 129

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

47 Meteorology and Climatology 136

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48 Oceanography 139

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics, and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

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51 Life Sciences (General) 141

Includes general research topics related to plant and animal biology (non–human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

52 Aerospace Medicine 142

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

53 Behavioral Sciences 148

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

54 Man/System Technology and Life Support 150

Includes human factors engineering; bionics, man–machine, life support, space suits and protective clothing. For related information see also *16 Space Transportation* and *52 Aerospace Medicine.*

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Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

60 Computer Operations and Hardware 154

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

61 Computer Programming and Software 155

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

62 Computer Systems 174

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

63 Cybernetics, Artificial Intelligence and Robotics 180

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

65 Statistics and Probability 182

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

66 Systems Analysis and Operations Research 184

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

67 Theoretical Mathematics 185

Includes algebra, functional analysis, geometry, topology set theory, group theory and and number theory.

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70 Physics (General) 187

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics*, *90 Astrophysics*, or *92 Solar Physics*.

71 Acoustics 187

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution.* For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion Propulsion and Power.*

72 Atomic and Molecular Physics 191

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see *73 Nuclear Physics*.

73 Nuclear Physics 194

Includes nuclear particles; and reactor theory. For space radiation see *93 Space Radiation*. For atomic and molecular physics see *72 Atomic and Molecular Physics*. For elementary particle physics see *77 Physics of Elementary Particles and Fields*. For nuclear astrophysics see *90 Astrophysics*.

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75 Plasma Physics 201

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

76 Solid-State Physics 203

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

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82 Documentation and Information Science 215

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

Subject Categories of the Division J. Space Sciences

89 Astronomy 220

Includes observations of celestial bodies, astronomical instruments and techniques; radio, gamma-ray, x–ray, ultraviolet, and infrared astronomy; and astrometry.

90 Astrophysics 222

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

91 Lunar and Planetary Science and Exploration 227

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

92 Solar Physics 231

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

93 Space Radiation 232

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *52 Aerospace Medicine*. For theory see *73 Nuclear Physics.*

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Typical Report Citation and Abstract

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

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 38, JULY 28, 2000

01
AERONAUTICS (GENERAL)

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

20000061419 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment ***la Conception et l'Optimisation Aerodynamiques des Vehicules Aeriens Dans un Environnement Pluridisciplinaire et Simultane***
Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000; 385p; In English, 18-21 Oct. 1999, Ottawa, Canada; See also 20000061420 through 20000061451; CD-ROM contains full text document in PDF format
Report No.(s): RTO-MP-35; AC/323(AVT)TP/15; ISBN 92-837-1040-1; Copyright Waived; Avail: CASI; A17, Hardcopy; A04, Microfiche; C01, CD-ROM

The Symposium dealt with Design Issues and more specifically Aerodynamic Design and Optimization of Flight Vehicles in a Concurrent Multi-Disciplinary Environment. Thirty two papers and a Keynote address were presented with the objective to survey the current and future scene given the trend towards a more concurrent and multi-disciplinary approach to aerospace vehicle engineering. There were six sessions covering the following topics: Lessons Learnt/Requirements for the Future Regard to the Role of Aerodynamicists in a Concurrent Multi-Disciplinary Design Process; The Role of Aerodynamics in Concept Phase of a Project Design; MDO and the Aerodynamics Design Process; Methodologies/Tools for Aerodynamic Optimisation; Application of Methodologies/Tools for Aerodynamic Optimisation; Techniques for Rapid Database Generation.
Author
Conferences; Aerodynamics; Design Analysis; Flight Optimization

20000064579 NASA Ames Research Center, Moffett Field, CA USA
Welcome to the NASA High Performance Computing and Communications Computational Aerosciences (CAS) Workshop 2000
Schulbach, Catherine H., Editor, NASA Ames Research Center, USA; Welcome to the NASA High Performance Computing and Communications Computational Aerosciences (CAS) Workshop 2000; February 2000; In English; 5th, 15-17 Feb. 2000, Moffett Field, CA, USA; See also 20000064580 through 20000064627; CD-ROM contains full text document in PDF format
Contract(s)/Grant(s): RTOP 509-10-61
Report No.(s): D-000001; NONP-NASA-CD-2000078328; No Copyright; Avail: CASI; C01, CD-ROM

The purpose of the CAS workshop is to bring together NASA's scientists and engineers and their counterparts in industry, other government agencies, and academia working in the Computational Aerosciences and related fields. This workshop is part of the technology transfer plan of the NASA High Performance Computing and Communications (HPCC) Program. Specific objectives of the CAS workshop are to: (1) communicate the goals and objectives of HPCC and CAS, (2) promote and disseminate CAS technology within the appropriate technical communities, including NASA, industry, academia, and other government labs, (3) help promote synergy among CAS and other HPCC scientists, and (4) permit feedback from peer researchers on issues facing High Performance Computing in general and the CAS project in particular. This year we had a number of exciting presentations in the traditional aeronautics, aerospace sciences, and high-end computing areas and in the less familiar (to many of us affiliated with CAS) earth science, space science, and revolutionary computing areas. Presentations of more than 40 high quality papers

were organized into ten sessions and presented over the three-day workshop. The proceedings are organized here for easy access: by author, title and topic.
Author
Conferences; Software Engineering; Supercomputers; Parallel Processing (Computers)

20000066622 Department of Defense, Office of the Inspector General, Arlington, VA USA
Low-Rate Initial Production of the EA-6B Program
Dec. 18, 1992; 54p; In English
Report No.(s): AD-A377218; IG/DOD-93-039; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Navy EA-6B aircraft performs the electronic warfare mission of suppression and degradation of enemy electronic defense systems by use of tactical jamming. The last new production EA-6B aircraft was delivered in 1989. The total program office cost estimate for the five contracts involved in developing a remanufactured upgrade of the aircraft was $761 million. The estimated total production cost for performing the remanufacture upgrade on 102 EA-6B aircraft is $6.8 billion.
DTIC
Electronic Warfare; Electronic Aircraft; Computer Program Integrity

02
AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery. For related information, see also 34 Fluid Mechanics and Heat Transfer.

20000061420 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Warton, UK
Eurofighter: Aerodynamics within a Multi-Disciplinary Design Environment
McKay, Keith, British Aerospace Public Ltd. Co., UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 1-1 - 1-10; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

The art and science of aerodynamics have been developing continually to meet the changing needs of aircraft of all types, in many cases, combat aircraft design drives this development farther and faster in the search for improved combat effectiveness. One result has been that an ever broadening of the individual but heavily integrated aspects of aerodynamics into a set of interdependent, diverse fields, covering fluid dynamics, structural dynamics, solid body mechanics, ballistics, acoustics and more recently electro-magnetics. Together, these individual disciplines are combined together into a term sometimes referred to as aerodynamic technology, as described in a recent Royal Aeronautical Society edition. This paper will examine the requirements placed upon these disciplines in the light of the multi-disciplinary design optimisation process that took place on the Eurofighter project, specifically highlighting the roles of the aerodynamic technologies within that process and the lessons learned from their application in this environment. The paper will also provide some recommendations for improvements in the design capabilities based upon the experience gained and lessons learned from the design of the Eurofighter Weapon System.
Author
Aerodynamics; Aircraft Design; Dynamic Structural Analysis

20000061432 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Warton, UK
An MDO Application for a Weapon Released from an Internal Bay
Moretti, G., British Aerospace Public Ltd. Co., UK; Spicer, D., British Aerospace Public Ltd. Co., UK; Sharples, N., British Aerospace Public Ltd. Co., UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 14-1 - 14-12; In English; See also 20000061419; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Multi Disciplinary Optimisation (MDO) process has always been identified as an essential tool for the development of an aircraft design. Recent engineering emphasis has been on improving the depth of optimisation within a reduced overall time frame, a goal which depends on the level of automation available and the capability and skill of each discipline. The figure below shows an overview of the general design cycle in the military aircraft manufacturer's world. The large time spans involved in the full process should be appreciated: it may take between ten and twenty years to bring a new project to fruition.
Author
Optimization; Aircraft Design; Procedures

20000061433 Pisa Univ., Dipartimento di Ingegneria Aerospaziale, Italy

Aerodynamics for MDO of an Innovative Configuration

Bernardini, G., Pisa Univ., Italy; Frediana, A., Pisa Univ., Italy; Morino, L., Rome Univ., Italy; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 16-1 - 16-11; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

A numerical methodology for the evaluation of aero-dynamic 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 theoretical basis of the present methodology is briefly described. Comparisons with available, numerical and experimental results are included.

Author

Aerodynamic Loads; Numerical Analysis; Evaluation; Loads (Forces)

20000061443 Synaps Ingenieur-Gesellschaft m.b.H., Bremen, Germany

A Conceptual Design Methodology to Predict the Wave Drag of a Transonic Wing

Kribler, T., Synaps Ingenieur-Gesellschaft m.b.H., Germany; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 27-1 - 27-8; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

A conceptual design methodology to predict the wave drag of a transonic wing for use within multidisciplinary aircraft design was developed. to achieve this, a database of cross section designs optimized with respect to total drag was set up varying the design parameters Ma, t/c, C(sub L) and Re. Mathematical formulations for the aerodynamic cross section characteristics total drag, viscous drag and the local shock location were derived from the database as functions of the design parameters. The cross section wave drag was then derived using these formulations. A locally infinite swept wing is assumed and simple sweep theory using the shock sweep angle is used to transform the wave drag. The wave drag of a 3-D wing is predicted summing locally infinite swept wing sections in spanwise direction. The achieved drag prediction is accurate enough for use within conceptual aircraft design and predicts well the trends in wave drag development as a function of the design parameters Ma, t/c, C(sub L), Re and the wing planform.

Author

Aircraft Design; Design Analysis; Wave Drag; Transonic Flow; Wing Planforms

20000061444 Florida Univ., Dept. of Aerospace Engineering, Mechanics and Engineering Science, Gainesville, FL USA

Airfoil and Wing Planform Optimization for Micro Air Vehicles

Sloan, J. G., Florida Univ., USA; Shyy, W., Florida Univ., USA; Haftka, R. T., Florida Univ., USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 28-1 - 28-14; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

Low Reynolds number flight for micro air vehicles (microAVs) suffers from laminar separation resulting in reduced lift and increased drag. The objective of the present work is to use the response surface methodology (RSM) to identify correlations between the airfoil and the wing planform to facilitate a two-level optimization procedure in which an optimized airfoil and wing planform are reached simultaneously. Several approaches have been considered in this work. A constant cross-section wing is modeled with maximum camber, y(sub c), maximum thickness, y(sub t) and aspect ratio,AR, as design variables at two different Reynolds numbers of 8.0 x 10(exp 4) and 2.0 x 10(exp 5). This is done to determine how the optimal airfoil may change for different aspect ratios and Reynolds numbers. A variable cross-section wing defined by root camber and angle-of-attack and tip camber and angle-of-attack is modeled in order to determine how the optimal airfoil may change from the root to the tip of the wing. Due to the size restrictions on microAVs, a fixed-span approach is used to model an aircraft subject to the constraints of steady flight with the aspect ratio and camber as design variables. This third approach balances trade-offs between wing area, aspect ratio, and Reynolds number in determining the overall flight efficiency. Optimal airfoils exhibit characteristics which change little with wing aspect ratio or location on the wing planform. There appears to be a trend of increasing optimal camber with decreasing Reynolds number. While the optimal design seems to favor airfoils with minimum thickness and relatively modest camber of about 4 to 5% of the chord, a higher camber may be a better choice if higher lift coefficient at minimum power is used as a design goal. Measurements of both the global and the local response surface prediction accuracy combined with design space refinement help to assess the reliability of the response surface approximations and optimal design predictions.

Author

Airfoils; Wing Planforms; Optimization; Camber; Design Analysis; Low Reynolds Number

20000061446 Aerospatiale, Matra Missiles, Chatillon, France

Multi-Flight Condition Optimization of Three Dimensional Supersonic Inlets

Carrier, Gerald, Aerospatiale, France; Bourdeau, Christophe, Aerospatiale, France; Knight, Doyle, Rutgers Univ., USA; Kergaravat, Yan, Aerospatiale, France; Montazel, Xavier, Aerospatiale, France; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 30-1 - 30-10; In English; See also 20000061419

Contract(s)/Grant(s): DDM980001N; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper presents an innovative methodology to address the three-dimensional supersonic inlet design problem. An efficient and robust process allows to optimize the aerodynamic performance of inlets for multiple flight conditions. This optimization process links together an optimizer with a fast and accurate simulation tool into an automated optimization loop. The implementation of this new design technique and its applications to two different test cases are presented, namely, the optimization for a single cruise condition, and the optimization for a mission comprised of acceleration, cruise and maneuver phases. The mission-optimized inlet achieves better overall performance than the cruise-optimized inlet.

Author

Flight Conditions; Supersonic Inlets; Procedures; Three Dimensional Models

20000062458 NASA Glenn Research Center, Cleveland, OH USA

Aeroacoustics Computation for Nearly Fully Expanded Supersonic Jets Using the CE/SE Method

Loh, Ching Y., Taitech, Inc., USA; Hultgren, Lennart S., NASA Glenn Research Center, USA; Wang, Xiao Y., Taitech, Inc., USA; Chang, Sin-Chung, NASA Glenn Research Center, USA; Jorgenson, Philip C. E., NASA Glenn Research Center, USA; June 2000; 16p; In English; 6th; Aeroacoustics, 12-14 Jun. 2000, Maui, HI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS3-97186; RTOP 523-90-43

Report No.(s): NASA/TM-2000-210225; E-12345; NAS 1.15:210225; AIAA Paper 2000-2010; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper, the space-time conservation element solution element (CE/SE) method is tested in the classical axisymmetric jet instability problem, rendering good agreement with the linear theory. The CE/SE method is then applied to numerical simulations of several nearly fully expanded axisymmetric jet flows and their noise fields and qualitative agreement with available experimental and theoretical results is demonstrated.

Author

Aeroacoustics; Computation; Gas Jets; Supersonic Flow

20000063378 NASA Glenn Research Center, Cleveland, OH USA

Generalized Wall Function for Complex Turbulent Flows

Shih, Tsan-Hsing, NASA Glenn Research Center, USA; Povinelli, Louis A., NASA Glenn Research Center, USA; Liu, Nan-Suey, NASA Glenn Research Center, USA; Chen, Kuo-Huey, Toledo Univ., USA; June 2000; 14p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 522-31-23

Report No.(s): NASA/TM-2000-209936; E-12182; NAS 1.15:209936; ICOMP-2000-04; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A generalized wall function was proposed by Shih et al., (1999). It accounts the effect of pressure gradients on the flow near the wall. Theory shows that the effect of pressure gradients on the flow in the inertial sublayer is very significant and the standard wall function should be replaced by a generalized wall function. Since the theory is also valid for boundary layer flows toward separation, the generalized wall function may be applied to complex turbulent flows with acceleration, deceleration, separation and recirculation. This paper is to verify the generalized wall function with numerical simulations for boundary layer flows with various adverse and favorable pressure gradients, including flows about to separate. Furthermore, a general procedure of implementation of the generalized wall function for National Combustion Code (NCC) is described, it can be applied to both structured and unstructured CFD codes.

Author

Computational Fluid Dynamics; Turbulent Flow; Pressure Effects; Walls

20000063489 NASA Langley Research Center, Hampton, VA USA

X-38 Experimental Aerothermodynamics

Horvath, Thomas J., NASA Langley Research Center, USA; Berry, Scott A., NASA Langley Research Center, USA; Merski, N. Ronald, NASA Langley Research Center, USA; Fitzgerald, Steve M., NASA Johnson Space Center, USA; [2000]; 30p; In

English; 34th; 34th Thermophysics Conference, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Report No.(s): AIAA Paper 2000-2685; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The X-38 program seeks to demonstrate an autonomously returned orbital test flight vehicle to support the development of an operational Crew Return Vehicle for the International Space Station. The test flight, anticipated in 2002, is intended to demonstrate the entire mission profile of returning Space Station crew members safely back to earth in the event of medical or mechanical emergency. Integral to the formulation of the X-38 flight data book and the design of the thermal protection system, the aerothermodynamic environment is being defined through a synergistic combination of ground based testing and computational fluid dynamics. This report provides an overview of the hypersonic aerothermodynamic wind tunnel program conducted at the NASA Langley Research Center in support of the X-38 development. Global and discrete surface heat transfer force and moment, surface streamline patterns, and shock shapes were measured on scaled models of the proposed X-38 configuration in different test gases at Mach 6, 10 and 20. The test parametrics include angle of attack from 0 to 50 degs, unit Reynolds numbers from 0.3 x 10 (exp 6) to 16 x 10 (exp 6)/ ft, rudder deflections of 0, 2, and 5 deg. and body flap deflections from 0 to 30 deg. Results from hypersonic aerodynamic screening studies that were conducted as the configuration evolved to the present shape at, presented. Heavy gas simulation tests have indicated that the primary real gas effects on X-38 aerodynamics at trim conditions are expected to favorably influence flap effectiveness. Comparisons of the experimental heating and force and moment data to prediction and the current aerodynamic data book are highlighted. The effects of discrete roughness elements on boundary layer transition were investigated at Mach 6 and the development of a transition correlation for the X-38 vehicle is described. Extrapolation of ground based heating measurements to flight radiation equilibrium wall temperatures at Mach 6 and 10 were made and generally compared to within 50 deg F of flight prediction.
Author
Aerothermodynamics; International Space Station; X-38 Crew Return Vehicle; Flight Tests; Computational Fluid Dynamics; Hypersonic Wind Tunnels; Wind Tunnel Tests

20000064077 NASA Ames Research Center, Moffett Field, CA USA
Comment on 'Guidance for an Aerocapture Maneuver
Tauber, Michael E., NASA Ames Research Center, USA; Journal of Guidance, Control, and Dynamics; July - August 1994; Volume 17, No. 4, pp. 878-878; In English; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: Issuing Activity; Abstract Only

It is stated that the aerodynamic forces on the vehicle being aerocaptured are controlled by "altering the angle of attack" and thereby controlling the lift coefficient. Furthermore, the resulting variation of drag coefficient with angle of attack was ignored. The purpose of this Comment is to point out that an aerodynamic control method that is much more effective than the pitch modulation has been studied and utilized during entries for many years. During aerocapture, it is desirable to have a large range of lift coefficients available, while keeping the vehicle's ballistic coefficients constant. This is accomplished by modulating the vehicle's bank angle, i.e., by rolling the vehicle about its velocity vector. by this method, the angle of attack can be held constant (at the trim angle, if desired), and the C(sub D) and the ballistic coefficient remain constant. Furthermore, the vertical component of the normal force vector (essentially the lift) can be varied over its entire range, from maximum positive to maximum negative values. Reaction controls, rather than aerodynamic ones, are usually utilized to change the bank angle of the vehicle, thus requiring the use of fuel. However, the fuel expenditure that is required to change the bank angle is far less than the amount that would have to be used to continuously hold the vehicle at pitch angles that differ significantly from its trim angle of attack. Also, it has been shown that bank angle modulation to vary the lift can enlarge the entry corridor by increasing the entry angle for the undershoot boundary, where both the heating rate and deceleration reach a maximum. Finally, the crew's deceleration tolerance can be increased somewhat when the bank angle is varied, as opposed to the pitch angle. For bank modulation, the deceleration force vector can be kept at a constant angle with respect to the occupants whose tolerance to g loads is highest when the force is applied in a direction normal to the upper torso. The advantages of bank angle variation to modulate the lift vector were recognized long ago, and this method of control was used successfully on the Apollo command module during lunar return' and, more recently, for the Space Shuttle Orbiter.
Author
Aerocapture; Aerodynamic Forces; Angle of Attack; Control Surfaces; Pitch (Inclination)

20000064088 Technische Hogeschool Twente, Faculty of Applied Mathematics, Enschede, Netherlands
Performance of an Implicit Algorithm for Inviscid Flow Around an Airfoil
Strating, P.; vanBuuren, R.; Jun. 25, 1997; 22p; In English
Report No.(s): PB2000-104904; No Copyright; Avail: National Technical Information Service (NTIS)

The authors discuss the parallelization of an implicit solver for the 2d Euler equations on a structured grid. The spatial distribution involves the MUSCL scheme, a Total Variation Diminishing scheme. It is shown that an implicit solver that is based on quasi-Newton iteration and approximate factorization to solve the linear system of equations resulting from the Euler Backward scheme, has favorable properties for both multigrid acceleration and parallelization as compared to explicit Runge-Kutta time stepping. to preserve data locality, the authors apply domain decomposition to obtain a parallelizable code. Although the domain decomposition does affect the efficiency of the approximately factorization method, the results show that this hardly affects the convergence rate as obtained with a single block code. the accuracy with which the linear system of equations is solved is found to be an important parameter. The combination of parallel execution and implicit time integration provides an interesting perspective for time dependent problems in computational fluid dynamics.
NTIS
Algorithms; Inviscid Flow; Computational Fluid Dynamics

20000064608 NASA Ames Research Center, Moffett Field, CA USA
NASA's Aero-Space Technology
Milstead, Phil, NASA Ames Research Center, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This presentation reviews the three pillars and the associated goals of NASA's Aero-Space Technology Enterprise. The three pillars for success are: (1) Global Civil Aviation, (2) Revolutionary Technology Leaps, (3) Advanced Space Transportation. The associated goals of the first pillar are to reduce accidents, emissions, and cost, and to increase the aviation system capacity. The goals of the second pillar are to reduce transoceanic travel time, revolutionize general aviation aircraft, and improve development capacity. The goals associated with the third pillar are to reduce the launch cost for low earth orbit and to reduce travel time for planetary missions. In order to meet these goals NASA must provide next-generation design capability for new and or experimental craft which enable a balance between reducing components of the design cycle by up to 50% and or increasing the confidence in design by 50%. These next-generation design tools, concepts, and processes will revolutionize vehicle development. The presentation finally reviews the importance of modeling and simulation in achieving the goals.
CASI
Simulation; Models; NASA Programs; Space Programs; Technology Utilization

20000064627 Boeing Co., Phantom Works, Long Beach, CA USA
Viscous Design Optimization Using ADJIFOR - An HPCCP Perspective
Sundaram, P., Boeing Co., USA; Agrawal, Shreekant, Boeing Co., USA; Hager, James O., Boeing Co., USA; Carle, Alan, Rice Univ., USA; Fagan, Mike, Rice Univ., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The accurate computation of objective function sensitivity to design variable (DV) perturbations is the most crucial and expensive element of gradient-based optimization. In a nonlinear aerodynamic optimization problem, where the objective functions are computed based on Euler/Navier-Stokes codes, the computation of sensitivities becomes a computational challenge even for today's large parallel systems. The situation gets even worse in constrained aerodynamic shape optimizations where the number of DVs tend to be rather large. The finite-difference method of calculating gradients for these problems is ruled out for two reasons: prohibitive cost and approximation error. Adjoint methods are essential for calculating the gradients. Primary among the adjoint methods is the method of deriving the adjoints by posing the original continuous form of the problem as a calculus of variations problem. This method requires long and tedious analytical derivations and hand-differentiation of the underlying partial differential equations. Furthermore, turbulence models present in Navier-Stokes equation solvers complicate the construction of adjoint codes. Consequently, few commercial Navier-Stokes adjoint codes are available, and those that are available cannot be easily adapted for use in the desired design environment. Automatic differentiation (AD) using ADIFOR has been known for sometime to be an accurate method of calculating analytical sensitivities of a FORTRAN function code. The forward-mode ADIFOR and adjoint-mode ADJIFOR tools (both components of the soon to be released ADIFOR 3.0 System) automatically enhance function codes with code to compute the required derivatives. In the past year, sensitivity calculations performed by ADIFOR and ADJIFOR-differentiated codes have shown great promise. In last year's HPCCP/CAS workshop, we presented initial results using an ADJIFOR-differentiated version of the CFL3D/Euler code on a shape design optimization problem. The present paper provides further details on the use of the derivative-enhanced CFL3D code as the basis of an automated design environment. In addition, the paper presents a successful HSCT configuration design discovered using this environment on the NAS Origin 2000 parallel system. This success on the CFL3D/Euler code has led to the application of ADJIFOR to compute flow sensitivities for the CFL3D/Navier-Stokes code. The paper compares gradient accuracy and time requirements for computing Navier-Stokes flow sensitivities using both ADIFOR and ADJIFOR-differentiated codes and describes additional steps taken to improve the effi-

ciency of the generated derivative code. Finally, the paper describes the trials and tribulations of adapting ADJIFOR-processed CFL3D viscous gradients for the aerodynamic shape optimization-based design environment to the NAS Origin 2000 and applying it to HSCT configuration design problem.
Author
Applications Programs (Computers); Computational Fluid Dynamics; Design Analysis; Navier-Stokes Equation; Optimization; Computer Systems Design; Computerized Simulation; Mathematical Models

20000064715 Mississippi State Univ., Dept. of Aerospace Engineering, Mississippi State, MS USA
Aero-Structural Interaction, Analysis, and Shape Sensitivity, *1 Jan. - 31 Dec. 1999*
Newman, James C., III, Mississippi State Univ., USA; [1999]; 11p; In English
Contract(s)/Grant(s): NCC1-286
Report No.(s): AIAA Paper 99-3101; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A multidisciplinary sensitivity analysis technique that has been shown to be independent of step-size selection is examined further. The accuracy of this step-size independent technique, which uses complex variables for determining sensitivity derivatives, has been previously established. The primary focus of this work is to validate the aero-structural analysis procedure currently being used. This validation consists of comparing computed and experimental data obtained for an Aeroelastic Research Wing (ARW-2). Since the aero-structural analysis procedure has the complex variable modifications already included into the software, sensitivity derivatives can automatically be computed. Other than for design purposes, sensitivity derivatives can be used for predicting the solution at nearby conditions. The use of sensitivity derivatives for predicting the aero-structural characteristics of this configuration is demonstrated.
Author
Aeroelasticity; Structural Analysis; Sensitivity; Structural Design; Design Analysis; Shapes

20000067656 NASA Langley Research Center, Hampton, VA USA
Exploratory Investigation of Aerodynamic Characteristics of Helicopter Tail Boom Cross-Section Models with Passive Venting
Banks, Daniel W., NASA Dryden Flight Research Center, USA; Kelley, Henry L., Army Aviation and Missile Command, USA; June 2000; 52p; In English
Contract(s)/Grant(s): RTOP 10-11-01
Report No.(s): NASA/TP-2000-210083; NAS 1.60:210083; AMCOM-AFDD/TR-00-A-007; L-17770; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Two large-scale, two-dimensional helicopter tail boom models were used to determine the effects of passive venting on boom down loads and side forces in hovering crosswind conditions. The models were oval shaped and trapezoidal shaped. Completely porous and solid configurations, partial venting in various symmetric and asymmetric configurations, and strakes were tested. Calculations were made to evaluate the trends of venting and strakes on power required when applied to a UH-60 class helicopter. Compared with the UH-60 baseline, passive venting reduced side force but increased down load at flow conditions representing right sideward flight. Selective asymmetric venting resulted in side force benefits close to the fully porous case. Calculated trends on the effects of venting on power required indicated that the high asymmetric oval configuration was the most effective venting configuration for side force reduction, and the high asymmetric with a single strake was the most effective for overall power reduction. Also, curves of side force versus flow angle were noticeable smoother for the vented configurations compared with the solid baseline configuration; this indicated a potential for smoother flight in low-speed crosswind conditions.
Author
Aerodynamic Characteristics; Helicopters; Strakes; Aerodynamic Configurations; Two Dimensional Models; Tail Assemblies

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation. For related information see also 16 Space Transportation and Safety; and 85 Technology Utilization and Surface Transportation.

20000062019 NASA Langley Research Center, Hampton, VA USA

Comparison of Pilots' Situational Awareness While Monitoring Autoland Approaches Using Conventional and Advanced Flight Display Formats

Kramer, Lynda J., NASA Langley Research Center, USA; Busquets, Anthony M., NASA Langley Research Center, USA; May 2000; 125p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 522-19-11-01

Report No.(s): NASA/TP-2000-210284; NAS 1.60:210284; L-17981; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A simulation experiment was performed to assess situation awareness (SA) and workload of pilots while monitoring simulated autoland operations in Instrument Meteorological Conditions with three advanced display concepts: two enhanced electronic flight information system (EFIS)-type display concepts and one totally synthetic, integrated pictorial display concept. Each concept incorporated sensor-derived wireframe runway and iconic depictions of sensor-detected traffic in different locations on the display media. Various scenarios, involving conflicting traffic situation assessments, main display failures, and navigation/autopilot system errors, were used to assess the pilots' SA and workload during autoland approaches with the display concepts. From the results, for each scenario, the integrated pictorial display concept provided the pilots with statistically equivalent or substantially improved SA over the other display concepts. In addition to increased SA, subjective rankings indicated that the pictorial concept offered reductions in overall pilot workload (in both mean ranking and spread) over the two enhanced EFIS-type display concepts. Out of the display concepts flown, the pilots ranked the pictorial concept as the display that was easiest to use to maintain situational awareness, to monitor an autoland approach, to interpret information from the runway and obstacle detecting sensor systems, and to make the decision to go around.

Author

Flight Simulation; Automatic Pilots; Display Devices; Workloads (Psychophysiology); Navigation Aids; Control Simulation; Guidance Sensors; Head-Up Displays

20000062844 National Transportation Safety Board, Washington, DC USA

Aircraft Accident Report: Controlled Flight into Terrain Korean Air Flight 801, Boeing 747-300, HL7468, Nimitz Hill, Guam, August 6, 1997

Jan. 13, 2000; 222p; In English

Report No.(s): AD-A377407; NTSB/AAR-00/01; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

On August 6, 1997, about 0142:26 Guam local time, Korean Air flight 801, a Boeing 747-3B5B (747-300), Korean registration 11L7468, operated by Korean Air Company, Ltd., crashed at Nimitz Hill, Guam. Flight 801 departed from Kimpo International Airport, Seoul, Korea, with 2 pilots, 1 flight engineer, 14 flight attendants, and 237 passengers on board. The airplane had been cleared to land on runway 6 Left at A.B. Won Guam International Airport, Agana, Guam, and crashed into high terrain about 3 miles southwest of the airport. of the 254 persons on board, 228 were killed, and 23 passengers and 3 flight attendants survived the accident with serious injuries. The airplane was destroyed by impact forces and a postcrash fire. Flight 801 was operating in U.S. airspace as a regularly scheduled international passenger service flight under the Convention on International Civil Aviation and the provisions of 14 Code of Federal Regulations Part 129 and was on an instrument flight rules flight plan. The National Transportation Safety Board determines that the probable cause of the Korean Air flight 801 accident was the captain's failure to adequately brief and execute the nonprecision approach and the first officer's and flight engineer's failure to effectively monitor and cross-check the captain's execution of the approach. Contributing to these failures were the captain's fatigue and Korean Air's inadequate flight crew training. Contributing to the accident was the Federal Aviation Administration's (FAA) intentional inhibition of the minimum safe altitude warning system (MSAW) at Guam and the agency's failure to adequately manage the system. The safety issues in this report focus on flight crew performance, approach procedures, and pilot training; air traffic control, including controller performance and the intentional inhibition of the MSAW system at Guam; emergency response; the adequacy of Korean Civil Aviation Bureau (KCAB) and FAA over

DTIC

Aircraft Accidents; Pilot Error; Human Performance; Flight Crews; Education; Pilot Training

20000063509 NASA Glenn Research Center, Cleveland, OH USA

Freezing Rain as an In-Flight Icing Hazard

Bernstein, Ben C., National Center for Atmospheric Research, USA; Ratvasky, Thomas P., NASA Glenn Research Center, USA; Miller, Dean R., NASA Glenn Research Center, USA; McDonough, Frank, National Center for Atmospheric Research, USA; June 2000; 12p; In English; 8th; Aviation, Range and Aerospace Meteorology, 10-15 Jan. 1999, Dallas, TX, USA; Sponsored by American Meteorological Society, USA

Contract(s)/Grant(s): NAS3-88; RTOP 548-21-23

Report No.(s): NASA/TM-2000-210058; E-12260; NAS 1.15:210058; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Exposure to supercooled large drops (SLD-subfreezing water droplets with diameters greater than approx. 50 microns) can pose a significant threat to the safety of some aircraft. Although SLD includes both freezing drizzle (FZDZ) and freezing rain (FZRA), much of the SLD research and development of operational SLD forecast tools has focused on FZDZ and ignored FZRA, regarding is as less of a hazard to aviation. This paper provides a counterpoint case study that demonstrates FZRA as a significant in-flight icing hazard. The case study is based on flight and meteorological data from a joint NASA/FAA/NCAR SLD icing research project collected on February 4, 1998. The NASA Twin Otter Icing Research Aircraft experienced a prolonged exposure to ”classical” FZRA that formed extensive ice formations including ridges and nodules on the wing and tail, and resulted in a substantial performance penalty. Although the case study provides only a singular FZRA event with one aircraft type, it is clear that classical FZRA can pose a significant in-flight icing hazard, and should not be ignored when considering SLD issues.

Author

Freezing; Ice Formation; Drop Size; Forecasting; Meteorological Parameters; Rain

20000065634 Instituto Nacional de Tecnica Aeroespacial, Torrejon de Ardoz, Spain

Development of an Ice Accretion Prediction Code: Calculation of Efficiency Collection Module ***Desarrollo de un Codigo de Simulacion de Hielo: Modelo de Calculo de la Eficiencia de Captacion***

Duran, Jose Antonio Aparicio, Instituto Nacional de Tecnica Aeroespacial, Spain; March 2000; 50p; In Spanish

Report No.(s): TNO/4410/003/INTA/00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is part of a research project to develop a 2D ice accretion prediction code, called CODICE. This report focuses upon the subroutines which calculate the ice droplet trajectory and efficiency collection, in simple and multicomponent (profile with flap) airfoils, combined into a code called ICETRAJECT. This code can be used both with structured and unstructured grids. With regard to unstructured grids it has been developed a new interpolation method based on QUADTREE generation and linked lists data structure. This method improves the interpolation process in this kind of meshes to get velocity field flow, needed to calculate droplet trajectories. The velocity field flow, which is the input of ICETRAJECT can be computated by any external structured and unstructured solver.

Author

Ice Formation; Prediction Analysis Techniques; Applications Programs (Computers); Drops (Liquids); Trajectories

20000065678 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Examining Air Mobility Command Support to the Expeditionary Aerospace Force

Gimbus, Martin T.; Jun. 1999; 57p; In English

Report No.(s): AD-A372348; AFIT/GMO/LAL/99Y-5; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Air Force has been tasked at an ever-increasing rate to support contingency operations around the world. These operations range from providing relief supplies to hurricane victims to providing combat firepower to enforce no-fly zones in Southwest Asia. As the Air Force responds to these contingencies, its opstempo has risen dramatically. The family lives of Air Force people are disrupted by the frequent and unpredictable deployments, which pushes experienced people out of the service. to counter these almost daily crises, the Air Force is creating a new organizational structure, the Expeditionary Aerospace Forces. The structure is based on providing light, lean forces, tailored to each individual contingency that allows rapid and decisive response to any potential crisis. This concept allows stability by providing a 15-month fixed schedule of what units would deploy and when. This paper examines the support required by Air Mobility Command’s airlift and air refueling assets under the Expeditionary concept. It focuses on the expected workload in deployment days for crews. The research compares current opstempo with the opstempo associated with past Air Expeditionary Force-type deployments and expected workload from the new concept. The results of the research depict a slight increase in opstempo under the Expeditionary concept but also discusses other possible reasons for the increase.

DTIC

Mobility; Support Systems; Aerospace Systems

20000066577 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Reducing Aircraft Quick-Turn Ground Times in the European Environment

Carlson, Karn L.; Jan. 1999; 47p; In English

Report No.(s): AD-A372327; AFIT/GMO/LAL/99Y-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Air Force has a limited number of air mobility aircraft and aircrews and these resources are becoming increasingly strained. Added to this, our workload is increasing - we are involved in an ever-increasing number of operations and exercises. Instead of working harder we need to work smarter, by looking for ways to process our aircraft more quickly and efficiently, yet maintain the needed safety standards.

DTIC

Flight Crews; Mobility

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

20000061967 Computer Sciences Corp., Lanham, MD USA

Autonomous Relative Navigation for Formation-Flying Satellites Using GPS

Gramling, Cheryl, NASA Goddard Space Flight Center, USA; Carpenter, J. Russell, NASA Goddard Space Flight Center, USA; Long, Anne, Computer Sciences Corp., USA; Kelbel, David, Computer Sciences Corp., USA; Lee, Taesul, Computer Sciences Corp., USA; [2000]; 10p; In English; 15th; Spaceflight Dynamics, Jun. 2000, Biarritz, France

Contract(s)/Grant(s): GS-35F-4381G; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Goddard Space Flight Center is currently developing advanced spacecraft systems to provide autonomous navigation and control of formation flyers. This paper discusses autonomous relative navigation performance for a formation of four eccentric, medium-altitude Earth-orbiting satellites using Global Positioning System (GPS) Standard Positioning Service (SPS) and ”GPS-like ” intersatellite measurements. The performance of several candidate relative navigation approaches is evaluated. These analyses indicate that an autonomous relative navigation position accuracy of 1meter root-mean-square can be achieved by differencing high-accuracy filtered solutions if only measurements from common GPS space vehicles are used in the independently estimated solutions.

Author

Global Positioning System; Autonomous Navigation; Satellites; Guidance (Motion)

20000063533 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

JPL Global GPS Network

Moore, A. W., Jet Propulsion Lab., California Inst. of Tech., USA; Stowers, D. A., Jet Propulsion Lab., California Inst. of Tech., USA; Khachikyan, R., Jet Propulsion Lab., California Inst. of Tech., USA; Marcin, M. R., Jet Propulsion Lab., California Inst. of Tech., USA; Harris, I. L., Jet Propulsion Lab., California Inst. of Tech., USA; Zumberge, J. F., Jet Propulsion Lab., California Inst. of Tech., USA; [1998]; 10p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The research described in this viewgraph was carried out by the Jet Propulsion Laboratory (JPL), California Institute of Technology, under a contract with the National Aeronautics and Space Administration (NASA). JPL currently operates more than 55 permanent, continuously operating GPS ground stations for NASA many in conjunction with international and regional agencies. The data are automatically uploaded from the remote stations, processed, and distributed, with a high degree of reliability.

Derived from text

Global Positioning System; NASA Programs; Data Processing; Networks

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles, see 85 Technology Utilization and Surface Transportation.

20000061421 Boeing Phantom Works, Air Vehicle Advanced Design, Long Beach, CA USA
The Future Role of Virtual Design Teams
Guthrie, Charlie, Boeing Phantom Works, USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 2-1 - 2-3; In English; See also 20000061419; Copyright Waived; Avail: CASI; A01, Hardcopy

This keynote presentation will discuss the role that our aerospace engineers and their design teams and tools will play in the ”Virtual” design office of the future. Dramatically improving information technology is rapidly changing the design environment and the potential capability of the design toolsets. Along with these improvements in capability, there is a change in our expectations and requirements for both the design teams and the tools that enable the design teams to accomplish their tasks.
Author
Engineers; Information Systems

20000061423 Lockheed Martin Corp., Skunk Works, Palmdale, CA USA
Role of the Aerodynamicist in a Concurrent Multi-Disciplinary Design Process
Nicolai, Leland M., Lockheed Martin Corp., USA; Carty, Atherton, Lockheed Martin Corp., USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 4-1 - 4-14; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

As the affordability of new aircraft and missile systems becomes an essential element of new development programs, the time spent in the early design (conceptual and preliminary design) needs to be reduced. This paper will address the time and activities associated with the conceptual and preliminary design of an aircraft, the role of the aerodynamicist in this early design period and the tools that he uses. The question of how the design time can be shortened will be discussed and what the aerodynamicist can do about it.
Author
Design Analysis; Time Dependence; Aircraft Design

20000061424 Cranfield Univ., Coll. of Aeronautics, Cranfield, UK
Learning Through Experience: Group Design Projects on the Masters Course in Aircraft Engineering
Jones, R. I., Cranfield Univ., UK; Scott, R. G., British Aerospace, UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 5-1 - 5-11; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

The successful completion of aerospace projects usually involves the bringing together of many different specialist skills. The need for aerospace engineers to be conversant with many disciplines and aware of the many facets of a project is today’s reality. However, in today’s working environment it is becoming increasingly difficult for individuals to achieve the necessary experience, with the timescales for major aerospace projects getting ever longer and their number decreasing. The Group Design Projects within the Aircraft Engineering course have the specific purpose of addressing this issue. They provide the opportunity for aerospace engineers from a range of disciplines to be involved in a real project, with many of the difficulties and constraints of those they will meet in their working lives. These projects progress through the full design process and provide this experience within a limited time period and, relatively, limited risk environment. In addition to meeting their basic objective, Group Design Projects commenced to-date have proved very demanding but provided further benefits to all concerned.
Author
Flat Surfaces; Design Analysis; Education

20000061425 Pisa Univ., Dept. of Aerospace Engineering, Italy
An Optimisation Procedure for the Conceptual Analysis of Different Aerodynamic Configurations
Lombardi, G., Pisa Univ., Italy; Mengali, G., Pisa Univ., Italy; Beux, F., Scuola Normale Superiore, Italy; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 6-1 - 6-10; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper addresses the problem to define a methodology for the analysis of the performances of different aircraft configurations in the phase of conceptual design. The proposed approach is based on a numerical optimisation procedure where a scalar objective function, the take-off weight, is minimized. The optimisation algorithm has obviously important consequences both from the point of view of the computational times and of the obtained results. For this reason a preliminary discussion is made where various different methodologies are critically compared. Although the best compromise between different approaches is probably given by an integration between a genetic algorithm approach and a classical gradient method, in this phase only the latter procedure has been used to pe$orm the simulations. The methodology takes into account the high number of geometrical parameters and the flight mechanics requirements involved in the problem. A basic example is described, and the use of the proposed methodology to investigate the effects of different geometrical and technological parameters is discussed.
Author
Aerodynamic Configurations; Aircraft Configurations; Measure and Integration; Optimization

20000061426 NASA Ames Research Center, Moffett Field, CA USA
Aero-Mechanical Design Methodology for Subsonic Civil Transport High-Lift Systems
vanDam, C. P., California Univ., USA; Shaw, S. G., California Univ., USA; VanderKam, J. C., California Univ., USA; Brodeur, R. R., California Univ., USA; Rudolph, P. K. C., PKCR, Inc., USA; Kinney, D., NASA Ames Research Center, USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 7-1 - 7-12; In English; See also 20000061419
Contract(s)/Grant(s): NCC2-5188; NCC2-5255; SNL-A0273; A46374D(LAS); A49736D(SLS); Copyright Waived; Avail: CASI; A03, Hardcopy

In today's highly competitive and economically driven commercial aviation market, the trend is to make aircraft systems simpler and to shorten their design cycle which reduces recurring, non-recurring and operating costs. One such system is the high-lift system. A methodology has been developed which merges aerodynamic data with kinematic analysis of the trailing-edge flap mechanism with minimum mechanism definition required. This methodology provides quick and accurate aerodynamic performance prediction for a given flap deployment mechanism early on in the high-lift system preliminary design stage. Sample analysis results for four different deployment mechanisms are presented as well as descriptions of the aerodynamic and mechanism data required for evaluation. Extensions to interactive design capabilities are also discussed.
Author
Procedures; Design Analysis; Subsonic Speed; Operating Costs; Kinematics; Commercial Aircraft; Aerodynamic Characteristics

20000061427 Defence Evaluation Research Agency, Farnborough, UK
Conceptual Design and Optimisation of Modern Combat Aircraft
Crawford, C. A., Defence Evaluation Research Agency, UK; Simm, S. E., Defence Evaluation Research Agency, UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 8-1 - 8-11; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

The design of a combat aircraft is an extremely complex task, due to the large range of design variables available. A fundamental understanding of the effects of changes to these variables, and to changes in design/performance requirements, is necessary to achieve a balanced design. At the Defence Evaluation and Research Agency (DERA) this is achieved with the help of conceptual design and optimisation programs, developed and used extensively over the past 20 years or so. These Multi-Variate Optimisation (MVO) programs are rapid assessment tools, enabling the effects of variations in design variables and performance requirements, in terms of overall aircraft sizing and geometric shape. to be quickly demonstrated. The programs are used routinely within the Air Vehicle Performance Group at DERA to conduct trade-off studies. These include assessments of the benefits of new technologies (e.g. in the fields of structures, aerodynamics or engines) and the impact of setting various levels of performance requirement. The results provide information and advice to the military customer, aiding balance of investment decisions and helping with initial concept definition.
Author
Design Analysis; Aircraft Design; Fighter Aircraft

20000061428 Dassault Aviation, Saint-Cloud, France
Multi-Disciplinary Constraints in Aerodynamic Design
Perrier, P., Dassault Aviation, France; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 10-1 - 10-12; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

A long tradition of aerodynamic design of combat vehicles shows that the expression of the targets and the constraints in the design are always difficult to select. Present long iteration processes hide such variable target/constraints continuous reassessment. Every processes of design unable to have flexibility in target/constraint handling is unusable. Fortunately, the geometrical constraints are now better handled in new CAD software with features modeling. The present development of new constrained features modeling will be described from its basic expression to the more complex and variable topology configuration. Fitting the optimization process to the physics of multidisciplinary constraints may not be as easy as for geometry. It is proposed to select a family of constrained variations of geometry, each able to cope with a specific physical optimization and to generate a multiprojection of the multi-constrained operators. Some conceptual examples of such processes will be presented in the case of aeroelastic design electromagnetic design and actively controlled configurations with variable geometry for improvement of flow control. The specific domains of use of deterministic and stochastic (genetic) algorithm and of self-adaptation by training (neural network) will be assessed. New strategies will be proposed for sharing the work of optimization between different companies cooperating to the design of advanced aerospace vehicles.
Author
Aerodynamics; Design Analysis; Active Control; Aerospace Vehicles; Complex Variables; Computer Aided Design

20000061429 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Warton, UK
Aspects of Aerodynamic Optimisation for Military Aircraft Design
Probert, B., British Aerospace Public Ltd. Co., UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 11-1 - 11-12; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

The paper considers the role of various optimisation strategies in the aerodynamic design of military combat aircraft. The multi - design point targets of military aircraft implies that the final product must achieve a carefully judged balance between, often conflicting, requirements. The current established way of working to achieve this ”balance” is first reviewed including the use of rule based procedures, the application of linearised CFD codes in both direct and inverse/optimisation modes, and the role of initial experimental data leading on to more detailed CFD work and experimental verification. Practical examples are given relating to the design of various projects including the Experimental Aircraft Programme (EAP), which was the forerunner of Eurotighter. The need for improvements is identified, being primarily brought about by considerations of affordability and reduced design cycle time and also by the challenge posed from novel configurations to met low observability requirements. The means of achieving these improvements is discussed, and these imply the development of Multi Disciplinary Optimisation (MDO) in a wide sense. Numerical optimisation experience is reviewed but it is strongly emphasised that there is a need for rapid experimental input to the configuration design choice programme. Means of achieving this are discussed and examples given. The high incidence requirements have a strong impact on CFD developments and areas of improvement are identified. This leads to a proposed new way of working implying a much stronger interaction between the initial and detailed design phases of aircraft design.
Author
Aircraft Design; Optimization; Aerodynamics; Computational Fluid Dynamics

20000061430 Defence Evaluation Research Agency, Aerodynamics and Hydrodynamics Centre, Farnborough, UK
Progress Towards a Multi-disciplinary Analysis and Optimisation Capability for Air Vehicle Assessment and Design: A UK Research Establishment View
Lovell, David, Defence Evaluation Research Agency, UK; Bartholomew, Peter, Defence Evaluation Research Agency, UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 12-1 - 12-11; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper considers progress towards establishing a Multi-disciplinary Design Optimisation (MDO) capability for assessment and design. Some basic questions are posed and answered on the basis of experience gained by DERA as a result of participation in a series of recent National and International projects undertaken in partnership with UK and European industry and government research agencies. Issues addressed include the definition of MDO: its function within concurrent engineering: the role of product models; the definition and execution of the MD0 process under users control; the use of trade-off studies for requirements capture: and the degree to which MD0 can support detailed design work. The need for the adoption of standards in the definition of the product model is highlighted.
Author
Design Analysis; Optimization; Aircraft Design

20000061431 Defence Evaluation Research Agency, UK

The Application of Pareto Frontier Methods in the Multidisciplinary Wing Design of a Generic Modern Military Delta Aircraft

Fenwick, Steven V., Defence Evaluation Research Agency, UK; Harris, John C., Defence Evaluation Research Agency, UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 13-1 - 13-7; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

As a partner in the EC Framework IV ”FRONTIER” project, DERA has investigated the application of a genetic algorithm (GA) and Pareto frontier methods to optimize the trade-off between multiple design objectives. A Pareto frontier is defined as the limit of design space beyond which one attribute of a design cannot be improved without detriment to another. DERA has applied the software produced within the project to the multidisciplinary design of the wing of a generic modern military delta aircraft, to trade-off the conflicting design requirements of range and agility. This paper recounts DERA’s experience of the methods as an approach to the solution of a trial multidisciplinary design and optimisation (MDO) problem together with some of the results produced. Details of the software produced within the project are provided, along with conclusions and recommendations from its use.

Author

Wings; Design Analysis; Computer Design; Genetic Algorithms

20000061436 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Design Aerodynamics, Brunswick, Germany

A System for the Aerodynamic Optimization of Three-Dimensional Configurations

Orlowski, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Tang, W., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 19-1 - 19-13; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

The paper presents a system for the aerodynamic optimization of three-dimensional configurations. This system is based on the repeated calculation of the flowfield around three-dimensional geometries by solving the Euler/Navier-Stokes equations. The basic structure of the system and the incorporated modules are described. Under the same conditions the system must provide the same solutions of classic aerodynamic optimization problems as given in literature. So the function of the system is checked with the Rhombus airfoil and the Sears-Haack body. The potential of the system is demonstrated with current aerodynamic optimization problems.

Author

Aerodynamic Configurations; Optimization; Three Dimensional Models

20000061437 Alenia Spazio S.p.A., Divisione Aeronautica, Turin, Italy

Alenia Multidisciplinary Design Optimisation: Topics and Approaches

Selmin, V., Alenia Spazio S.p.A., Italy; Vitagliano, P. O., Alenia Spazio S.p.A., Italy; Pennavaria, A., Alenia Spazio S.p.A., Italy; Crosetta, L., Alenia Spazio S.p.A., Italy; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 20-1 - 20-6; In English; See also 20000061419

Contract(s)/Grant(s): CEC-BE95-2056; Copyright Waived; Avail: CASI; A02, Hardcopy

The purpose of this paper is to report on methods which have been developed or which are under development at Alenia Aeronautica for multidisciplinary optimum design, with particularly emphasis on aerodynamic shape design. Results of transonic 2D and 3D optimisation problems are presented.

Author

Optimization; Design Analysis; Two Dimensional Models; Three Dimensional Models

20000061438 Instituto Nacional de Tecnica Aeroespacial, Fluid Dynamics Dept., Madrid, Spain

Design and Optimization of Wings in Subsonic and Transonic Regime

Monge, Fernando, Instituto Nacional de Tecnica Aeroespacial, Spain; Jimenez-Varona, Jose, Instituto Nacional de Tecnica Aeroespacial, Spain; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 21-1 - 21-10; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

For a realistic and practical aerodynamic optimization the most appropriate combination of the three sets of tools taking part in the process should be carefully studied. That is, the optimization should allow an easy implementation of constraints, and should be multipoint without the need to prescribe pressure distributions in the objective function; the design space should be broad enough; and the analysis tool should be fast and robust. Taking into account these criteria, a code for multipoint design and optimization of wings in subsonic and transonic regime has been developed and will be described in this paper. The objective can be any combination of the global aerodynamic coefficients, and geometrical and physical constraints can be applied. Results for sub-

sonic and transonic cases will be presented. Flexibility in the use of the design variables allows many different tests to be performed before the best solution is achieved. Lastly, the computational cost is reduced by the use of a low level code for computing the aerodynamic coefficients.
Author
Wings; Design Analysis; Optimization; Subsonic Flow; Transonic Flow

20000061439 Italian Aerospace Research Center, Capua, Italy
A Multiobjective Approach to Transonic Wing Design by Means of Genetic Algorithms
Vicini, A., Italian Aerospace Research Center, Italy; Quagliarella, D., Italian Aerospace Research Center, Italy; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 22-1 - 22-12; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

In this work a transonic wing design problem is faced by means of a multiobjective genetic algorithm, and using a full potential flow model. The applications here presented regard both planform and wing section optimization. It is shown how both geometric and aerodynamic constraints can be taken into account, and how the multiobjective approach to optimization can be an effective way to handle conflicting design criteria. An interpolation technique allowing a better approximation of Pareto fronts is described. Two possible ways of improving the computational efficiency of the genetic algorithm, namely a parallel implementation of the code and a hybrid optimization approach, are presented.
Author
Aircraft Design; Wings; Design Analysis; Transonic Flow; Genetic Algorithms

20000061440 National Research Council of Canada, Aerodynamics Lab., Ottawa, Ontario Canada
Application of Micro Genetic Algorithms and Neural Networks for Airfoil Design Optimization
Tse, Daniel C. M., National Research Council of Canada, Canada; Chan, Louis Y. Y., National Research Council of Canada, Canada; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 23-1 - 23-11; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

Genetic algorithms are versatile optimization tools suitable for solving multi-disciplinary optimization problems in aerodynamics where the design parameters may exhibit multi-modal or non-smooth variations. However, the fitness evaluation phase of the algorithms casts a large overhead on the computational requirement and is particularly acute in aerodynamic problems where time-consuming CFD methods are needed for evaluating performance. Methods and strategies to improve the performance of basic genetic algorithms are important to enable the method to be useful for complicated three-dimensional or multi-disciplinary problems. Two such methods are studied in the present work: micro genetic algorithms and artificial neural networks. Both methods are applied to inverse and direct airfoil design problems and the resulting improvement in efficiency is noted and discussed.
Author
Genetic Algorithms; Neural Nets; Airfoils; Design Analysis; Optimization

20000061441 Daimler-Benz Aerospace A.G., Munich, Germany
Multi-Objective Aeroelastic Optimization
Stettner, M., Daimler-Benz Aerospace A.G., Germany; Haase, W., Daimler-Benz Aerospace A.G., Germany; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 24-1 - 24-8; In English; See also 20000061419
Contract(s)/Grant(s): ESPRDIT Proj. 20082; Copyright Waived; Avail: CASI; A02, Hardcopy

The present work is aiming at an aeroelastic analysis of the X31 delta wing and particularly at the aeroelastic optimization problem of maximizing the aerodynamic roll rate and minimizing the structural weight at supersonic flow speeds. Results are achieved by means of a multi-objective genetic algorithm (GA) utilizing a GUI-supported software being developed in the European-Union funded ESPRIT project FRONTIER.
Author
Aeroelasticity; Optimization; Delta Wings; Genetic Algorithms

20000061442 NASA Marshall Space Flight Center, Huntsville, AL USA

Emergent Aerospace Designs Using Negotiating Autonomous Agents

Deshmukh, Abhijit, Massachusetts Univ., USA; Middelkoop, Timothy, Massachusetts Univ., USA; Krothapalli, Anjaneyulu, Florida State Univ., USA; Smith, Charles, NASA Marshall Space Flight Center, USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 25-1 - 25-8; In English; See also 20000061419 Contract(s)/Grant(s): NAG2-1114; NSF ARC-99-78923; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper presents a distributed design methodology where designs emerge as a result of the negotiations between different stake holders in the process, such as cost, performance, reliability, etc. The proposed methodology uses autonomous agents to represent design decision makers. Each agent influences specific design parameters in order to maximize their utility. Since the design parameters depend on the aggregate demand of all the agents in the system, design agents need to negotiate with others in the market economy in order to reach an acceptable utility value. This paper addresses several interesting research issues related to distributed design architectures. First, we present a flexible framework which facilitates decomposition of the design problem. Second, we present overview of a market mechanism for generating acceptable design configurations. Finally, we integrate learning mechanisms in the design process to reduce the computational overhead.

Author

Decomposition; Design Analysis; Systems Engineering; Decision Making; Architecture; Structural Design

20000061445 Loughborough Univ. of Technology, Dept. of Aeronautical and Automotive Engineering, UK

Design Tools for Performance Assessment of Fighter Aircraft Incorporating New Technologies

Kutschera, Anthony, Loughborough Univ. of Technology, UK; Render, Peter M., Loughborough Univ. of Technology, UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 29-1 - 29-9; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

The performance assessment of modern fighter aircraft has been the subject of considerable research in recent years. A new metric called Nodal Maneuver Analysis has been proposed, which allows performance assessment of new technologies to be carried out during the conceptual/preliminary design stages of an aircraft. This paper seeks to demonstrate the uses of the Nodal Maneuver Analysis metric by considering three case studies. These studies assess the changes in performance of a baseline aircraft in a vertical turn maneuver, when new technology is incorporated. The technologies are 1) an increase in thrust, 2) a reduction in weight, and 3) the incorporation of Thrust Vectoring and Post Stall Maneuverability. Through these studies, it is shown that Nodal Maneuver Analysis can quantify the advantages/disadvantages of incorporating new technology into the design.

Author

Design Analysis; Software Development Tools; Performance Prediction; Fighter Aircraft; Technology Assessment

20000061447 Aerospatiale, Matra Missiles, Chatillon, France

Inlet/Body Integration Preliminary Design for Supersonic Air-Breathing Missiles Using Automated Multi-Disciplinary Optimization

Kergaravat, Yan, Aerospatiale, France; Vives, Eric, Aerospatiale, France; Knight, Doyle, Rutgers - The State Univ., USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 31-1 - 31-12; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

In order to reduce the design cycle time and cost and to improve the multi-disciplinary interactions at the preliminary design stage of supersonic air-breathing missiles, an automated optimization method has been developed for inlet/body integration in a concurrent engineering environment. Three disciplines of higher relevance have been considered for the shape optimization problem: propulsion, aerodynamics and electromagnetics. This paper describes the numerical method, which incorporates a genetic algorithm and three analysis modules into the optimization loop. The parametric model of the generic missile is presented. The optimization problem is defined and solved for a given mission and set of specifications. The problem is addressed in three phases corresponding to an increasing number of concurrent disciplines. This progression enables to emphasize the conflicting goals between the disciplines and to understand how the optimizer yields the best compromises. This preliminary study shows interesting results and strong potential for future development and industrial applications.

Author

Air Breathing Engines; Concurrent Engineering; Genetic Algorithms; Design Analysis; Optimization; Procedures; Supersonic Inlets

20000061449 British Aerospace Public Ltd. Co., Mathematical Modelling Dept., Bristol, UK

Rapid Aerodynamic Data Generation Using an Iterative Approximation Method

Toomer, C. A., British Aerospace Public Ltd. Co., UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 33-1 - 33-11; In English; See also 20000061419; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Aerodynamic design and optimisation is a costly and complicated process in which numerically generated information about the design space plays a vital role. Hence the information needs to be of good quality, i.e. describing the correct physics, and to be easily accessible from databases using standardised formats. to make this process affordable and efficient, the codes must be fast, robust and accurate. Aerodynamic design problems tend to involve a large number of design parameters and constraints on the design. Large data sets are generated and so it is wise to automate the data generating and processing whenever possible. Data generation is only part of the process. Efficient algorithms to access and interpret the data are required, as is an efficient means of negotiating through the design space. Optimisation is the usual method by which the data are analysed, and regions within the design space identified as possible design solutions or improvements to existing designs.

Author

Aerodynamics; Data Bases; Data Processing; Design Analysis; Optimization

20000061450 Naples Univ., Dipartimento di Progettazione Aeronautica, Italy

Design and Aerodynamic Optimization of a New Reconnaissance Very Light Aircraft through Wind-Tunnel Tests

Giordano, V., Naples Univ., Italy; Coiro, D. P., Naples Univ., Italy; Nicolosi, F., Naples Univ., Italy; DiLeo, L., Naples Univ., Italy; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 34-1 - 34-8; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

Design of a new Very Light Aircraft (V.L.A.) called G97 Spotter has been carried out at DPA (Department of Aeronautical Engineering) and an extensive wind tunnel test campaign has been performed on both aircraft and airfoil models. Wind tunnel tests have guided in the design phase allowing configuration optimization. Effects of nacelle and air intake shape, fuselage stretching, wing incidence and flap/aileron effectiveness have been analyzed through wind tunnel tests. The airfoil has also been designed and modified with the help of wind tunnel test results obtained for a model. Optimization of the airfoil leading edge shape has been done and has brought to a sensible drag reduction at high speed conditions. Optimization of the air intake shape on the aircraft model has been performed leading to a configuration characterized by lower drag. Influence of an air intake fairing has been analyzed and tested through wind tunnel tests. Wing stall path has been studied. Importance of wind tunnel tests as a device to analyze and design light aircraft configuration has been highlighted.

Author

Aerodynamic Stalling; Design Analysis; Ailerons; Aircraft Models; Drag Reduction; Light Aircraft; Optimization; Wind Tunnel Tests

20000061965 Colorado Univ., Dept. of Aerospace Engineering Sciences, Boulder, CO USA

User's Manual for LINER: FORTRAN Code for the Numerical Simulation of Plane Wave Propagation in a Lined Two-Dimensional Channel

Reichert, R, S., Colorado Univ., USA; Biringen, S., Colorado Univ., USA; Howard, J. E., Colorado Univ., USA; Apr. 07, 1999; 55p; In English

Contract(s)/Grant(s): NAG1-1864; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

LINER is a system of FORTRAN 77 codes which performs a 2D analysis of acoustic wave propagation and noise suppression in a rectangular channel with a continuous liner at the top wall. This new implementation is designed to streamline the usage of the several codes making up LINER, resulting in a useful design tool. Major input parameters are placed in two main data files, input.inc and nurn.prm. Output data appear in the form of ASCII files as well as a choice of GNUPLOT graphs. Section 2 briefly describes the physical model. Section 3 discusses the numerical methods; Section 4 gives a detailed account of program usage, including input formats and graphical options. A sample run is also provided. Finally, Section 5 briefly describes the individual program files.

Author

Applications Programs (Computers); Wave Propagation; User Manuals (Computer Programs); Numerical Analysis; Noise Reduction

20000062846 Defence Science and Technology Organisation, Airframes and Engines Div., Melbourne Australia

Development of a Stress Transfer Function for an Idealised Helicopter Structure

Polanco, Frank G.; Mar. 2000; 74p; In English

Report No.(s): AD-A377442; DSTO-RR-0171; DODA-AR-011-237; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report presents an investigation of the effects that may have an influence on the development of a linear stress transfer function (STF) relating the stress in dynamic components to the stress in static components. Effects such as buckling, non-uniqueness, vibration, and solution procedure are considered. Two procedures for determining the STF are compared, one termed the vector procedure and the other the matrix procedure. A simple two dimensional truss, which models an idealised helicopter structure, is constructed to numerically simulate the development of a STF. Using random inputs the resulting stresses are evaluated exactly. Noise is then added to both the input loads and output stresses to develop a noisy data set. Using this noisy data set, STFs are developed using both the vector and matrix techniques. The vector procedure is shown to be sensitive to collinearity in the input, while the matrix technique is found to be more stable under the same ill-conditioning.

DTIC

Stress Analysis; Stress Functions; Fracturing; Euler Buckling; Helicopters

20000064011 NASA Dryden Flight Research Center, Edwards, CA USA

The SR-71 Test Bed Aircraft: A Facility for High-Speed Flight Research

Corda, Stephen, NASA Dryden Flight Research Center, USA; Moes, Timothy R., NASA Dryden Flight Research Center, USA; Mizukami, Masashi, NASA Dryden Flight Research Center, USA; Hass, Neal E., NASA Dryden Flight Research Center, USA; Jones, Daniel, NASA Dryden Flight Research Center, USA; Monaghan, Richard C., NASA Dryden Flight Research Center, USA; Ray, Ronald J., NASA Dryden Flight Research Center, USA; Jarvis, Michele L., NASA Dryden Flight Research Center, USA; Palumbo, Nathan, NASA Dryden Flight Research Center, USA; June 2000; 38p; In English

Contract(s)/Grant(s): RTOP 529-70-14

Report No.(s): NASA/TP-2000-209023; NAS 1.60:209023; H-2405; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The SR-71 test bed aircraft is shown to be a unique platform to flight-test large experiments to supersonic Mach numbers. The test bed hardware mounted on the SR-71 upper fuselage is described. This test bed hardware is composed of a fairing structure called the ”canoe” and a large ”reflection plane” flat plate for mounting experiments. Total experiment weights, including the canoe and reflection plane, as heavy as 14,500 lb can be mounted on the aircraft and flight-tested to speeds as fast as Mach 3.2 and altitudes as high as 80,000 ft. A brief description of the SR-71 aircraft is given, including details of the structural modifications to the fuselage, modifications to the J58 engines to provide increased thrust, and the addition of a research instrumentation system. Information is presented based on flight data that describes the SR-71 test bed aerodynamics, stability and control, structural and thermal loads, the canoe internal environment, and reflection plane flow quality. Guidelines for designing SR-71 test bed experiments are also provided.

Author

SR-71 Aircraft; Flight Tests; Aerodynamic Stability; Test Stands; Fuselages; Structural Design

20000064050 Department of Defense, Office of the Inspector General, Arlington, VA USA

Quick-Reaction Report on the Acquisition of the F-15 Downsized Tester

Jun. 30, 1993; 66p; In English

Report No.(s): AD-A376228; IG/DOD-93-138; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The Air Force is procuring an F-15 Downsized Tester (the Tester) to replace existing automatic test equipment for the F-15 aircraft. The Tester will be a portable automatic test equipment system for testing a portion of the electronic equipment on the F-15 aircraft at the intermediate maintenance level. The Tester will initially replace the F-15 Avionics Intermediate Shop test equipment that has been in operation since 1974. Later the Tester will replace the F-15E Mobile Electronic Test Set used on the F-13E model aircraft since 1986. The audit was requested by the Director, Weapon Support Improvement Group, Office of the Assistant Secretary of Defense (Production and Logistics). The Air Force plans to award a contract for 167 million for 55 units of automatic test equipment over the 6-year Future Years Defense Program (FY 1992 through FY 1997).

DTIC

Electronic Equipment; Portable Equipment; Automatic Test Equipment

20000064593 NASA Langley Research Center, Hampton, VA USA

Session on High Speed Civil Transport Design Capability Using MDO and High Performance Computing

Rehder, Joe, NASA Langley Research Center, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Since the inception of CAS in 1992, NASA Langley has been conducting research into applying multidisciplinary optimization (MDO) and high performance computing toward reducing aircraft design cycle time. The focus of this research has been the development of a series of computational frameworks and associated applications that increased in capability, complexity, and performance over time. The culmination of this effort is an automated high-fidelity analysis capability for a high speed civil transport (HSCT) vehicle installed on a network of heterogeneous computers with a computational framework built using Common Object Request Broker Architecture (CORBA) and Java. The main focus of the research in the early years was the development of the Framework for Interdisciplinary Design Optimization (FIDO) and associated HSCT applications. While the FIDO effort was eventually halted, work continued on HSCT applications of ever increasing complexity. The current application, HSCT4.0, employs high fidelity CFD and FEM analysis codes. For each analysis cycle, the vehicle geometry and computational grids are updated using new values for design variables. Processes for aeroelastic trim, loads convergence, displacement transfer, stress and buckling, and performance have been developed. In all, a total of 70 processes are integrated in the analysis framework. Many of the key processes include automatic differentiation capabilities to provide sensitivity information that can be used in optimization. A software engineering process was developed to manage this large project. Defining the interactions among 70 processes turned out to be an enormous, but essential, task. A formal requirements document was prepared that defined data flow among processes and subprocesses. A design document was then developed that translated the requirements into actual software design. A validation program was defined and implemented to ensure that codes integrated into the framework produced the same results as their standalone counterparts. Finally, a Commercial Off the Shelf (COTS) configuration management system was used to organize the software development. A computational environment, CJOPT, based on the Common Object Request Broker Architecture, CORBA, and the Java programming language has been developed as a framework for multidisciplinary analysis and Optimization. The environment exploits the parallelisms inherent in the application and distributes the constituent disciplines on machines best suited to their needs. In CJOpt, a discipline code is ”wrapped” as an object. An interface to the object identifies the functionality (services) provided by the discipline, defined in Interface Definition Language (IDL) and implemented using Java. The results of using the HSCT4.0 capability are described. A summary of lessons learned is also presented. The use of some of the processes, codes, and techniques by industry are highlighted. The application of the methodology developed in this research to other aircraft are described. Finally, we show how the experience gained is being applied to entirely new vehicles, such as the Reusable Space Transportation System. Additional information is contained in the original.

Author

Aircraft Design; Computational Fluid Dynamics; Computer Networks; Design Analysis; Finite Element Method; Software Engineering; Multidisciplinary Design Optimization; Computer Aided Design; Systems Engineering

20000064900 Cranfield Univ., Flight Test and Dynamics Group, Cranfield, UK

An Analysis of the Flight Dynamics of a Second Generation SST Aircraft *Interim Report*

Steer, A. J., Cranfield Univ., UK; October 1999; 86p; In English

Report No.(s): COA-9914; ISBN 1-86194-046-7; Copyright; Avail: Issuing Activity

The principal aerodynamic properties that distinguish the low speed stability, control and handling characteristics of an SCT aircraft are: (1) The requirement for relaxed longitudinal stability in order to reduce trim drag, both at higher speeds as the aerodynamic centre moves aft and to improve performance at lower speeds through reduced control surface sizing. The relaxed stability, achieved through locating the CG at the NP, results in an unconventional dynamic response on the approach characterized by a 3doscillatory mode with short period damping and phugoid like frequency combined with two real modes, one of which is unstable. (2) The low static margin when flying at low-speed coupled with the absence of a second control surface results in relatively low pitch damping, M(sub q), combined with a high pitch inertia, I(sub y). The aircraft’s unaugmented longitudinal response to a control input is thus characterized by a low pitch acceleration, hence sluggish pitch response combined with a slow time to settle. Solutions include feeding back either incidence or pitch rate to restore stability and enhance the maneuver response as well as augmenting control power by providing a second pitch control surface. (3) The delta wing’s low lift curve slope requiring large angles of attack on the approach in order to generate sufficient low-speed lift at the expense of considerable amounts of induced drag. Hence the aircraft flies considerably below the minimum drag speed, known as ’backside’ operation, resulting in speed instability and difficult flightpath control. The effects of speed instability are that at a constant engine thrust on a -3 deg. flightpath, the short term response to an aft stick movement is an increase in height relative to the flightpath. The long-term effect is an increase in drag and consequent steepening of the flightpath. Conversely, a forward stick movement initially steepens the flightpath and in the long term, the increase in speed causes the aircraft to fly above the flightpath. These effects can be overcome by

use of an auto-throttle, to control speed through engine thrust. For manual control, the technique is to control the airspeed through pitch attitude and to maintain the glide slope by adjusting engine thrust. (4) The pronounced longitudinal non-minimum phase behaviour due to the movement of large trailing edge lift producing surfaces for pitch maneuver control. With only wing trailing edge mounted elevons for pitch control, their small moment arm requires a large control deflection to generate the required pitch acceleration. The ‚up' elevon results in negative lift from the control surface and an initial loss in aircraft height until the aircraft incidence is modified and total lift increased. This non-minimum phase behaviour, characterized by a positive zero in the response transfer function, results in an undershoot in flight path response. Resulting in a hesitation in height response which may result in a heavy landing if a correction is made late into the approach. (5) Significant delta wing generated ground effect resulting in some cushioning of the landing, hence reduced sink rates. However, the negative pitching moments degrade the rate of nose rotation on take-off and may prove disconcerning to the pilot when the aircraft leaves its effect. (6) The pilot's location far ahead of the undercarriage resulting in difficulty in judging mainwheel position during landing at high approach attitudes. (7) The capability to generate relatively rapid rates of roll due to the inherently low roll inertia combined with the large and effective elevon control surfaces. However, the low value of the roll damping derivative, L(sub p), leads to a large roll mode time constant since -tau(sub p) approx. = I(sub x)/L(sub p), the roll control power of the elevons is also large resulting in a tendency to over-control in roll. In addition, the rolling moment due to sideslip being a function of sweepback angle and incidence tends to oppose the demanded roll maneuver if sideslip is allowed to build hence slowing the initial response. (8) A dutch roll mode characterized by a near pure rolling oscillation due to the large value of L(sub nu) combined with a low roll inertia. In addition, it has a relatively high frequency and hence short period, requiring the mode to be adequately damped to ensure acceptable handling characteristics. (9) A large yaw/roll inertia ratio resulting in a tendency for the unaugmented aircraft to roll about the longitudinal body axis and not the velocity vector, hence degrading heading response.
Derived from text
Aerodynamic Balance; Angle of Attack; Deflection; Degradation; Drag Reduction; Dynamic Response; Minimum Drag; Undercarriages

20000066590 Department of the Navy, Washington, DC USA
Neural Network System for Estimation of Helicopter Gross Weight and Center of Gravity Location
McCool, Kelly, Inventor; Haas, David, Inventor; Nov. 16, 1999; 5p; In English; Supersedes US-Patent-Appl-SN-09042045
Patent Info.: Filed 13 Mar. 1998; US-Patent-Appl-SN-09,042,045; US-Patent-5,987,397
Report No.(s): AD-D019711; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The invention is directed to a helicopter health and usage monitoring system utilizing a neural network for estimating gross weight and center of gravity location from measured flight condition parameter inputs; and includes means for measuring a plurality of variable flight condition parameters during flight of he helicopter; memory means for successively receiving and storing parameter input signals as well as estimates of gross weight and center of gravity location; and processing means responsive to the signals received from the measurement means for generating the gross weight and center of gravity location estimates.
DTIC
Center of Gravity; Helicopters; Neural Nets; Weight (Mass); Weight Measurement

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.

20000061968 NASA Langley Research Center, Hampton, VA USA
Developing Conceptual Hypersonic Airbreathing Engines Using Design of Experiments Methods
Ferlemann, Shelly M., NASA Langley Research Center, USA; Robinson, Jeffrey S., NASA Langley Research Center, USA; Martin, John G., NASA Langley Research Center, USA; Leonard, Charles P., NASA Langley Research Center, USA; Taylor, Lawrence W., NASA Langley Research Center, USA; Kamhawi, Hilmi, TechnoSoft, Inc., USA; [2000]; 12p; In English; 21st; Aerodynamic Measurement Technology and Ground Testing, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Report No.(s): AIAA Paper 2000-2694; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Designing a hypersonic vehicle is a complicated process due to the multi-disciplinary synergy that is required. The greatest challenge involves propulsion-airframe integration. In the past, a two-dimensional flowpath was generated based on the engine

performance required for a proposed mission. A three-dimensional CAD geometry was produced from the two-dimensional flowpath for aerodynamic analysis, structural design, and packaging. The aerodynamics, engine performance, and mass properties arc inputs to the vehicle performance tool to determine if the mission goals were met. If the mission goals were not met, then a flowpath and vehicle redesign would begin. This design process might have to be performed several times to produce a ”closed” vehicle. This paper will describe an attempt to design a hypersonic cruise vehicle propulsion flowpath using a Design of’ Experiments method to reduce the resources necessary to produce a conceptual design with fewer iterations of the design cycle. These methods also allow for more flexible mission analysis and incorporation of additional design constraints at any point. A design system was developed using an object-based software package that would quickly generate each flowpath in the study given the values of the geometric independent variables. These flowpath geometries were put into a hypersonic propulsion code and the engine performance was generated. The propulsion results were loaded into statistical software to produce regression equations that were combined with an aerodynamic database to optimize the flowpath at the vehicle performance level. For this example, the design process was executed twice. The first pass was a cursory look at the independent variables selected to determine which variables are the most important and to test all of the inputs to the optimization process. The second cycle is a more in-depth study with more cases and higher order equations representing the design space.
Author
Fabrication; Air Breathing Engines; Applications Programs (Computers); Computer Aided Design; Design Analysis; Experiment Design; Structural Design

20000063377 NASA Glenn Research Center, Cleveland, OH USA
The Numerical Propulsion System Simulation: An Overview
Lytle, John K., NASA Glenn Research Center, USA; June 2000; 14p; In English; Computational Aerosciences, 15-17 Feb. 2000, Moffett Field, CA, USA; Sponsored by NASA Ames Research Center, USA
Contract(s)/Grant(s): RTOP 509-10-11
Report No.(s): NASA/TM-2000-209915; E-12152; NAS 1.15:209915; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Advances in computational technology and in physics-based modeling are making large-scale, detailed simulations of complex systems possible within the design environment. For example, the integration of computing, communications, and aerodynamics has reduced the time required to analyze major propulsion system components from days and weeks to minutes and hours. This breakthrough has enabled the detailed simulation of major propulsion system components to become a routine part of designing systems, providing the designer with critical information about the components early in the design process. This paper describes the development of the numerical propulsion system simulation (NPSS), a modular and extensible framework for the integration of multicomponent and multidisciplinary analysis tools using geographically distributed resources such as computing platforms, data bases, and people. The analysis is currently focused on large-scale modeling of complete aircraft engines. This will provide the product developer with a ”virtual wind tunnel” that will reduce the number of hardware builds and tests required during the development of advanced aerospace propulsion systems.
Author
Propulsion System Performance; Propulsion System Configurations; Complex Systems; Mathematical Models; Simulation

20000064592 General Electric Co., Aircraft Engines, Cincinnati, OH USA
High Bypass Turbofan Compressions System Simulations Using 3D, Parallel, Multistage CFD
Dailey, Lyle D., General Electric Co., USA; Turner, Mark G., General Electric Co., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A parallelized set of analysis tools for turbofan system components is being used to simulate the aerodynamics through a GE high bypass turbofan compression system. The compression system has been analyzed in multiple components to improve the understanding of each individual component, as well as the interactions between components. These components include isolated blade rows, isolated stages, the fan, the low pressure compressor (or booster), and blocks of the high pressure compressor (HPC). Simulations are also planned to couple various components, such as the fan and booster and all blocks of the HPC, and to couple the entire system, comprised of fan, booster, and HPC. The individual component simulations were validated by running at respective rig conditions and comparing to rig test data. The full system simulation, which will be run at engine takeoff operating conditions, will be validated with limited test data from static turbofan tests, and by comparing the computed shaft horsepower to the engine cycle. These large-scale simulations have been made possible by utilizing parallel computing in the pre-processing and flow solver tools. The grid generation tool used for these simulations, developed at NASA Glenn Research Center, is called APG. by running APG in parallel, the grids for any component can be completed in about 20 minutes by using multiple processors. The flow solver was originally developed by John Adamcyzk’s team at NASA Glenn, and later parallelized and made multiblock by

GE. The simulations make use of the multiblock capabilities of APG and APNASA, allowing treatment of multiple flow regions, such as the core flow, bypass flow, and bleed flows. The grid generator and flow solver have been run at GE on a networked system of workstations. The flow solver is also commonly run on the NASA Origin system at NASA Ames. Performance of the flow solver on the two systems will be compared. Additional information is contained in the original.
Author
Compressors; Computational Fluid Dynamics; Grid Generation (Mathematics); Parallel Processing (Computers); Turbofans; Computerized Simulation

20000064598 General Electric Co., Aircraft Engines, Cincinnati, OH USA
Integrated Multidisciplinary Design
Bailey, Michael W., General Electric Co., USA; Irani, Rohinton K., General Electric Co., USA; Finnigan, Peter M., General Electric Co., USA; Rohl, Peter J., General Electric Co., USA; Badhrinath, Krishnakumar, General Electric Co., USA; Welcome to the NASA High Performance Computing and Communications Computational Aerosciences (CAS) Workshop 2000; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

An integrated multidisciplinary approach to system design of aircraft engines has been the goal for many years. Frequently referred to as concurrent engineering, this has been a predominantly manual process since the computer structure to support it has been unavailable. Historically the approach has been to achieve this multidisciplinary integration by linking aerodynamic and structural code inputs and outputs and typically generating geometry in the form of an IGES files as required. This approach does not provide a seamless flow of information from Conceptual through to Preliminary, Detail Design and manufacturing. Simplification at the Concept and Preliminary Design phases when commitments are made to the customer are often invalidated at the Detail Design phase. This results in rework, sub-optimal designs and potentially low customer satisfaction. Master Model or Common Geometry is a geometric centric approach that provides a linked associative environment from concept to manufactured product. Here the intent is to create 3-Dimensional solid geometry at engine concept which would flow seamlessly into detail design, digital engine mockup and manufacturing. This paper describes the move towards a more integrated CAD/CAM/CAE approach based on the concept of a common geometric representation of the product being the design integrator. Everyone is familiar with the concept of building up a system from its constituent parts. Less well understood is how the system level constraints and requirements flow down to these parts with resultant feedback to the system. This has traditionally been the goal of concurrent engineering but the degree of concurrency necessary to provide optimization at the system level has never been achieved. The ultimate goal is an infrastructure that will support concurrent design by analysis. This will be complimented by robust design techniques which use a probabilistic approach to account for the uncertainty associated with a design. GEAE is currently implementing a Common Geometry infrastructure that will support the product from creation to manufacturing and ultimately engine services. This infrastructure will also support the move from deterministic to probabilistic design. Several pilot projects have been successfully completed paving the way to a successful initial implementation. An integral part of this whole process is CAD Integration with Analysis where analytical models are created by applying boundary conditions to the same geometry using context models or views of geometry. Manufacturing also uses the same geometry combined with context models to create in-process models. A prerequisite in this is the creation of 3-Dimensional parametric feature based models. The goal is to significantly shorten the design cycle not only by automation but by creating a degree of concurrency previously unachievable. Results from these pilots, the initial implementation and the productivity gains demonstrated will be discussed. GEAE initiated the Common Geometry project two years ago. The ground rules were that the system would be Unigraphics based and be implemented in commercial software wherever possible. The Common Geometry environment should support the product creation from concept to manufacturing and ultimately services. An integral part of the system would be a Product Data Management System (PDMS) which would support the storage and retrieval of both data related directly to geometry and other metadata. This PDMS would permit the different activities to function concurrently and permit updates to flow down to all aspects of the design activity. This paper will build on the approach described in another publication. In every design there exists a performance floor and cost ceiling between which multiple solutions exist. The purpose of a design is to create a product that will provide customer satisfaction in terms of expectations and technical requirements. In the military world this is the ability to complete a specific mission and in the commercial world this is the ability to produce a revenue stream. The challenge is to translate these customer Critical to Quality requirements into hardware that will comprise a system. Consequently an understanding of the flowdown of the customer CTQ's to individual parts is essential if customer satisfaction is to be achieved. This represents the challenge in GEAE's Design For Six Sigma Initiative and is driving the shift from deterministic to probabilistic design methodologies. Common Geometry is a key enabling technology to achieving these goals. Shortening the design cycle by designing by analysis and minimizing testing will significantly reduce engine develop-

ment cost and create better products. Common geometry will provide the computer infrastructure to make true concurrent engineering a reality.
Author
Computer Aided Design; Concurrent Engineering; Computerized Simulation; Three Dimensional Models

20000064602 NASA Glenn Research Center, Cleveland, OH USA
Modular Multi-Fidelity Simulation Methodology for Multiple Spool Turbofan Engines
Hall, Edward J., Rolls-Royce Allison, USA; VanDrei, Don, NASA Glenn Research Center, USA; Townsend, Scott, NASA Glenn Research Center, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This paper describes the development of a component-based simulation environment for multiple-spool turbofan gas turbine engines. Engine performance simulations are based on coupled models of individual components (fans, compressors, combustors, turbines, nozzles, etc.) employing multiple levels of fidelity. During the course of the simulation, the performance of each component may be derived through computational models of varying levels of fidelity including: (1) 0-D performance map lookup (2) Steady 2-D CFD analysis (3) Steady 3-D CFD analysis (4) Time-dependent 3-D CFD analysis This study builds on previous efforts directed at whole engine performance simulation which modeled the low pressure (LP) and high pressure (HP) components separately, using different solution methodologies. The ultimate strategy in the current development effort is to provide an environment whereby the traditional model for engine performance simulations (the cycle analysis) can be extended to provide the level of fidelity available in modern three-dimensional turbomachinery CFD codes. Traditional cycle analysis provides a representative framework for the overall engine simulation whereby individual components are represented via zero-dimensional block elements. The performance of each element is traditionally computed based on table or map look-up. This is the essential capability provided in the Numerical Propulsion System Simulation (NPSS Version 1.0) at it's lowest level of fidelity. The interest in the current study lies in extending the level of fidelity available in each of the block components to three dimensions and beyond. This capability enhancement is derived from computational results from the ADPAC CFD code based on realistic 3-D component models of each of the block elements in the engine cycle analysis. The simulation environment exploits paralellism at several different levels. Individual CFD simulations employ multiple processors and provide message passing between individual blocks of a single component simulation. Coupled simulations of multiple components provide yet another level of parallelism. Finally, simultaneous low-fidelity and high-fidelity simulations yield yet another opportunity for parallelism. Simulation models have been developed and applied to two modem engine designs: the General Electric Energy Efficient Engine (EEE) and the Rolls-Royce Allison AE3007 engine. Both of these engines employ a dual spool configuration (separate spools for HP and LP components). Low fidelity (0-D) NPSS models were developed for each of these engine configurations. Simultaneously, high fidelity CFD models (3-D) were also developed on a component by component basis. Cooperative simulation between codes with varying levels of physics is provided through sophisticated inter-code communication environments using the CORBA data exchange model. Both JAVA-based and C++-based executive programs have been developed to drive the overall simulation employing mixed models of component representation. The system has been demonstrated for performance simulations of both the EEE and AE3007 engines to explore the multidisciplinary aspects of the simulation environment. Both aerodynamic and mechanical coupling are provided between common shaft-mounted components via a shaft power balance procedure. Dual spool shaft power balance procedures based on 3-D CFD results have also been developed to provide a nearly complete 3-D representation of the entire engine flowfield. Additional information is contained in the original.
Author
Computational Fluid Dynamics; Computerized Simulation; Gas Turbine Engines; Mathematical Models; Simulation; Turbofan Engines; Turbomachinery

20000064604 ASE Technologies, Inc., Cincinnati, OH USA
Multi-Stage Simulation of Advanced Gas Turbine Engines
Vitt, Paul, ASE Technologies, Inc., USA; Subramanian, S. Mani, ASE Technologies, Inc., USA; Cherry, David, General Electric Co., USA; Turner, Mark, General Electric Co., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Next generation gas turbine engines are being developed to increase thrust and fuel economy, and to be environmentally friendly, all while reducing cost and weight, for both military and commercial applications. NASA's Ultra Efficient Engine Technology (UEET), and DoD's Integrated High Performance Turbine Engine Technology (IHPTET) and Joint Technology Advanced Gas Generator (JTAGG) programs, are supporting these technology goals. The beneficiaries of these developmental programs include commercial aircraft, such as the Boeing 737NG and the Next Generation Regional Transport, and military programs like the Joint Strike Fighter (JSF). to support these technology programs related to propulsion systems, advanced computa-

tional fluid dynamics methods that simulate entire components of gas turbines are being developed. by integrating the results of these calculations early in the design cycle, the engine designer can investigate areas where the engine weight and complexity can be reduced or aerodynamic efficiency improved. The individual blade rows that comprise a gas turbine engine significantly interact with their surrounding blade rows, and the interaction effect can be tuned by the designer to provide aerodynamic performance improvement. The current computational fluid dynamics analyses are focusing on including all of the blade rows within a turbine component, such as the booster and high pressure compressor or the high and low pressure turbines. Once the performance of the component system is known, the effect of design changes for increased performance or reduced weight can be estimated. Calculating all of the individual aerodynamic contributions of the airfoils in a compressor or turbine is a computationally intensive task, and highly-parallel processing techniques are the best current approach to reducing the time required for an analysis. The HPCCP computational resource has been used as a testbed to demonstrate the capability to simulate the flow in a complete compressor or turbine, and to address design issues relevant to integrating the aerodynamic components in a timely manner.
Author
Computational Fluid Dynamics; Gas Turbine Engines; Parallel Processing (Computers); Computerized Simulation

20000064618 NASA Glenn Research Center, Cleveland, OH USA
Probabilistic Multi-Scale, Multi-Level, Multi-Disciplinary Analysis and Optimization of Engine Structures
Chamis, Christos C., NASA Glenn Research Center, USA; Abumeri, Galib H., DYNACS Engineering Co., Inc., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Aircraft engines are assemblies of dynamically interacting components. Engine updates to keep present aircraft flying safely and engines for new aircraft are progressively required to operate in more demanding technological and environmental requirements. Designs to effectively meet those requirements are necessarily collections of multi-scale, multi-level, multi-disciplinary analysis and optimization methods and probabilistic methods are necessary to quantify respective uncertainties. These types of methods are the only ones that can formally evaluate advanced composite designs which satisfy those progressively demanding requirements while assuring minimum cost, maximum reliability and maximum durability. Recent research activities at NASA Glenn Research Center have focused on developing multi-scale, multi-level, multidisciplinary analysis and optimization methods. Multi-scale refers to formal methods which describe complex material behavior metal or composite; multi-level refers to integration of participating disciplines to describe a structural response at the scale of interest; multidisciplinary refers to open-ended for various existing and yet to be developed discipline constructs required to formally predict/describe a structural response in engine operating environments. For example, these include but are not limited to: multi-factor models for material behavior, multi-scale composite mechanics, general purpose structural analysis, progressive structural fracture for evaluating durability and integrity, noise and acoustic fatigue, emission requirements, hot fluid mechanics, heat-transfer and probabilistic simulations. Many of these, as well as others, are encompassed in an integrated computer code identified as Engine Structures Technology Benefits Estimator (EST/BEST) or Multi-faceted/Engine Structures Optimization (MP/ESTOP). The discipline modules integrated in MP/ESTOP include: engine cycle (thermodynamics), engine weights, internal fluid mechanics, cost, mission and coupled structural/thermal, various composite property simulators and probabilistic methods to evaluate uncertainty effects (scatter ranges) in all the design parameters. The objective of the proposed paper is to briefly describe a multi-faceted design analysis and optimization capability for coupled multi-discipline engine structures optimization. Results are presented for engine and aircraft type metrics to illustrate the versatility of that capability. Results are also presented for reliability, noise and fatigue to illustrate its inclusiveness. For example, replacing metal rotors with composites reduces the engine weight by 20 percent, 15 percent noise reduction, and an order of magnitude improvement in reliability. Composite designs exist to increase fatigue life by at least two orders of magnitude compared to state-of-the-art metals.
Author
Aircraft Engines; Design Analysis; Multidisciplinary Design Optimization; Engine Design

20000064624 NASA Glenn Research Center, Cleveland, OH USA
Numerical Propulsion System Simulation: An Overview
Lytle, John K., NASA Glenn Research Center, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The cost of implementing new technology in aerospace propulsion systems is becoming prohibitively expensive and time consuming. One of the main contributors to the high cost and lengthy time is the need to perform many large-scale hardware tests and the inability to integrate all appropriate subsystems early in the design process. The NASA Glenn Research Center is developing the technologies required to enable simulations of full aerospace propulsion systems in sufficient detail to resolve critical design issues early in the design process before hardware is built. This concept, called the Numerical Propulsion System Simula-

tion (NPSS), is focused on the integration of multiple disciplines such as aerodynamics, structures and heat transfer with computing and communication technologies to capture complex physical processes in a timely and cost-effective manner. The vision for NPSS, as illustrated, is to be a ”numerical test cell” that enables full engine simulation overnight on cost-effective computing platforms. There are several key elements within NPSS that are required to achieve this capability: 1) clear data interfaces through the development and/or use of data exchange standards, 2) modular and flexible program construction through the use of object-oriented programming, 3) integrated multiple fidelity analysis (zooming) techniques that capture the appropriate physics at the appropriate fidelity for the engine systems, 4) multidisciplinary coupling techniques and finally 5) high performance parallel and distributed computing. The current state of development in these five area focuses on air breathing gas turbine engines and is reported in this paper. However, many of the technologies are generic and can be readily applied to rocket based systems and combined cycles currently being considered for low-cost access-to-space applications. Recent accomplishments include: (1) the development of an industry-standard engine cycle analysis program and plug ’n play architecture, called NPSS Version 1, (2) A full engine simulation that combines a 3D low-pressure subsystem with a 0D high pressure core simulation. This demonstrates the ability to integrate analyses at different levels of detail and to aerodynamically couple components, the fan/booster and low-pressure turbine, through a 3D computational fluid dynamics simulation. (3) Simulation of all of the turbomachinery in a modern turbofan engine on parallel computing platform for rapid and cost-effective execution. This capability can also be used to generate full compressor map, requiring both design and off-design simulation. (4) Three levels of coupling characterize the multidisciplinary analysis under NPSS: loosely coupled, process coupled and tightly coupled. The loosely coupled and process coupled approaches require a common geometry definition to link CAD to analysis tools. The tightly coupled approach is currently validating the use of arbitrary Lagrangian/Eulerian formulation for rotating turbomachinery. The validation includes both centrifugal and axial compression systems. The results of the validation will be reported in the paper. (5) The demonstration of significant computing cost/performance reduction for turbine engine applications using PC clusters. The NPSS Project is supported under the NASA High Performance Computing and Communications Program.
Author
Propulsion System Configurations; Computerized Simulation; Parallel Processing (Computers); Computer Aided Design; Mathematical Models; Engine Design; Distributed Processing

20000066606 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Occupational Health Risks of Exhaust Gases of the F-16 During Operational Exercises with the 40L70 ***Final Report Arbeidshygienische Risico’s Door Uitlaatgassen uit de F-16 Tijdens Operationele Oefeningen met de 40L0***
Groeneveld, F. R., Prins Maurits Lab. TNO, Netherlands; February 2000; 26p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A99,KLu/431; TNO Proj. 014.11168
Report No.(s): TD99-0420; PML-1999-A104; Copyright; Avail: Issuing Activity
The personnel of the canon 40L70 are feeling inconvenience by the exhaust of the F-16 positioned at the top of runway 24 at Twenthe air base during operational exercises. An unfavourable wind the exhaust gases were blowing over their fixed position of the 40L70. After measurements of several compounds of the exhaust gases the concentrations did not exceed the MAC-value at a distance of 100 meter below the wind of the F-16.
Derived from text
Exhaust Gases; Personnel; F-16 Aircraft

20000067666 NASA Glenn Research Center, Cleveland, OH USA
A Probabilistic Approach to Aeropropulsion System Assessment
Tong, Michael T., NASA Glenn Research Center, USA; Jan. 31, 2000; 8p; In English; 45th; Gas Turbine and Aeroengine Technical Congress, 8-11 May 2000, Munich, Germany; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): RTOP 522-70-03; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
A probabilistic approach is described for aeropropulsion system assessment. to demonstrate this approach, the technical performance of a wave rotor-enhanced gas turbine engine (i.e. engine net thrust, specific fuel consumption, and engine weight) is assessed. The assessment accounts for the uncertainties in component efficiencies/flows and mechanical design variables, using probability distributions. The results are presented in the form of cumulative distribution functions (CDFS) and sensitivity analyses, and are compared with those from the traditional deterministic approach. The comparison shows that the probabilistic approach provides a more realistic and systematic way to assess an aeropropulsion system.
Author
Distribution Functions; Gas Turbine Engines; Probability Theory; Wave Rotors; Mechanical Engineering; Propulsion System Performance

08
AIRCRAFT STABILITY AND CONTROL

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

20000064689 NASA Marshall Space Flight Center, Huntsville, AL USA

X-33 Ascent Flight Controller Design by Trajectory Linearization: A Singular Perturbational Approach

Zhu, J. Jim, Louisiana State Univ., USA; Banker, Brad D., Louisiana State Univ., USA; Hall, Charles E., NASA Marshall Space Flight Center, USA; [2000]; 7p; In English; Guidance, Control and Dynamics, 2000, Reston, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

The flight control of X-33 poses a challenge to conventional gain-scheduled flight controllers due to its large attitude maneuvers from liftoff to orbit and reentry. In addition, a wide range of uncertainties in vehicle handling qualities and disturbances must be accommodated by the attitude control system. Nonlinear tracking and decoupling control by trajectory linearization can be viewed as the ideal gain-scheduling controller designed at every point on the flight trajectory. Therefore it provides robust stability and performance at all stages of flight without interpolation of controller gains and eliminates costly controller redesigns due to minor airframe alteration or mission reconfiguration. In this paper, a prototype trajectory linearization design for an X-33 ascent flight controller is presented along with 3-DOF and 6-DOF simulation results. It is noted that the 6-DOF results were obtained from the 3-DOF design with only a few hours of tuning, which demonstrates the inherent robustness of the design technique. It is this ”plug-and-play” feature that is much needed by NASA for the development, test and routine operations of the RLV’S. Plans for further research are also presented, and refined 6-DOF simulation results will be presented in the final version of the paper. Author

Approach Control; Attitude Control; Controllability; Flight Control; Prototypes; Simulation; X-33 Reusable Launch Vehicle

09
RESEARCH AND SUPPORT FACILITIES (AIR)

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

20000061489 NASA Langley Research Center, Hampton, VA USA

Simultaneous Global Pressure and Temperature Measurement Technique for Hypersonic Wind Tunnels

Buck, Gregory M., NASA Langley Research Center, USA; [2000]; 14p; In English; 21st; Aerodynamic Measurement Technology and Ground Testing, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-2649; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

High-temperature luminescent coatings are being developed and applied for simultaneous pressure and temperature mapping in conventional-type hypersonic wind tunnels, providing global pressure as well as Global aeroheating measurements. Together, with advanced model fabrication and analysis methods, these techniques will provide a more rapid and complete experimental aerodynamic and aerothermodynamic database for future aerospace vehicles. The current status in development of simultaneous pressure- and temperature-sensitive coatings and measurement techniques for hypersonic wind tunnels at Langley Research Center is described. and initial results from a feasibility study in the Langley 31-Inch Mach 10 Tunnel are presented.
Author

Pressure Measurement; Temperature Measurement; Aerodynamic Heating

20000062013 NASA Langley Research Center, Hampton, VA USA

Overview of Selected Measurement Techniques for Aerodynamics Testing in the NASA Langley Unitary Plan Wind Tunnel

Erickson, Gary E., NASA Langley Research Center, USA; [2000]; 56p; In English; Fluids, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Report No.(s): AIAA Paper 2000-2396; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

An overview is given of selected measurement techniques used in the NASA Langley Research Center (LaRC) Unitary Plan Wind Tunnel (UPWT) to determine the aerodynamic characteristics of aerospace vehicles operating at supersonic speeds. A broad definition of a measurement technique is adopted in this paper and is any qualitative or quantitative experimental approach that provides information leading to the improved understanding of the supersonic aerodynamic characteristics. On-surface and off-

surface measurement techniques used to obtain discrete (point) and global (field) measurements and planar and global flow visualizations are described, and examples of all methods are included. The discussion is limited to recent experiences in the UPWT and is, therefore, not an exhaustive review of existing experimental techniques. The diversity and high quality of the measurement techniques and the resultant data illustrate the capabilities of a ground-based experimental facility and the key role that it plays in the advancement of our understanding, prediction, and control of supersonic aerodynamics.
Author
Aerodynamic Characteristics; Aerospace Vehicles; Wind Tunnel Tests; Procedures; Measuring Instruments

20000063473 Defence Science and Technology Organisation, Air Operations Div., Melbourne, Australia
Calibration of the Reference Velocity in the Test Section of the Low Speed Wind Tunnel at the Aeronautical and Maritime Research Laboratory
Edwards, Craig D., Defence Science and Technology Organisation, Australia; February 2000; 46p; In English
Report No.(s): DSTO-TN-0248; AR-011-214; Copyright; Avail: Issuing Activity

The measurement of wind velocity in the test section of the Low Speed Wind Tunnel is obtained from the measurement of dynamic pressure using two piezometer rings located at the entrance and exit of the tunnel contraction. Following the recent installation of a new contraction, a calibration of the dynamic pressure measurement system was performed to determine a new wind tunnel ”calibration” factor. This factor is applied as a correction to the pressure measurements obtained from the two piezometer rings to represent accurately the correct dynamic pressure and consequently, velocity, at the centre of the test section midway between the centres of the turntables in the floor and ceiling. A sub-standard pitot-static probe was used to acquire pressure data at various positions within the wind tunnel test section for a range of velocities. The new tunnel calibration factor, representative of all wind speeds, was determined to be 1.079, an increase of 3.3% over the factor of 1.045 for the previous contraction. This report contains all of the test data and a detailed account of the procedure and equipment used to derive this new calibration factor.
Author
Calibrating; Wind Velocity Measurement; Dynamic Pressure; Low Speed Wind Tunnels

20000064101 Institute for Human Factors TNO, Soesterberg, Netherlands
Specification and Evaluation of the Functional Requirements of a UAV Crew Trainer *Final Report*
Helsdingen, A. S., Institute for Human Factors TNO, Netherlands; Aug. 12, 1999; 52p; In English
Contract(s)/Grant(s): A96/CO/363; TNO Proj. 730.3
Report No.(s): TD-99-0332; TM-99-A055; Copyright; Avail: Issuing Activity

To investigate the possibilities for application of low-cost simulators within military training courses, the research project called ELSTAR (European Low-cost Simulation technology for the ARmed forces) is carried out under the contract of the Ministries of Defence of the five participating countries of Research Technology Project (RTP) 11.8, viz. Belgium, France, Germany, Greece, and The Netherlands. This project consists of 5 work packages. In the current work package 3 of the ELSTAR project, an elaborate investigation of the task- and training requirements of the selected training areas, must render more detailed descriptions of four selected training systems. The current report includes a task- and training analysis of a Unmanned Aerial Vehicle (UAV) crew, which formed the basis for the functional requirements of a UAV crew trainer. In order to determine low-cost solutions for this trainer, the cost driving requirements of the system were identified. The effects of degrading these requirements on the training value of the UAV crew trainer were evaluated in a experimental study. The results of the task and training analyses show that visual information is the most important source of information for the UAV crew to perform its tasks; therefore, the focus of the functional specifications is on the image system, with its image generator, display system, and visual database. In the development of a UAV simulator, it seems that the visual database is the major factor in the costs. This database needs to be large and very detailed, which causes the development to be time- consuming and expensive. In the evaluation study two degraded database configurations were tested: both configurations involve the definition of a high detail target area within the database, while the surrounding area is either left out or displayed with a lower level of detail. The results show that the UAV experts evaluated both simulator configurations as having a high training value. Nevertheless, their additional remarks show that they see room for improvement. This evaluation experiment can be seen as a first attempt to define the value of specific configuration of subsystems of the simulator for training. In a later stage of this project, training value will be determined by objective measurements against alternative training methods.
Author
Data Bases; Display Devices; Education; Functional Design Specifications; Pilotless Aircraft; Research and Development; Systems Simulation; Training Simulators

20000064113 DYNACS Engineering Co., Inc., Brook Park, OH USA

Subsonic Calibration of the NASA Glenn Research Center 10- by 10-Foot Supersonic Wind Tunnel (1998 Tests)

Arrington, E. Allen, DYNACS Engineering Co., Inc., USA; Gonsalez, Jose C., DYNACS Engineering Co., Inc., USA; Curry, Monroe R., III, DYNACS Engineering Co., Inc., USA; [2000]; 26p; In English; 21st; Aerodynamic Measurement Technology and Ground Testing, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-2448; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Safe and efficient subsonic operation of the NASA Glenn Research Center 10- by 10-Foot Supersonic Wind Tunnel (10x10 SWT) was demonstrated in April 1996, at which time limited test section flow quality data were collected. Those data showed that the subsonic operating conditions were acceptable in terms of pressure and Mach number distribution, and it was recommended that more complete documentation of the subsonic operating regime be compiled. Calibration and flow quality surveys were conducted in the test section of the 10x10 SWT to fully document the subsonic capabilities of the facility. This report describes the testing, data analysis and results from the calibration and flow quality surveys.
Author

Supersonic Wind Tunnels; Calibrating; Test Chambers

12
ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see categories 13 through 20. For extraterrestrial exploration, see 91 Lunar and Planetary Science and Exploration.

20000064903 NASA Kennedy Space Center, Cocoa Beach, FL USA

Delta WIND Mission Science Briefing

Oct. 31, 1994; In English; Videotape: 12 min. 7 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000078325; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

A continuation of the question and answer period on the Delta WIND science briefing is presented. See NONP-NASA-VT-2000078324 for live coverage of the WIND science briefing.
CASI

Solar Wind; Space Missions; Earth Magnetosphere; Plasmas (Physics)

20000064904 NASA Kennedy Space Center, Cocoa Beach, FL USA

Delta WIND Mission Science Briefing

Oct. 31, 1994; In English; Videotape: 62 min. 41 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000078324; No Copyright; Avail: CASI; B04, Videotape-Beta; V04, Videotape-VHS

The science objectives of the WIND mission are to: 1) provide complete plasma, energetic particle, and magnetic field input for magnetospheric and ionospheric studies; 2) Determine the magnetospheric output to interplanetary space in the up-stream region; 3) Investigate basic plasma processes occurring in the near-Earth solar wind; and 4) Provide baseline ecliptic plane observations to be used in heliospheric latitudes from ULYSSES. The WIND science briefing is presented by George Diller, NASA public affairs; Dr. Robert L. Carovillano, Project Scientist for the Global Geospace Science Initiative, NASA Headquarters; Dr. Mario H. Acuna, Project Scientist for the WIND Project, Goddard Space Flight Center (GSFC); Dr. Keith W. Ogilvie, Principle Investigator, Solar Wind Experiment at GSFC; Dr. Jean Louis Bougeret, Principle Investigator, Radio/Plasma Wave Experiment, Paris; and Dr. Eugeny Mazets, Co-Principle Investigator, Russian Gamma Ray Spectrometer Instrument, St. Pertersburg, Russia. Dr. Carovillano presents a cartoon slide of the Solar Terrestrial System and describes the Sun and the Magnetic field of the Earth. Dr. Acuna also presents a cartoon slide describing GEOTAIL, POLAR, WIND, SOHO, ULYSSES and Cluster which are the various tools used to study the complex solar terrestrial system. Dr. Ogilvie explains four particle and wave instruments on WIND. These instruments will be used to study the contributions and characteristics of plasma and plasma waves that occur in the solar wind. Dr. Bougeret explains the European participation in the WIND mission. He also shows a slide presentation of SOHO and the CLUSTER spacecraft. Dr. Mazets explains the main objective of the Transient Gamma Ray Spectrometer (TGRS) aboard the WIND spacecraft, which is to perform high resolution measurements of Gamma Ray Burst spectra and time histories,

with emphasis on the search for line features in the energy spectra. The briefing ends with a question and answer period. See NONP-NASA-VT-2000078325 for additional question and answer footage.
CASI
Solar Wind; Space Missions; Plasmas (Physics); Delta Launch Vehicle; Earth Magnetosphere

20000066619 Naval Space Command, Dahlgren, VA USA
Space Tracks: A Naval Space Command Bulletin On Naval Space Issues and Initiatives, April 2000
Apr. 2000; 16p; In English
Report No.(s): AD-A377202; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Space Tracks SPACE TRACKS is published four times a year in January, April, July and October as an official, authorized publication of Naval Space Command. Its purpose is to discuss naval space issues and initiatives, and promote broader awareness of space support available to the naval warfighter. Information contained in Space Tracks does not necessarily reflect the official views of the U.S. Government. the Department of Defense, or the Department of the Navy. The editorial content is prepared by the Public Affairs Office of the Commander. Naval Space Command.
DTIC
Defense Program; Aerospace Systems

20000067680 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
NASA/JPL Plans for Fundamental Physics Research in Space
Isaelsson, Ulf E., Jet Propulsion Lab., California Inst. of Tech., USA; Lee, Mark C., NASA, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

In 1998, about 100 researchers met twice to develop plans for the future in this research area. The results of these meetings have been collected in a package titled ”A Roadmap for Fundamental Physics in Space”. A summary of the Roadmap will be presented along with an overview of the current program. Research is being performed in Low Temperature and Condensed Matter Physics, Laser Cooling and Atomic Physics, and Gravitational and Relativistic Physics. There are currently over 50 investigators in the program of which 8 are being evaluated as potential flight experiments. The number of investigators is expected to grow further during the next selection cycle, planned to start toward the end of this year. In the near future, our investigators will be able to take advantage of long duration experimentation in Space using a suite of different carriers under development.
Author
Gravitational Effects; Condensed Matter Physics; Atomic Physics

15
LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also 18 Spacecraft Design, Testing, and Performance; and 20 Spacecraft Propulsion and Power.

20000062016 NASA Langley Research Center, Hampton, VA USA
Parametric Weight Comparison of Advanced Metallic, Ceramic Tile, and Ceramic Blanket Thermal Protection Systems
Myers, David E., NASA Langley Research Center, USA; Martin, Carl J., NASA Langley Research Center, USA; Blosser, Max L., NASA Langley Research Center, USA; June 2000; 48p; In English
Contract(s)/Grant(s): RTOP 242-33-01-50
Report No.(s): NASA/TM-2000-210289; L-17954; NAS 1.15:210289; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A parametric weight assessment of advanced metallic panel, ceramic blanket, and ceramic tile thermal protection systems (TPS) was conducted using an implicit, one-dimensional (I-D) finite element sizing code. This sizing code contained models to account for coatings fasteners, adhesives, and strain isolation pads. Atmospheric entry heating profiles for two vehicles, the Access to Space (ATS) vehicle and a proposed Reusable Launch Vehicle (RLV), were used to ensure that the trends were not unique to a certain trajectory. Ten TPS concepts were compared for a range of applied heat loads and substructural heat capacities to identify general trends. This study found the blanket TPS concepts have the lightest weights over the majority of their applicable ranges, and current technology ceramic tiles and metallic TPS concepts have similar weights. A proposed, state-of-the-art metallic

system which uses a higher temperature alloy and efficient multilayer insulation was predicted to be significantly lighter than the ceramic tile stems and approaches blanket TPS weights for higher integrated heat loads.
Author
Ceramics; Fasteners; Isolation; Loads (Forces); Multilayer Insulation; Thermal Protection; Tiles; Trajectories

20000062303 NASA Kennedy Space Center, Cocoa Beach, FL USA
Delta II Geotail -- 1st Stage and Solid Motor Booster Erection
Jul. 22, 1992; In English; Videotape: 2 min. playing time, in color, no sound
Report No.(s): NONP-NASA-VT-2000078584; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
The Geotail mission's goal was to investigate the structure and dynamics of the geomagnetic tail that extends on the nightside of the Earth. The launch date was July 24, 1992. This video shows the Delta II on the pad, being prepared for the launch. The first stage and the solid motor booster are shown being moved into place on the rocket.
CASI
Construction; Delta Launch Vehicle; Rocket Vehicles

20000062360 NASA Kennedy Space Center, Cocoa Beach, FL USA
Mars Observer Spacecraft Processing
Sep. 25, 1992; In English; Videotape: 51 min. 36 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000081547; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
Footage shows various Mars Observer activities. Scenes include the checkout of the radar pin, the arrival of both the transfer orbit stage and the Mars Observer Spacecraft. Also shown are the mating of the spacecraft, pre-launch activities, countdown, animation of the Martian Environment, and replays of the launching of the Titan satellite.
CASI
Mars Observer; Mars Missions; Mars Exploration; Mars Environment

20000063386 NASA Kennedy Space Center, Cocoa Beach, FL USA
Atlas 2 Animation
Mar. 30, 1993; In English; Videotape: 6 min. 45 sec. playing time, in color, no sound
Report No.(s): NONP-NASA-VT-200081533; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
The Atmospheric Laboratory for Applications and Science-2 (ATLAS-2), was designed to collect data on the relationship between the sun's energy output and Earth's middle atmosphere and how these factors affect the ozone layer. The ATLAS-2 flew on the Space Shuttle Discovery's mission SST-56, launched on April 8, 1993. The videotape consists of an animated tour of the instruments that were included as part of the mission. The first half of the tape shows the various instruments, pointing to each in turn and identifying each by the associated initialisms. The instruments identified were: the Atmospheric Trace Molecule Spectroscopy (ATMOS), Millimeter Wave Atmospheric Sounder (MAS), Shuttle Solar Backscatter Ultraviolet/A (SSBUV/A) spectrometer, Solar Spectrum Measurement (SOLSPEC) instrument, Solar Ultraviolet Irradiance Monitor (SUSIM), Active Cavity Radiometer (ACR) and Solar Constant (SOLCON).) The second half of the animation shows the same tour without the pointing or the identification of the instruments.
CASI
Solar Instruments; Space Transportation System Flights; Radiation Measuring Instruments

20000063490 NASA Kennedy Space Center, Cocoa Beach, FL USA
AC 67 Launch Video
Mar. 26, 1987; In English; Videotape: 2 min. 4 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000078612; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
Live footage of the Unmanned Atlas Centaur (AC) 67 launch is presented on March 26, 1987 at the WESH television station in Florida. Lightning is shown after 49 seconds into the flight. The vehicle is totally destroyed due to a cloud-to-ground lightning flash.
CASI
Pilotless Aircraft; Atlas Centaur Launch Vehicle; Liftoff (Launching)

20000063520 NASA Kennedy Space Center, Cocoa Beach, FL USA
Atlas/Centaur 121 SOHO Launch
Dec. 02, 1995; In English; Videotape: 1 hr. 2 min. 28 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000081545; No Copyright; Avail: CASI; B04, Videotape-Beta; V04, Videotape-VHS

Footage shows the early morning launch of the Atlas/Centaur rocket. Also seen are panoramic views of the launch complex. Scenes of the countdown, engine ignition, and liftoff are also presented. The jettison of both the first and second stage engines are also seen.
CASI
Atlas Centaur Launch Vehicle; Stage Separation; Jettisoning

20000065629 NASA Kennedy Space Center, Cocoa Beach, FL USA
TITAN III/Mars Observer Post-Launch Press Conference
Sep. 25, 1992; In English; Videotape: 26 min. 10 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000081548; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

Footage shows George Diller, NASA's Public Affairs Officer, as he introduces the panel members. Speakers includes: William Piotrowski, Program Manager from NASA Headquarters; James Womack, NASA Launch Manager from Kennedy Space Center; John Gibb, TITAN Launch Vehicle Manager from Langley Research Center; Sid Saucier, Transfer Orbit Stage, Director from Marshall Space Flight Center; and David Evans, Mars Observer, Director from the Jet Propulsion Laboratory. The speakers discuss the launch procedures, activities, and some trouble that the Observer is having. The panelists are also seen answering questions from both the audience as well as other NASA Centers.
CASI
Titan Launch Vehicles; Mars Observer; Conferences

20000067650 NASA Marshall Space Flight Center, Huntsville, AL USA
High Voltage Design Concepts for Launch Vehicles and Orbital Spacecraft Applications
Hall, David K., NASA Marshall Space Flight Center, USA; Kirkici, Hulya, NASA Marshall Space Flight Center, USA; Hillard, G. Barry, NASA Glenn Research Center, USA; Schweickart, Daniel, Department of the Air Force, USA; Dunbar, Bill, Dunbar (Bill), USA; [2000]; 1p; In English; High Voltage, 10-12 Apr. 2000, Newport Beach, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

With the advent of design concepts such as, electromechanical actuation and "more electric" initiatives, has come the need for electrical power buses and electronic equipment to operate at higher than normal dc voltages to meet power requirements while keeping current levels to manageable levels. This new bus voltage has been typically 270 Volts dc nominal for launch vehicles, and 120 Volt dc for the International Space Station. This paper will discuss the new design applications for high voltage dc power in existing and future launch vehicles and spacecraft and the potential problems associated therewith. These new applications must be operational from lift-off, ascent, on orbit and descent in all of the pressure and temperature conditions for each, i.e. through the "Paschen region" twice. This paper will also attempt to stimulate an interest in the academic and professional communities to support and conduct research needed for design data applicable to high voltage dc usage.
Author
High Voltages; Launch Vehicles; Spacecraft Orbits; Design Analysis; Technology Utilization; Direct Current

20000067661 NASA Marshall Space Flight Center, Huntsville, AL USA
Reusable Launch Vehicle Control In Multiple Time Scale Sliding Modes
Shtessel, Yuri, Alabama Univ., USA; Hall, Charles, NASA Marshall Space Flight Center, USA; Jackson, Mark, NASA Marshall Space Flight Center, USA; [2000]; 29p; In English; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A reusable launch vehicle control problem during ascent is addressed via multiple-time scaled continuous sliding mode control. The proposed sliding mode controller utilizes a two-loop structure and provides robust, de-coupled tracking of both orientation angle command profiles and angular rate command profiles in the presence of bounded external disturbances and plant uncertainties. Sliding mode control causes the angular rate and orientation angle tracking error dynamics to be constrained to linear, de-coupled, homogeneous, and vector valued differential equations with desired eigenvalues placement. Overall stability of a two-loop control system is addressed. An optimal control allocation algorithm is designed that allocates torque commands into end-effector deflection commands, which are executed by the actuators. The dual-time scale sliding mode controller was designed for the X-33 technology demonstration sub-orbital launch vehicle in the launch mode. Simulation results show that the designed controller provides robust, accurate, de-coupled tracking of the orientation angle command profiles in presence of external distur-

bances and vehicle inertia uncertainties. This is a significant advancement in performance over that achieved with linear, gain scheduled control systems currently being used for launch vehicles.
Author
Reusable Launch Vehicles; Optimal Control; Stability; Decoupling; Angular Velocity

20000067669 NASA Kennedy Space Center, Cocoa Beach, FL USA
Atlas/Centaur-SOHO Pre-Launch News Conference
Nov. 22, 1995; In English; Videotape: 20 min. 55 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000081546; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

Live coverage of a pre-launch news conference on the Atlas/Centaur SOHO mission is presented. George Diller, NASA Public Affairs, introduces the panel. Floyd Curington, NASA Launch Manager, Kennedy Space Center, presents countdown activities. Pat Symons, Launch Vehicle Manager, NASA Lewis Research Center, analyzes the time duration from liftoff to spacecraft separation. Fabrizio Felici, SOHO Mission Director European Space Agency (ESA), explains the important features of SOHO, which includes a payload of 650 kilos and 12 major instruments with multisensors. Ken Sizemore, International Solar Terrestrial Physics (ISTP) Project Manager Goddard Space Flight Center (GSFC), talks about the successful international collaboration between the ESA and NASA. Joel Tumbiolo, Launch Weather Officer USA Air Force (USAF, presented the weather forecast. SOHO was launched aboard an Atlas II rocket on November 23, 1995. The news conference ends with a brief question and answer period.
CASI
Atlas Centaur Launch Vehicle; SOHO Mission; Prelaunch Summaries; Spacecraft Launching

16
SPACE TRANSPORTATION AND SAFETY

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 15 Launch Vehicles and Launch Vehicles, and 18 Spacecraft Design, Testing and Performance. For space suits, see 54 Man/System Technology and Life Support.

20000063511 NASA Johnson Space Center, Houston, TX USA
STS 101: Post Flight Presentation
Jun. 21, 2000; In English; Videotape: 15 min. 7 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000087291; JSC-1827; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

The crew (Mission Commander James D. Halsell, Jr., Pilot Scott J. Horowitz, and Mission Specialists Mary Ellen Weber, Jeffrey N. Williams, James S. Voss, Susan J. Helms, and Yuri Vladimirovich Usachev) describe the highlights of the STS 101 Mission. The primary scenes reviewed include the spacewalk, incremental assembly/upgrades, space station rendevous, suit testing, critical replacement and repairs to suspect batteries, and reboosting the station from 230 statute miles to 250 statute miles.
CASI
Space Transportation System Flights; Spacecrews; Space Stations; Space Transportation System

20000067639 NASA Marshall Space Flight Center, Huntsville, AL USA
Transportation System Options For The Interstellar Probe Mission
Johnson, Charles Les, NASA Marshall Space Flight Center, USA; May 22, 2000; 1p; In English; xThe Outer Heliosphere: The Next Frontiers, 24-28 Jul. 2000, Potsdam, Germany; Sponsored by Committee on Space Research, France; No Copyright; Avail: Issuing Activity; Abstract Only

NASA is considering a mission to explore near-interstellar space early in the next decade as the first step toward a vigorous interstellar exploration program. A key enabling technology for such an ambitious science and exploration effort is the development of propulsion systems capable of providing fast trip times. Advanced propulsion technologies that might support an interstellar precursor mission early in the next century include some combination of solar sails, nuclear electric propulsion systems, and aerogravity assists. For years, the scientific community has been interested in the development of solar sail technology to support exploration of the inner and outer planets. Progress in thin-film technology and the development of technologies that may enable the remote assembly of lar2e sails in space are only now maturing to the point where ambitious interstellar precursor missions can be considered. Electric propulsion is now being demonstrated for planetary exploration by the Deep Space I mission. The

primary issues for it's adaptation to interstellar precursor applications include the nuclear reactor that would be required and the engine lifetime. A propulsion system concept for the proposed Interstellar Probe mission will be described for each.
Author
Transportation; Interstellar Space; Space Missions; Space Exploration; Nuclear Electric Propulsion; Propulsion System Performance

20000067685 NASA Marshall Space Flight Center, Huntsville, AL USA
Manufacturing and NDE of Large Composite Structures for Space Transportation at MSFC
McGill, Preston, NASA Marshall Space Flight Center, USA; Russell, Sam, NASA Marshall Space Flight Center, USA; [2000]; 41p; In English; 9th; 2000 ASNT Spring Conference, 29 Mar. 2000, Birmingham, AL, Birmingham, AL, USA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents the Marshall Space Flight Center's (MSFC's) vision to manufacture, increase safety and reduce the cost of launch vehicles. Nondestructive evaluations of large composite structures are tested for space transportation at MSFC. The topics include: 1) 6 1/2 Generations of Airplanes in a Century; 2) Shuttle Safety Upgrades; 3) Generations of Reusable Launch Vehicles; 4) RLV Technology Demonstration Path; 5) Second Generation; 6) Key NASA Requirements; 7) X-33 Elements; 8) Future-X Pathfinder Projects and Experiments; 9) Focus Area Technical Goals; 10) X-34 Expanded View; 11) X-38 Spacecraft with De-Orbit Propulsion Stage (DPS); 12) Deorbit Module (DM) Critical Design Review (CDR) Design; 13) Forward Structural Adapter (FSA) CDR Design; 14) X-38 DPS CDR Design; 15) RLV Focused Propulsion Technologies; and 16) Challenges in Technology. This paper is presented in viewgraph form.
CASI
Composite Structures; Manufacturing; Nondestructive Tests; Reusable Launch Vehicles; Space Transportation

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

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

20000063381 NASA Glenn Research Center, Cleveland, OH USA
Radiation Hardened, Modulator ASIC for High Data Rate Communications
McCallister, Ron, SICOM, Inc., USA; Putnam, Robert, SICOM, Inc., USA; Andro, Monty, NASA Glenn Research Center, USA; Fujikawa, Gene, NASA Glenn Research Center, USA; June 2000; 12p; In English; 18th; Communication Satellite Systems, 10-14 Apr. 2000, Oakland, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS3-99096; RTOP 632-6E-51
Report No.(s): NASA/TM-2000-210045; E-12246; NAS 1.15:210045; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Satellite-based telecommunication services are challenged by the need to generate down-link power levels adequate to support high quality (BER approx. equals 10(exp 12)) links required for modem broadband data services. Bandwidth-efficient Nyquist signaling, using low values of excess bandwidth (alpha), can exhibit large peak-to-average-power ratio (PAPR) values. High PAPR values necessitate high-power amplifier (HPA) backoff greater than the PAPR, resulting in unacceptably low HPA efficiency. Given the high cost of on-board prime power, this inefficiency represents both an economical burden, and a constraint on the rates and quality of data services supportable from satellite platforms. Constant-envelope signals offer improved power-efficiency, but only by imposing a severe bandwidth-efficiency penalty. This paper describes a radiation- hardened modulator which can improve satellite-based broadband data services by combining the bandwidth-efficiency of low-alpha Nyquist signals with high power-efficiency (negligible HPA backoff).
Author
Telecommunication; Application Specific Integrated Circuits; Modulators; Power Efficiency

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SPACECRAFT DESIGN, TESTING AND PERFORMANCE

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

20000062015 Texas Univ., Dept. of Mechanical Engineering, Austin, TX USA
Simulation of Hypervelocity Impact on Aluminum-Nextel-Kevlar Orbital Debris Shields ***Final Report***
Fahrenthold, Eric P., Texas Univ., USA; Jun. 30, 2000; 30p; In English
Contract(s)/Grant(s): NCC9-73; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An improved hybrid particle-finite element method has been developed for hypervelocity impact simulation. The method combines the general contact-impact capabilities of particle codes with the true Lagrangian kinematics of large strain finite element formulations. Unlike some alternative schemes which couple Lagrangian finite element models with smooth particle hydrodynamics, the present formulation makes no use of slidelines or penalty forces. The method has been implemented in a parallel, three dimensional computer code. Simulations of three dimensional orbital debris impact problems using this parallel hybrid particle-finite element code, show good agreement with experiment and good speedup in parallel computation. The simulations included single and multi-plate shields as well as aluminum and composite shielding materials. at an impact velocity of eleven kilometers per second.
Author
Simulation; Hypervelocity Impact; Aluminum; Finite Element Method; Computer Programs; Kevlar (Trademark); Shielding; Space Debris

20000062361 NASA Kennedy Space Center, Cocoa Beach, FL USA
SOHO Mission Science Briefing
Oct. 31, 1995; In English; Videotape: 1 hr. 6 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000081535; No Copyright; Avail: CASI; B04, Videotape-Beta; V04, Videotape-VHS

Footage shows the SOHO Mission Pre-Launch Science Briefing. The moderator of the conference is Fred Brown, NASA/GSFC Public Affairs, introduces the panel members. Included are Professor Roger Bonnet, Director ESA Science Program, Dr. Wesley Huntress, Jr., NASA Associate Administrator for Space Science and Dr. Vicente Domingo, ESA SOHO Project Scientist. Also present are several members from the SOHO Team: Dr. Richard Harrison, Art Poland, and Phillip Scherrer. The discussions include understanding the phenomena of the sun, eruption of gas clouds into the atmosphere, the polishing of the mirrors for the SOHO satellite, artificial intelligence in the telescopes, and the launch and operating costs. The panel members are also seen answering questions from various NASA Centers and Paris.
CASI
SOHO Mission; ESA Satellites; Conferences

20000062728 NASA Kennedy Space Center, Cocoa Beach, FL USA
GEOS-I Satellite Applications Briefing
Apr. 12, 1994; In English; Videotape: 53 min. 41 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000081542; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Footage shows a panel discussion on the GEOS-I Satellite. The moderator George Diller, NASA Public Affairs, introduces the panel members. Panel members include Dr. Joe Friday, Director of the National Weather Service and Dr. Bob Sheets, from the National Hurricane Center. Discussions include infrared and microwave imagery, the GEOS-I satellite, and the gathering of weather and hurricane data.
CASI
GEOS Satellites (ESA); Conferences

20000064069 NASA Kennedy Space Center, Cocoa Beach, FL USA
Dutch Viking TROS Aktua Special
Sep. 02, 1986; In English; Videotape: 1 hr. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000081534; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Footage shows the night vertical takeoff of the Viking Hollan hot air balloon. The crew is shown participating in survival technique training, boarding the plane to depart to Canada, and preparing for the vertical takeoff in the hot air balloon across the Atlantic Ocean. Scenes also include the making of the capsule for the balloon, some flight activities, and the landing of the balloon. CASI

Vertical Takeoff; Balloon Flight; Vertical Flight; Climbing Flight; Vertical Landing; Crash Landing

20000064110 NASA Glenn Research Center, Cleveland, OH USA

Issues and Effects of Atomic Oxygen Interactions With Silicone Contamination on Spacecraft in Low Earth Orbit

Banks, Bruce, NASA Glenn Research Center, USA; Rutledge, Sharon, NASA Glenn Research Center, USA; Sechkar, Edward, DYNACS Engineering Co., Inc., USA; Stueber, Thomas, DYNACS Engineering Co., Inc., USA; Snyder, Aaron, NASA Glenn Research Center, USA; deGroh, Kim, NASA Glenn Research Center, USA; Haytas, Christy, Cleveland State Univ., USA; Brinker, David, NASA Glenn Research Center, USA; May 2000; 14p; In English; 8th; 5th; Materials in a Space Environment, 4-9 Jun. 2000, Arcachon, Arcachon, France, France; Sponsored by Centre National d'Etudes Spatiales, France

Contract(s)/Grant(s): RTOP 632-6A-1E

Report No.(s): NASA/TM-2000-210056; E-12258; NAS 1.15:210056; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The continued presence and use of silicones on spacecraft in low Earth orbit (LEO) has been found to cause the deposition of contaminant films on surfaces which are also exposed to atomic oxygen. The composition and optical properties of the resulting SiO(x)- based (where x is near 2) contaminant films may be dependent upon the relative rates of arrival of atomic oxygen, silicone contaminant and hydrocarbons. This paper presents results of in-space silicone contamination tests, ground laboratory simulation tests and analytical modeling to identify controlling processes that affect contaminant characteristics.

Author

Oxygen Atoms; Silicones; Contaminants; Mathematical Models

20000064622 Virginia Polytechnic Inst. and State Univ., Multidisciplinary Analysis and Design (MAD) Center for Advanced Vehicles, Blacksburg, VA USA

Study of a Global Design Space Exploration Method for Aerospace Vehicles

Baker, Chuck A., Virginia Polytechnic Inst. and State Univ., USA; Watson, Layne T., Virginia Polytechnic Inst. and State Univ., USA; Grossman, Bernard, Virginia Polytechnic Inst. and State Univ., USA; Mason, William H., Virginia Polytechnic Inst. and State Univ., USA; Cox, Steven E., Florida Univ., USA; Haftka, Raphael T., Florida Univ., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In the early stages of the design process of aerospace vehicles, the search for optimal configurations is wide open, and the use of local optimization tools may risk missing the best designs. Therefore, global optimization methods are attractive for the early design stage. Unfortunately, global design optimization usually requires the evaluation of a very large number of designs, a formidable computational challenge. The present work demonstrates the use of massively parallel computers for handling this computational challenge. A variety of load balancing methods are used to ensure efficient utilization of the computer nodes. Global optimization was applied to the High Speed Civil Transport (HSCT) aerospace configuration design problem with 28 design variables and 68 nonlinear constraints in a multidisciplinary design optimization (MDO) environment. Even with the use of simple engineering analyses, a thorough design space search is computationally expensive due to the large number of designs that need to be evaluated. The more expensive constraints, such as range and takeoff distances, are performance related. Previous work with this design problem has shown that the design space contains disconnected islands of feasible points, representing different available design concepts. These complexities make it difficult for an optimizer to successfully find the global optimum. The global optimization method used is a Lipschitz algorithm that (essentially) uses all possible values of the Lipschitz constant. By using all possible values of the constant, equal emphasis is placed on local and global search by the optimizer. This causes the optimizer to continue searching globally for the islands of feasible space, while converging on designs in the promising regions that have already been discovered. For each optimization cycle in the algorithm, a large set of new designs that need to be evaluated is generated. Since the objective function and constraint evaluations for each design can be computed independently, parallel computers can be easily used to concurrently evaluate all of the new designs. When there is enough variance in the evaluation time of these designs it is beneficial to have some form of dynamic load balancing. The load balancing schemes investigated for this study are: static load balancing, dynamic load balancing with a master-slave processor organization, fully distributed dynamic load balancing, and fully distributed dynamic load balancing via threads. The parallel optimization runs were conducted for a fixed number of iterations of the modified Lipschitzian algorithm on an SGI Origin 2000. Around 10,000 aircraft designs were evaluated in the design space exploration before finding the global optimum, with the optimizer sampling many of the promising regions of the design space in the process. The variation in the evaluation times of the designs investigated was small. The parallel efficien-

cies for runs with up to 64 processors are shown. It can be seen that when using a small number of processors, the fully distributed version of the code with dynamic load balancing outperforms the other methods of load balancing for the HSCT problem. However, as the number of processors increase, the static load balancing and hierarchical dynamic load balancing are the most efficient. The reason for this behavior is that with fewer processors the number of tasks per processor is increased and differences in evaluation time are magnified, making the problem better suited to dynamic load balancing. With more processors, the processor load imbalance becomes negligible and dynamic load balancing is not needed. For the parallel computer used, the extra overhead in the threaded dynamic load balancing scheme caused its efficiency to decrease more than the schemes without threads as the number of processors was increased. The global optimizer proved to be a useful tool for design space exploration. The optimizer was able to methodically search a high dimensional design space and identify regions of promise containing different design concepts with surprisingly few function evaluations. The sensitivity of load balancing performance to variation in function evaluation time for large MDO problems was also observed. It was seen that when there is a small variation in design evaluation time, the computational overhead needed for dynamic load balancing impeded the parallel performance, and it was more efficient to use static load balancing. However, when the variation in design evaluation times is sufficiently large, fully distributed versions of the code with dynamic load balancing performed best.
Author
Aircraft Design; Design Analysis; Massively Parallel Processors; Multidisciplinary Design Optimization; Parallel Processing (Computers)

20000064717 NASA Marshall Space Flight Center, Huntsville, AL USA
Starfire I/ Consort III Launch
May 16, 1990; In English; Videotape: 28 min. 11 sec. playing time, in color. with sound
Report No.(s): NONP-NASA-VT-2000081529; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The Consort 3 is a commercial suborbital rocket that carried 12 microgravity experiments. It was launched on a Starfire rocket on May 16, 1990, from the Naval Ordnance Missile Test Station facilities at the U.S. Army's White Sands Missile Range (WSMR), NM. The videotape opens with approximately 2 minutes of a man speaking into a microphone but there is no sound. This is followed by a brief summary of the payload, and the expected trajectory, a view of the launch vehicle, the countdown and the launch. The videotape then shows a film clip from the University of Alabama, with Dr. Francis Wessling, project manager for the Consort 3 project, speaking about the mission goals in the materials sciences experimentation. The video shows footage of the payload being assembled. The next section is a discussion by Dr. Roy Hammustedt, of Pennsylvania State University, who reviews the Penn State Bio Module,and the goal of learning about the effects of gravity on physiology. This is followed by George Maybee, from McDonald Douglas, who spoke about the payload integration process while the video shows some of the construction. The last section of the videotape shows a press conference at the launch site. Ana Villamil answers questions from the press about the flight.
CASI
Launching; Microgravity; Payloads; Low Gravity Manufacturing; Gravitational Physiology; Physiological Effects

20000064899 NASA Kennedy Space Center, Cocoa Beach, FL USA
AC-67/FLTSATCOM Launch with Isolated Cam Views/ Freeze of Lightning/ Press Conference
Mar. 26, 1987; In English; Videotape: 34 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000078604; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

The FLTSATCOM system provides worldwide, high-priority UHF communications between naval aircraft, ships, submarines, and ground stations and between the Strategic Air Command and the national command authority network. This videotape shows the attempted launch of the 6th member of the satellite system on an Atlas Centaur rocket. Within a minute of launch a problem developed. The initial sign of the problem was the loss of telemetry data. The videotape shows three isolated views of the launch, and then a freeze shot of a lightning strike shortly after the launch. The tape then shows a press conference, with Mr. Wolmaster, Mr. Gibbs, and Air Force Colonel Alsbrooke. Mr. Gibbs summarizes the steps that would be taken to review the launch failure. The questions from the press mostly concern the weather conditions, and the possibility that the weather might have caused the mission failure.
CASI
Fleet Satellite Communication System; Launching; Lightning; Failure; Liftoff (Launching); Launchers

20000067665 NASA Kennedy Space Center, Cocoa Beach, FL USA
TOPEX/POSEIDON Launch from Guiana Space Center Aboard an Ariane 42P
Aug. 10, 1992; In English; Videotape: 22 min. 23 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000081530; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

Footage shows the Launch Control Center (LCC) as they prepare for launch. During preparation Charles Bigot, Chairman and C.E.O. of Arianespace, and Jean-Daniel Levi, Director of CNES spoke briefly about the join effort between National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA). The NASA administrator, Don Golding also made a brief speech via telephone before the launching. Live footage also shows the launching of the TOPEX/POSEIDON satellite.
CASI
Poseidon Satellite; TOPEX; Spacecraft Launching; Ariane Launch Vehicle

20000067668 NASA Kennedy Space Center, Cocoa Beach, FL USA
Pegasus Departs from KSC
Feb. 09, 1993; In English; Videotape: 2 min. 32 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000081536; KSC93-30261; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Footage shows the departure of the Pegasus launch vehicle from Kennedy Space Center (KSC).
CASI
Pegasus Air-Launched Booster; Air Launching; B-52 Aircraft

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SPACECRAFT INSTRUMENTATION AND ASTRIONICS

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

20000063380 NASA Glenn Research Center, Cleveland, OH USA
Quasi-Steady Acceleration Direction Indicator in Three Dimensions
DeLombard, Richard, NASA Glenn Research Center, USA; Nelson, Emily S., NASA Glenn Research Center, USA; Jules, Kenol, NASA Glenn Research Center, USA; May 2000; 12p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 398-95-0G
Report No.(s): NASA/TM-2000-209931; E-12175; NAS 1.15:209931; AIAA Paper 2000-0570; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many materials processing and fluids physics experiments conducted in a microgravity environment require knowledge of the orientation of the low-frequency acceleration vector. This need becomes especially acute for space experiments such as directional solidification of a molten semiconductor, which is extremely sensitive to orientation and may involve tens of hours of operations of a materials furnace. These low-frequency acceleration data have been measured for many Shuttle missions with the Orbital Acceleration Research Experiment. Previous attempts at using fluid chambers for acceleration measurements have met with limited success due to pointing and vehicle attitude complications. An acceleration direction indicator is described, which is comprised of two orthogonal short cylinders of fluid, each with a small bubble. The motion and the position of the bubble within the chamber will indicate the direction of the acceleration experienced at the sensor location. The direction of the acceleration vector may then be calculated from these data. The frequency response of such an instrument may be tailored for particular experiments with the proper selection of fluid and gas parameters, surface type, and geometry. A three-dimensional system for sensing and displaying the low-frequency acceleration direction via an innovative technique described in this paper has advantages in terms of size, mass, and power compared with electronic instrumentation systems.
Author
Accelerometers; Semiconductors (Materials); Low Frequencies; Directional Solidification (Crystals); Attitude (Inclination); Microgravity

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SPACECRAFT PROPULSION AND POWER

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

20000063506 NASA Glenn Research Center, Cleveland, OH USA
The Electric Power System of the International Space Station: A Platform for Power Technology Development
Gietl, Eric B., Boeing Co., USA; Gholdston, Edward W., Boeing Co., USA; Manners, Bruce A., NASA Glenn Research Center, USA; Delventhal, Rex A., NASA Glenn Research Center, USA; June 2000; 12p; In English; Aerospace, 18-25 Mar. 2000, Big Sky, MT, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): RTOP 478-29-10
Report No.(s): NASA/TM-2000-210209; E-12329; NAS 1.15:210209; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The electrical power system developed for the International Space Station represents the largest space-based power system ever designed and, consequently, has driven some key technology aspects and operational challenges. The full U.S.-built system consists of a 160-Volt dc primary network, and a more tightly regulated 120-Volt dc secondary network. Additionally, the U.S. system interfaces with the 28-Volt system in the Russian segment. The international nature of the Station has resulted in modular converters, switchgear, outlet panels, and other components being built by different countries, with the associated interface challenges. This paper provides details of the architecture and unique hardware developed for the Space Station, and examines the opportunities it provides for further long-term space power technology development, such as concentrating solar arrays and flywheel energy storage systems.
Author
Electric Power Supplies; Energy Storage; Space Platforms; Fabrication

20000064686 NASA Marshall Space Flight Center, Huntsville, AL USA
Fastrac Nozzle Design, Performance and Development
Peters, Warren, NASA Marshall Space Flight Center, USA; Rogers, Pat, NASA Marshall Space Flight Center, USA; Lawrence, Tim, NASA Marshall Space Flight Center, USA; Davis, Darrell, NASA Marshall Space Flight Center, USA; DAgostino, Mark, NASA Marshall Space Flight Center, USA; Brown, Andy, NASA Marshall Space Flight Center, USA; [2000]; 11p; In English; 36th; Joint Propulsion, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-3397; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

With the goal of lowering the cost of payload to orbit, NASA/MSFC (Marshall Space Flight Center) researched ways to decrease the complexity and cost of an engine system and its components for a small two-stage booster vehicle. The composite nozzle for this Fastrac Engine was designed, built and tested by MSFC with fabrication support and engineering from Thiokol-SEHO (Science and Engineering Huntsville Operation). The Fastrac nozzle uses materials, fabrication processes and design features that are inexpensive, simple and easily manufactured. As the low cost nozzle (and injector) design matured through the subscale tests and into full scale hot fire testing, X-34 chose the Fastrac engine for the propulsion plant for the X-34. Modifications were made to nozzle design in order to meet the new flight requirements. The nozzle design has evolved through subscale testing and manufacturing demonstrations to full CFD (Computational Fluid Dynamics), thermal, thermomechanical and dynamic analysis and the required component and engine system tests to validate the design. The Fastrac nozzle is now in final development hot fire testing and has successfully accumulated 66 hot fire tests and 1804 seconds on 18 different nozzles.
Author
Nozzle Design; Injectors; Design Analysis; Engine Design

20000064699 Thiokol Propulsion, Brigham City, UT USA
Internal Flow Analysis of Large L/D Solid Rocket Motors
Laubacher, Brian A., Thiokol Propulsion, USA; [2000]; 12p; In English; 36th; 36th Joint Propulsion Conference, 16-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS8-38100
Report No.(s): AIAA Paper 2000-3803; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Traditionally, Solid Rocket Motor (SRM) internal ballistic performance has been analyzed and predicted with either zero-dimensional (volume filling) codes or one-dimensional ballistics codes. One dimensional simulation of SRM performance is only

necessary for ignition modeling, or for motors that have large length to port diameter ratios which exhibit an axial ”pressure drop” during the early burn times. This type of prediction works quite well for many types of motors, however, when motor aspect ratios get large, and port to throat ratios get closer to one, two dimensional effects can become significant. The initial propellant grain configuration for the Space Shuttle Reusable Solid Rocket Motor (RSRM) was analyzed with 2-D, steady, axi-symmetric computational fluid dynamics (CFD). The results of the CFD analysis show that the steady-state performance prediction at the initial burn geometry, in general, agrees well with 1-D transient prediction results at an early time, however, significant features of the 2-D flow are captured with the CFD results that would otherwise go unnoticed. Capturing these subtle differences gives a greater confidence to modeling accuracy, and additional insight with which to model secondary internal flow effects like erosive burning. Detailed analysis of the 2-D flowfield has led to the discovery of its hidden 1-D isentropic behavior, and provided the means for a thorough and simplified understanding of internal solid rocket motor flow. Performance parameters such as nozzle stagnation pressure, static pressure drop, characteristic velocity, thrust and specific impulse are discussed in detail and compared for different modeling and prediction methods. The predicted performance using both the 1-D codes and the CFD results are compared with measured data obtained from static tests of the RSRM. The differences and limitations of predictions using ID and 2-D flow fields are discussed and some suggestions for the design of large L/D motors and more critically, motors with port to throat ratios near one, are covered.
Author
Internal Flow; Solid Propellant Rocket Engines; Computational Fluid Dynamics; Flow Distribution; Performance Prediction; Prediction Analysis Techniques

20000065622 NASA Marshall Space Flight Center, Huntsville, AL USA
Magnetic Flux Compression Concept for Aerospace Propulsion and Power
Litchford, Ron J., NASA Marshall Space Flight Center, USA; Robertson, Tony, NASA Marshall Space Flight Center, USA; Hawk, Clark W., Alabama Univ., USA; Turner, Matt, Alabama Univ., USA; Koelfgen, Syri, Alabama Univ., USA; Jun. 14, 2000; 4p; In English; 31st; Plasmadynamics and Lasers, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of this research is to investigate system level performance and design issues associated with magnetic flux compression devices for aerospace power generation and propulsion. The proposed concept incorporates the principles of magnetic flux compression for direct conversion of nuclear/chemical detonation energy into electrical power. Specifically a magnetic field is compressed between an expanding detonation driven diamagnetic plasma and a stator structure formed from a high temperature superconductor (HTSC). The expanding plasma cloud is entirely confined by the compressed magnetic field at the expense of internal kinetic energy. Electrical power is inductively extracted, and the detonation products are collimated and expelled through a magnetic nozzle. The long-term development of this highly integrated generator/propulsion system opens up revolutionary NASA Mission scenarios for future interplanetary and interstellar spacecraft. The unique features of this concept with respect to future space travel opportunities are as follows: ability to implement high energy density chemical detonations or ICF microfusion bursts as the impulsive diamagnetic plasma source; high power density system characteristics constrain the size, weight, and cost of the vehicle architecture; provides inductive storage pulse power with a very short pulse rise time; multimegajoule energy bursts/terawatt power bursts; compact pulse power driver for low-impedance dense plasma devices; utilization of low cost HTSC material and casting technology to increase magnetic flux conservation and inductive energy storage; improvement in chemical/nuclear-to-electric energy conversion efficiency and the ability to generate significant levels of thrust with very high specific impulse; potential for developing a small, lightweight, low cost, self-excited integrated propulsion and power system suitable for space stations, planetary bases, and interplanetary and interstellar space travel; potential for attaining specific impulses approaching 10 (exp 6) seconds, which would enable missions to the outer planets within ten years and missions at interstellar distances within fifty years.
Derived from text
Magnetic Flux; Spacecraft Propulsion; Compression Loads; Electric Generators

20000065640 Thiokol Propulsion, Brigham City, UT USA
Thermal-Flow Code for Modeling Gas Dynamics and Heat Transfer in Space Shuttle Solid Rocket Motor Joints
Wang, Qunzhen, Thiokol Propulsion, USA; Mathias, Edward C., Thiokol Propulsion, USA; Heman, Joe R., Thiokol Propulsion, USA; Smith, Cory W., Thiokol Propulsion, USA; [2000]; 14p; In English; 36th; Joint Propulsion, 16-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS8-38100; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new, thermal-flow simulation code, called SFLOW. has been developed to model the gas dynamics, heat transfer, as well as O-ring and flow path erosion inside the space shuttle solid rocket motor joints by combining SINDA/Glo, a commercial thermal

analyzer. and SHARPO, a general-purpose CFD code developed at Thiokol Propulsion. SHARP was modified so that friction, heat transfer, mass addition, as well as minor losses in one-dimensional flow can be taken into account. The pressure, temperature and velocity of the combustion gas in the leak paths are calculated in SHARP by solving the time-dependent Navier-Stokes equations while the heat conduction in the solid is modeled by SINDA/G. The two codes are coupled by the heat flux at the solid-gas interface. A few test cases are presented and the results from SFLOW agree very well with the exact solutions or experimental data. These cases include Fanno flow where friction is important, Rayleigh flow where heat transfer between gas and solid is important, flow with mass addition due to the erosion of the solid wall, a transient volume venting process, as well as some transient one-dimensional flows with analytical solutions. In addition, SFLOW is applied to model the RSRM nozzle joint 4 subscale hot-flow tests and the predicted pressures, temperatures (both gas and solid), and O-ring erosions agree well with the experimental data. It was also found that the heat transfer between gas and solid has a major effect on the pressures and temperatures of the fill bottles in the RSRM nozzle joint 4 configuration No. 8 test.
Derived from text
Computational Fluid Dynamics; Gas Dynamics; Heat Transfer; Applications Programs (Computers); Joints (Junctions); Navier-Stokes Equation; Space Shuttle Boosters; Thermal Analysis

20000066593 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Analysis of the Lifetime Critical Components of the Hellfire 2 Missile and the Hydra 70, 2.75" Rocket ***Final Report Een Analyse van de Levensduurkritische Elementen van het Hellfire II Missile en de 2.75" Hydra 70 Raket***
Keizers, H. L. J., Prins Maurits Lab. TNO, Netherlands; Thomassen, H. J. M., Prins Maurits Lab. TNO, Netherlands; Klein, A. A. J., Prins Maurits Lab. TNO, Netherlands; August 1999; 26p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A98/KLu/445; TNO Proj. 014.11175
Report No.(s): TD99-0115; PML-1999-A20; Copyright; Avail: Issuing Activity

In 1998, a system level study is performed into the lifetime critical aspects of the Hellfire 2 missile and the Hydra 70, 2.75" rocket. The purpose of this study was to identify the lifetime critical components of both systems, in order to assist the Royal Netherlands Airforce on both systems in the coming years. For the Hellfire system this will consist of technical support in field surveillance programme, which is probably going to be performed at AMCOM (USA). For the Hydra 70, test activities and technical support are foreseen. For both systems it is anticipated that the energetic components will become lifetime limiting. If stored under well controlled conditions, a lifetime larger than 10 years seems possible for both systems. The effect of operational conditions in terms of number of captive flight hours, temperature and humidity levels is unknown. It is recommended to obtain information on these effects. Together with information on the ageing characteristics of the systems, this information can probably be used to extent the lifetime or to increase the safety of both systems.
Author
Surveillance; Captive Tests; Air to Surface Missiles; Air to Air Missiles

20000067640 NASA Marshall Space Flight Center, Huntsville, AL USA
Propulsion Options For Interstellar Exploration
Johnson, Les, NASA Marshall Space Flight Center, USA; Leifer, Stephanie, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; 36th; 36th Joint Propulsion Conference, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

NASA is considering missions to explore near-interstellar space (40 - 250 Astronomical Units) early in the next decade as the first step toward a vigorous interstellar exploration program. A key enabling technology for such an ambitious science and exploration effort is a propulsion system capable of providing fast trip times, yet which has low enough mass to allow for the use of inexpensive launch vehicles. Advanced propulsion technologies that might support the First interstellar precursor mission by the end of the first decade of the new millennium include solar sails and nuclear electric propulsion. Solar sails and electric propulsion are two technology areas that may hold promise for the next generation of interstellar precursor missions as well - perhaps a thousand astronomical units traveled in a professional lifetime. Future missions to far beyond the Heliosphere will require the development of propulsion technologies that are only at the conceptual stage today. For years, the scientific community has been interested in solar sail and electric propulsion technologies to support robotic exploration of the solar system. Progress in thin-film materials fabrication and handling, and advancement in technologies that may enable the deployment of large sails in space are only now maturing to the point where ambitious interstellar precursor missions using sails can be considered. Xenon ion propulsion is now being demonstrated for planetary exploration by the Deep Space 1 mission. The primary issues for the adaptation of electric propulsion to interstellar precursor applications include the development of low specific mass nuclear power systems,

engine lifetime, and high power operation. Recent studies of interstellar precursor mission scenarios that use these propulsion systems will be described, and the range of application of each technology will be explored.
Author
Interstellar Space; Space Exploration; Propulsion System Configurations; Propulsion System Performance

20000067658 NASA Marshall Space Flight Center, Huntsville, AL USA
A Design Tool for Liquid Rocket Engine Injectors
Farmer, R., SECA, Inc., USA; Cheng, G., SECA, Inc., USA; Trinh, H., NASA Marshall Space Flight Center, USA; Tucker, K., NASA Marshall Space Flight Center, USA; [2000]; 12p; In English; Joint Propulsion, 17-19 Jul. 2000, Huntsville, AL, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A practical design tool which emphasizes the analysis of flowfields near the injector face of liquid rocket engines has been developed and used to simulate preliminary configurations of NASA's Fastrac and vortex engines. This computational design tool is sufficiently detailed to predict the interactive effects of injector element impingement angles and points and the momenta of the individual orifice flows and the combusting flow which results. In order to simulate a significant number of individual orifices, a homogeneous computational fluid dynamics model was developed. to describe sub- and supercritical liquid and vapor flows, the model utilized thermal and caloric equations of state which were valid over a wide range of pressures and temperatures. The model was constructed such that the local quality of the flow was determined directly. Since both the Fastrac and vortex engines utilize RP-1/LOX propellants, a simplified hydrocarbon combustion model was devised in order to accomplish three-dimensional, multiphase flow simulations. Such a model does not identify drops or their distribution, but it does allow the recirculating flow along the injector face and into the acoustic cavity and the film coolant flow to be accurately predicted.
Author
Combustible Flow; Computational Fluid Dynamics; Injectors; Liquid Propellant Rocket Engines; Three Dimensional Flow; Navier-Stokes Equation; Vorticity

23
CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see categories 24 through 29. For astrochemistry see category 90 Astrophysics.

20000063529 Universal Energy Systems, Inc., Dayton, OH USA
Advanced Thermal Barrier Coating ***Final Report, 3 May 1999 - 3 Feb 2000***
Bhattacharya, Rabi S.; Apr. 26, 2000; 29p; In English
Contract(s)/Grant(s): F33615-99-C-5206
Report No.(s): AD-A377045; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The primary research objective of this work was to develop a novel thermal barrier coating (TBC) system by depositing a high quality alpha alumina sublayer on the metallic bond-coat, prior to the deposition of the yttria stabilized zirconia (YSZ) coating. We have used a patented filtered cathodic arc deposition equipment to deposit an alpha alumina layer on a superalloy that was plasma-spray coated with a NiCoCrAlY bond-coat. The filtered arc coating process allows droplet-free deposition of coatings. Also, this process provides high ionization (> 90%) compared with the standard physical vapor deposition processes (is less than 20%), thereby providing excellent bonding between the coating and the substrate. Using this approach, 0.5 - 0.6 micron thick alpha alumina coatings were deposited on metallic substrate at 925 deg C. Oxidation tests reveal that further improvements are necessary for the system to perform better than state-of-the-art TBCs. The performance was impaired by microstructural instability and surface rumpling of the bond-coat, which caused failure of the alumina layer at a number of locations.
DTIC
Thermal Control Coatings; Yttria-Stabilized Zirconia; Yttrium Oxides; Heat Resistant Alloys; Turbines

20000064083 California Univ., Dept. of Pharmaceutical Chemistry, San Francisco, CA USA
Interaction of a Model Peptide with a Water--Bilayer System
Pohorille, A., California Univ., USA; Wilson, M. A., California Univ., USA; Structure and Reactivity in Aqueous Solution: Characterization of Chemical and Biological Systems; 1994; ISSN 0097-6156, pp. 395-408; In English
Contract(s)/Grant(s): NCC2-772; NCA2-792; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We discuss a molecular dynamics study of the alanine dipeptide at the interface between water and a glycerol-1-monooleate (GMO) bilayer. The dipeptide is interfacially active and incorporates into the bilayer without disrupting its structure. The interfacial region that is readily penetrated by the dipeptide spans the entire head group portion of the bilayer. The polar groups of the alanine dipeptide mostly remain well solvated by water and the oxygen atoms of GMO, and conformations of the dipeptide are characterized by (phi, psi) angles typical of alpha-helix and beta-sheet structures. When the molecule is deeper in the bilayer, the C(sub 7eq) state also becomes stable. The barrier to the isomerization reaction at the interface is lower than in bulk phases. After 7 ns of trajectories, the system is not fully equilibrated, due to slow collective motions involving GMO head groups. These result in decreased mobility and lower rates of isomerization of the dipeptide at the interface.
Author
Molecular Dynamics; Alanine; Peptides; Water; Glycerols

20000065654 NASA Glenn Research Center, Cleveland, OH USA
Hall Effect Thruster Plume Contamination and Erosion Study
Jaworske, Donald A., NASA Glenn Research Center, USA; June 2000; 26p; In English
Contract(s)/Grant(s): RTOP 632-A1-1E
Report No.(s): NASA/TM-2000-210204; E-12324; NAS 1.15:210204; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of the Hall effect thruster plume contamination and erosion study was to evaluate the impact of a xenon ion plume on various samples placed in the vicinity of a Hall effect thruster for a continuous 100 hour exposure. NASA Glenn Research Center was responsible for the pre- and post-test evaluation of three sample types placed around the thruster: solar cell cover glass, RTV silicone, and Kapton(R). Mass and profilometer), were used to identify the degree of deposition and/or erosion on the solar cell cover glass, RTV silicone, and Kapton@ samples. Transmittance, reflectance, solar absorptance, and room temperature emittance were used to identify the degree of performance degradation of the solar cell cover glass samples alone. Auger spectroscopy was used to identify the chemical constituents found on the surface of the exposed solar cell cover glass samples. Chemical analysis indicated some boron nitride contamination on the samples, from boron nitride insulators used in the body of the thruster. However, erosion outweighted contamination. All samples exhibited some degree of erosion. with the most erosion occurring near the centerline of the plume and the least occurring at the +/- 90 deg positions. For the solar cell cover glass samples, erosion progressed through the antireflective coating and into the microsheet glass itself. Erosion occurred in the solar cell cover glass, RTV silicone and Kapton(R) at different rates. All optical properties changed with the degree of erosion, with solar absorptance and room temperature emittance increasing with erosion. The transmittance of some samples decreased while the reflectance of some samples increased and others decreased. All results are consistent with an energetic plume of xenon ions serving as a source for erosion.
Author
Hall Effect; Chemical Analysis; Chemical Composition; Contaminants; Contamination; Exhaust Gases; Plumes; Rocket Engines

20000066599 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Toxicity of Tolyltriazole to Gram-Positive Coccus Microorganisms
Mitchell, Heather L.; Mar. 2000; 111p; In English
Report No.(s): AD-A377117; AFIT/GEE/ENV/00M-13; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Maintaining safe flight operations, military and civilian, in cold weather requires the use of de-icing fluids. Glycols, the primary component of de-icers, have been extensively studied. Water and additives such as corrosion inhibitors and other performance enhancing chemicals make up the remaining portion of de-icing fluids. Little research has been conducted on the additives, but several are suspected toxins to microorganisms, therefore the EPA regulates the disposal of spent de-icing fluids. Tolyltriazole, a corrosion inhibitor found in de-icing fluids, is a suspected human carcinogen. It is also known to be moderately toxic to microorganisms based on Microtox results. The purpose of this research was to determine whether tolyltriazole is toxic to isolated and/or consortia of common soil microorganisms found in soil samples and cultivated using propylene glycol and yeast extract.
DTIC
Toxicity; Deicers; Microorganisms; Deicing; Toxins and Antitoxins

24
COMPOSITE MATERIALS

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

20000062451 Saclay Research Centre, Inst. National des Sciences et Techniques Nucleaires, Gif-sur-Yvette, France
Regular multi-sequences copolymers study at interfaces and in solution
Leclerc, E.; Nov. 15, 1996; 189p; In French; In English
Report No.(s): DE98-732050; FRCEA-TH-590; No Copyright; Avail: Department of Energy Information Bridge

In this study, the conformations which are taken by multi-sequences copolymers in various situations are described. The phase diagram of copolymers near an interface defined by two non-miscible liquids has been given, respectively for a strongly adsorbing interface and for a weakly adsorbing interface. The passage between these two extreme conditions has revealed the existence of many intermediate conditions. Copolymers have also been studied with several solvents of different quality. The formation of folded structures described by micellar structures has been studied according to the size of the respective sequences in a 'good' solvent and in a 'bad' solvent. The obtaining of 'flower' micelles is due to very strict conditions on the solvent quality and on the sequences size. The phase diagram of the different micellar structures has been established. Along with this theoretical study, experimental work has been developed on a model protein: the (beta) casein. The main characteristic parameters of the aggregates formed by the protein have been established by experiments of small angle neutrons scattering. The interactions which are present between macromolecules are strongly attractive at low concentration (formation of micelles) and repulsive when the concentration increases. Some resemblances exist between the micelles formed by the copolymers and the aggregates formed by the (beta) casein.
NTIS
Sequencing; Copolymers; Interfaces; Solubility

20000063379 NASA Glenn Research Center, Cleveland, OH USA
A New Local Failure Model with Application to the Longitudinal Tensile Behavior of Continuously Reinforced Titanium Composites
Bednarcyk, Brett A., Ohio Aerospace Inst., USA; Arnold, Steven M., NASA Glenn Research Center, USA; May 2000; 36p; In English
Contract(s)/Grant(s): NCC3-650; RTOP 242-23-52
Report No.(s): NASA/TM-2000-210027; E-12224; NAS 1.15:210027; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new model for local fiber failures in composite materials loaded longitudinally is presented. In developing the model, the goal was to account for the effects of fiber breakage on the global response of a composite in a relatively simple and efficient manner. Towards this end, the model includes the important feature of local stress unloading, even as global loading of the composite continues. The model has been incorporated into NASA Glenn's Micromechanics Analysis Code with Generalized Method of Cells (MAC/GMC) and was employed to simulate the longitudinal tensile deformation and failure behavior of several silicon carbide fiber/titanium matrix (SiC/Ti) composites. The model is shown to be quite realistic and capable of accurate predictions for various temperatures, fiber volume fractions, and fiber diameters. Further- more, the new model compares favorably to Curtin's (1993) effective fiber breakage model, which has also been incorporated into MAC/GMC.
Author
Titanium; Fiber Composites; Tensile Deformation; Silicon Carbides; Micromechanics

20000064104 Mississippi State Univ., Dept. of Aerospace Engineering, Mississippi State, MS USA
Design Optimization and Residual Strength Assessment of a Cylindrical Composite Shell Structure, *May 1999 - Apr. 2000*
Rais-Rohani, Masoud, Mississippi State Univ., USA; [2000]; 17p; In English
Contract(s)/Grant(s): NAG1-2038; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A summary of research conducted during the specified period is presented. The research objectives included the investigation of an efficient technique for the design optimization and residual strength assessment of a semi-monocoque cylindrical shell structure made of composite materials. The response surface methodology is used in modeling the buckling response of individual skin panels under the combined axial compression and shear loading. These models are inserted into the MSC/NASTRAN code for design optimization of the cylindrical structure under a combined bending-torsion loading condition. The comparison between the monolithic and sandwich skin design cases indicated a 35% weight saving in using sandwich skin panels. In addition, the residual strength of the optimum design was obtained by identifying the most critical region of the structure and introducing a damage in the form of skin-stringer and skin-stringer-frame detachment. The comparison between the two skin design concepts indicated

that the sandwich skin design is capable of retaining a higher residual strength than its monolithic counterpart. The results of this investigation are presented and discussed in this report.
Author
Design Analysis; Optimization; Residual Strength; Shells (Structural Forms); Cylindrical Shells; Technology Assessment

20000064109 NASA Glenn Research Center, Cleveland, OH USA
Ceramic Matrix Composites (CMC) Life Prediction Method Development
Levine, Stanley R., NASA Glenn Research Center, USA; Calomino, Anthony M., NASA Glenn Research Center, USA; Ellis, John R., NASA Glenn Research Center, USA; Halbig, Michael C., Army Research Lab., USA; Mital, Subodh K., Toledo Univ., USA; Murthy, Pappu L., NASA Glenn Research Center, USA; Opila, Elizabeth J., Cleveland State Univ., USA; Thomas, David J., Ohio Aerospace Inst., USA; Thomas-Ogbuji, Linus U., DYNACS Engineering Co., Inc., USA; Verrilli, Michael J., NASA Glenn Research Center, USA; May 2000; 14p; In English; 24th; Composites, Materials and Structures, 24-28 Jan. 2000, Cape Canaveral, FL, USA; Sponsored by Department of Defense, USA
Contract(s)/Grant(s): RTOP 242-82-77
Report No.(s): NASA/TM-2000-210052; E-12253; NAS 1.15:210052; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Advanced launch systems (e.g., Reusable Launch Vehicle and other Shuttle Class concepts, Rocket-Based Combine Cycle, etc.), and interplanetary vehicles will very likely incorporate fiber reinforced ceramic matrix composites (CMC) in critical propulsion components. The use of CMC is highly desirable to save weight, to improve reuse capability, and to increase performance. CMC candidate applications are mission and cycle dependent and may include turbopump rotors, housings, combustors, nozzle injectors, exit cones or ramps, and throats. For reusable and single mission uses, accurate prediction of life is critical to mission success. The tools to accomplish life prediction are very immature and not oriented toward the behavior of carbon fiber reinforced silicon carbide (C/SiC), the primary system of interest for a variety of space propulsion applications. This paper describes an approach to satisfy the need to develop an integrated life prediction system for CMC that addresses mechanical durability due to cyclic and steady thermomechanical loads, and takes into account the impact of environmental degradation.
Author
Ceramic Matrix Composites; Technology Utilization; Silicon Carbides; Prediction Analysis Techniques; Life (Durability); Fiber Composites; Durability

20000065665 Los Alamos National Lab., NM USA
Impact-produced stress waves in composites
Clements, B.; Johnson, J.; Addessio, F.; Hixson, R.; Dec. 31, 1997; 9p; In English; Mechanical and physical behavior of materials under dynamic loading (EURO/DYMAT)
Report No.(s): DE97-005016; LA-UR-97-788; No Copyright; Avail: Department of Energy Information Bridge

The Nonhomogenized Dynamic Method of Cells (NHDMOC) is used to study the propagation of stress waves through laminates. The accuracy of the theory is tested by applying it to a plate-impact experiment and checking its ability to resolve a propagation shock wave front. The theory is then compared to Lagrangian hydrodynamic calculations, where it is found that the NHDMOC consistently requires less fine spatial and temporal grids, and less artificial viscosity to control numerical noise. The theory is then used to treat the impact of an epoxy-graphite bilaminate. When the viscoelastic properties of the epoxy are accounted for, the theory agrees well with the experiment.
NTIS
Stress Waves; Graphite-Epoxy Composites; Stress Propagation; Wave Propagation

20000065666 Sandia National Labs., Albuquerque, NM USA
Testing program to evaluate the effects of simulant mixed wastes on plastic transportation packaging components
Nigrey, P. J.; Dickens, T. G.; Dickman, P. T.; Dec. 31, 1997; 19p; In English; 4th; Mixed waste symposium; Sponsored by American Society of Mechanical Engineers, USA
Report No.(s): DE97-006866; SAND-97-1082C; No Copyright; Avail: Department of Energy Information Bridge

Based on regulatory requirements for Type A and B radioactive material packaging, a Testing Program was developed to evaluate the effects of mixed wastes on plastic materials which could be used as liners and seals in transportation containers. The plastics evaluated in this program were butadiene-acrylonitrile copolymer (Nitrile rubber), cross-linked polyethylene, epichlorohydrin, ethylene-propylene rubber (EPDM), fluorocarbons, high-density polyethylene (HDPE), butyl rubber, polypropylene, polytetrafluoroethylene, and styrene-butadiene rubber (SBR). These plastics were first screened in four simulant mixed wastes. The liner materials were screened using specific gravity measurements and seal materials by vapor transport rate (VTR) measure-

ments. For the screening of liner materials, Kel-F, HDPE, and XLPE were found to offer the greatest resistance to the combination of radiation and chemicals. The tests also indicated that while all seal materials passed exposure to the aqueous simulant mixed waste, EPDM and SBR had the lowest VTRs. In the chlorinated hydrocarbon simulant mixed waste, only Viton passed the screening tests. In both the simulant scintillation fluid mixed waste and the ketone mixture waste, none of the seal materials met the screening criteria. Those materials which passed the screening tests were subjected to further comprehensive testing in each of the simulant wastes. The materials were exposed to four different radiation doses followed by exposure to a simulant mixed waste at three temperatures and four different exposure times (7, 14, 28, 180 days). Materials were tested by measuring specific gravity, dimensional, hardness, stress cracking, VTR, compression set, and tensile properties.
NTIS
Wastes; Materials Tests; Radioactive Materials

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20000062845 Defence Science and Technology Organisation, Weapons Systems Div., Melbourne Australia
Thermochemistry and Kinetics Models for Magnesium/Teflon/Viton Pyrotechnic Compositions
Christo, Farid C.; Dec. 1999; 42p; In English
Report No.(s): AD-A377423; DSTO-TR-0938; DODA-AR-011-217; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study examines in detail the equilibrium chemistry of Magnesium/Teflon (MT), Magnesium/Teflon/Viton (MTV), and MTV-air compositions. Gas-phase as well as solid-phase chemistry has been included. Equilibrium calculations accounting for over 47 species and various initial conditions have been performed. A comparison between MT and MTV combustion has been carried out with emphasis on investigating the effect of Viton on the combustion characteristics. The effect of air on MTV combustion has also been investigated for two possible MTV-air combustion models. A chemical kinetic mechanism with 18 reactions and 17 species, has been used to study the time evolution of reacting MT mixtures, accounting for finite-rate elementary reactions as well as performing sensitivity analysis with respect to reaction rates. Three different variations of the kinetic scheme have been studied and their effects on combustion products and flame temperature have been examined. Kinetic analysis has been repeated for three pyrotechnic compositions that are commonly used in flare and rocket motor igniter formulations.
DTIC
Thermochemistry; Chemical Reactions; Reaction Kinetics; Combustion Physics; Combustion Chemistry; Pyrotechnics

20000063365 National Inst. of Standards and Technology, (BFRL), Gaithersburg, MD USA
User's Guide for Smokeview Version 1.0: A Tool for Visualizing Fire Dynamics Simulation Data
Forney, G. P.; McGrattan, K. B.; May 2000; 44p; In English
Report No.(s): PB2000-105779; NISTIR-6513; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Smokeview is a software tool designed to visualize numerical predictions generated by the NIST Fire Dynamics Simulator (FDS). FDS is a computational fluid dynamics (CFD) model of fire-driven fluid flow. These two tools are used in concert to respectively model and analyze scenarios involving features such as fire, wind, sprinklers, complex geometry, etc. Smokeview visualizes FDS modeling results in many ways, some of which are 1) animating flow of smoke or tracer particles, 2) animating 2D contours of data slices, 3) plotting 2D and 3D static contours, or 4) plotting flow vectors.
NTIS
Software Development Tools; Software Engineering; Scientific Visualization; Computational Fluid Dynamics; Computerized Simulation; Numerical Flow Visualization

20000063500 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Contaminant Ice Visualization Experiment in a Glass Pulse Tube
Hall, J. L., Jet Propulsion Lab., California Inst. of Tech., USA; Ross, R. G., Jr., Jet Propulsion Lab., California Inst. of Tech., USA; Le, A. K., California Univ., USA; [2000]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Results are presented from pulse tube experiments designed to investigate the effect of 400 parts per million water vapor contamination of the helium working gas. The experiments were conducted in a glass pulse tube to enable visualization of ice formation on internal surfaces. Photographs of this ice formation were taken along with simultaneous coldtip temperature and

compressor power measurements. Four types of regenerator elements were tested in various combinations: 200- and 400-mesh stainless steel screens, 1.6 mm diameter glass beads, and 1.6 mm thick perforated plastic plates. Internal spacers were also used to provide clear fields of view into the regenerator stack. Substantial water-ice formation was observed at the cold end of the regenerator and on the inside wall of pulse tube; it appeared to be highly porous, like snow, and was seen to accumulate only in a very localized region at the coldest end, despite changing the cold tip temperature across a range of 150 to 235 K. Ice formation degraded pulse tube thermal performance only in cases where screen regenerators were used at the regenerator cold end. It was concluded that flow blockage was the mechanism by which contaminants affected performance; coarse regenerator elements were largely immune over the tested time scale of a few days. Substantially reduced ice formation and minimal performance loss were also observed in repeated tests where the contaminated gas was reused after warming up and melting of the accumulated internal ice. Significant adsorption of the liquid water onto the regenerator was inferred, a process that depleted the gas phase concentration of water.
Author
Contamination; Glass; Helium; Pipes (Tubes); Vapor Phases; Visual Observation; Ice Formation

20000063517 National Inst. of Standards and Technology, Gaithersburg, MD USA
Molecular Dynamics Study of Tethered Chains
Mountain, R. D.; Hubbard, J. B.; Meuse, C. W.; Simmons, V.; Mar. 2000; 26p; In English
Report No.(s): PB2000-105430; NISTIR-6481; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The results of a series of molecular dynamics simulations of monolayer films formed by tethered, long chain molecules (octadecanthiol) are discussed. The emphasis is on the structure of the chains. The density profiles, the distribution of gauche defects along the chains, and two orientation measures are described. Where possible, the connections with experimental probes of such films are mentioned.
NTIS
Molecular Dynamics; Tethering; Molecular Chains; Molecular Structure; Atomic Structure

20000063530 Iowa State Univ. of Science and Technology, Ames, IA USA
Theoretical Studies of Silicon and Related Elements ***Final Report, 1 Jan. 199 - 30 Jun. 1998***
Gordon, Mark S.; Mar. 14, 2000; 19p; In English
Contract(s)/Grant(s): F49620-95-1-0073
Report No.(s): AD-A376264; AFRL-SR-BL-TR-00-0129; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
The main goals of this program have been to develop new, more effective methods for perform in accurate ab initio electronic structure calculations and to use these methods for the prediction of molecular structure, bonding and reactivity, especially for main group species and reactions of interest to the Air Force. Progress on the associated AASERT grant is include in this report. From the theoretical point of view, the principle accomplishments have been extensive development of approaches and codes for performing electronic structure calculations in parallel, continued development of methods for interfacing electronic structure calculations with dynamics, the development of a new model for treating solvation, and the development and implementation of a gridless approach to density functional theory. Applications have ranged from the development of very accurate and extensive potential energy surfaces for A + HB reactions (to interface with the experiments of Neumark and Zare) to the role of catalysts in the hydrosilation reaction and the formation of silsesquioxanes to extensive studies of reactions involved in both main group and transition metal chemical vapor deposition (CVD) to broad-based studies of cage molecules (using our new parallel capabilities) that are potential precursors for new materials, electronic and optical devices, and catalysts.
DTIC
Silicon; Molecular Structure; Electronic Structure

20000064053 Brigham Young Univ., Dept. of Chemistry and Biochemistry, Provo, UT USA
N,N-Bis-(8-hydroxy-5-Nitroquinolin-7-ylmethyl)diaza-18-Crown-6, a Chemosensor for Mercury Ions
Savage, Paul B., Brigham Young Univ., USA; Su, Ning, Brigham Young Univ., USA; Bradshaw, Jerald S., Brigham Young Univ., USA; Izatt, Reed M., Brigham Young Univ., USA; Prodi, Luca, Brigham Young Univ., USA; Mar. 13, 2000; 8p; In English
Contract(s)/Grant(s): N00014-98-1-0485
Report No.(s): AD-A375273; TR-17; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy
Diaza-18-crown-6 appended with two 8-hydroxy-5-nitroquinoline groups acts as an effective fluorescent chemosensor for Hg(2+). The apparent PK(a)s of the phenolic protons on the ligand decrease significantly in the presence of mercury allowing

formation of a neutral, fluorescent complex. The ligand responds selectively to Hg(2+) in the presence of other metal ions including alkali metal and alkaline earth cations, Zn(2+), Cd(2+), Ni(2+) and Cu(2+).
DTIC
Mercury (Metal); Ethers; Hydroxyl Radicals

20000064059 Joint Inst. for Nuclear Research, Flerov Lab. of Nuclear Reactions, Dubna, USSR
Determination of natural and artificial actinides in samples of natural water using reaction of photofission
Tolmachev, S.; Dmitriev, S. N.; Maslov, O. D.; Molokanova, L. G.; Gustova, M. V.; Dec. 31, 1998; 11p; In Russian; In English
Report No.(s): DE99-607986; JINR-R-12-98-24; No Copyright; Avail: Department of Energy Information Bridge

The method of determination of the ultra small contents of actinides using the photofission ((gamma), f) reaction and registration of fission fragments by solid state track detectors has been developed. The radiochemical scheme of thorium, uranium, neptunium and plutonium isolation and analysis in natural waters is offered. The compact electron accelerator - microtron MT-25 served as a source of gamma quanta of the Bremsstrahlung.
NTIS
Actinide Series; Fission

20000064610 NASA Glenn Research Center, Cleveland, OH USA
NCC: A Physics-Based Design and Analysis Tool for Combustion Systems
Liu, Nan-Suey, NASA Glenn Research Center, USA; Quealy, Angela, DYNACS Engineering Co., Inc., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The National Combustion Code (NCC) is an integrated system of computer codes for physics-based design and analysis of combustion systems. It uses unstructured meshes and runs on parallel computing platforms. The NCC is composed of a set of distinct yet closely related modules. They are: (1) a gaseous flow module solving 3-D Navier-Stokes equations; (2) a turbulence module containing the non-linear k-epsilon models; (3) a chemistry module using either the conventional reduced kinetics approach of solving species equations or the Intrinsic Low Dimensional Manifold (ILDM) kinetics approach of table looking up in conjunction with solving the equations of the progressive variables; (4) a turbulence-chemistry interaction module including the option of solving the joint probability density function (PDF) for species and enthalpy; and (5) a spray module for solving the liquid phase equations. In early 1995, an industry-government team was formed to develop the NCC. In July 1998, the baseline beta version was completed and presented in two NCC sessions at the 34th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit, July 1998. An overview of this baseline beta version was presented at the NASA HPCCP/CAS Workshop 98, August 1998. Since then, the effort has been focused on the streamlining, validation, and enhancement of the th baseline beta version. The progress is presented in two NCC sessions at the AIAA 38 Aerospace Sciences Meeting & Exhibit, January 2000. At this NASA HPCCP/CAS Workshop 2000, an overview of the NCC papers presented at the AIAA 38 th Aerospace Sciences Meeting & Exhibit is presented, with emphasis on the reduction of analysis time of simulating the (gaseous) reacting flows in full combustors. In addition, results of NCC simulation of a modern turbofan combustor will also be reported.
Author
Combustion; Computer Programs; K-Epsilon Turbulence Model; Kinetics; Parallel Processing (Computers); Navier-Stokes Equation

20000064712 Wisconsin Univ., Dept. of Chemistry, Madison, WI USA
Structure and Spectroscopy of (HCN)(sub n) Clusters: Cooperative and Electronic Delocalization Effects in C-H...N Hydrogen Bonding
King, Bretta F., Wisconsin Univ., USA; Weinhold, Frank, Wisconsin Univ., USA; Journal of Chemical Physics; Jul. 01, 1995; ISSN 0021-9606; Volume 103, No. 1, pp. 333-347; In English
Contract(s)/Grant(s): NSF CE-90-07850; Copyright; Avail: Issuing Activity

We investigate ab initio energetic, structural, dielectric, and ir spectroscopic properties of linear (HCN)(sub n) clusters (extending the theoretical levels and cluster sizes previously considered) to quantitatively characterize cooperative effects in C-H...N hydrogen bonding that may be amenable to experimental detection. Our results indicate that large cooperative effects should be evident in H-bond energies (approximately 90% increase), intermolecular separations (approximately 0.10-0.15 A shrinkage), average dipole moments (approximately 25% increase), and, particularly, in CH stretching frequencies (approximately 100/cm shift) and intensities (approximately 300%-400% increase per monomer) as cluster size increases. Such non-pairwise-additive effects lie outside the scope of empirical potentials in common usage, and thus reflect fundamental inadequacies of these potentials and the underlying ”electrostatic” picture of H bonding. We employ natural bond orbital (NBO) analysis to examine the detailed electronic origins of cooperative effects, particularly the dramatic ir intensity enhancements that may provide

a unique spectroscopic signature of concerted intermolecular charge shifts. NBO analysis suggests how the nonlinear cooperativity effects can be rationalized in terms of the fundamental n(sub N) yields sigma(sup *, sub CH) ”charge transfer” (”resonance”) nature of H bonding, manifested even in low-polarity H bonds involving CH groups.
Author
Infrared Spectroscopy; Hydrocyanic Acid; Dielectric Properties; Structural Analysis

20000065620 NASA Marshall Space Flight Center, Huntsville, AL USA
Thermophysics Characterization of Kerosene Combustion
Wang, Ten-See, NASA Marshall Space Flight Center, USA; [2000]; 31p; In English; 34th; Thermophysics, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A one-formula surrogate fuel formulation and its quasi-global combustion kinetics model are developed to support the design of injectors and thrust chambers of kerosene-fueled rocket engines. This surrogate fuel model depicts a fuel blend that properly represents the general physical and chemical properties of kerosene. The accompanying gaseous-phase thermodynamics of the surrogate fuel is anchored with the heat of formation of kerosene and verified by comparing a series of one-dimensional rocket thrust chamber calculations. The quasi-global combustion kinetics model consists of several global steps for parent fuel decomposition, soot formation, and soot oxidation, and a detailed wet-CO mechanism. The final thermophysics formulations are incorporated with a computational fluid dynamics model for prediction of the combustor efficiency of an uni-element, tri-propellant combustor and the radiation of a kerosene-fueled thruster plume. The model predictions agreed reasonably well with those of the tests.
Author
Combustion Physics; Computational Fluid Dynamics; Kerosene; Mathematical Models; Rocket Engine Design; Reaction Kinetics; Thermodynamics

20000065632 NASA Marshall Space Flight Center, Huntsville, AL USA
Parallel Processing in Combustion Analysis
Schunk, Richard Gregory, NASA Marshall Space Flight Center, USA; Chung, T. J., Alabama Univ., USA; Apr. 26, 2000; 19p; In English; Finite Elements in Flow Problems, 30 Apr. - 4 May 2000, Austin, TX, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this research is to demonstrate the application of the Flow-field Dependent Variation (FDV) method to a problem of current interest in supersonic chemical combustion. Due in part to the stiffness of the chemical reactions, the solution of such problems on unstructured three dimensional grids often dictates the use of parallel computers. Preliminary results for the injection of a supersonic hydrogen stream into vitiated air are presented.
Derived from text
Flow Distribution; Parallel Processing (Computers); Supersonic Combustion; Parallel Computers

20000065650 Wisconsin Univ., Dept. of Chemistry, Madison, WI USA
Quadrupole Coupling Constants in Linear (HCN(n) Clusters: Theoretical and Experimental Evidence for Cooperativity Effects in C-H...N Hydrogen Bonding
King, B. F., Wisconsin Univ., USA; Farrar, T. C., Wisconsin Univ., USA; Weinhold, F., Wisconsin Univ., USA; Journal of Chemical Physics; Jul. 01, 1995; ISSN 0021-9606; Volume 103, No. 1, pp. 348-352; In English
Contract(s)/Grant(s): NSF CHE-90-07850; NSF CHE-91-02674; Copyright; Avail: Issuing Activity

Ab initio quadrupole coupling constants chi(D), chi(N-14) for deuterium and nitrogen nuclei are obtained for the sequence of linear (HCN)(n) clusters (up to n=6) at the RHF/6-31 + G* level, complementing previous studies of n-dependent ”cooperative” effects in these C-H ... N hydrogen-bonded species. For the dimer and trimer, the theoretical values are compared with experimental equilibrium values of Gutowsky and co-workers and found to successfully reproduce both the magnitudes and patterns of measured shifts. For larger (HCN)(n) clusters, the n-dependent trends in chi(D), chi(N-14) appear to be correlated with cooperativity effects found previously (binding energies, geometrical parameters, dipole moments, ir frequencies and intensities). This suggests that quadrupole coupling measurements can provide a useful probe of cooperative H-bonding phenomena in gaseous and condensed media.
Author
Quadrupoles; Coupling; Constants; Molecular Clusters; Hydrocyanic Acid

20000065655 Ames Lab., IA USA

Fundamental studies of supported bimetallic catalysts by NMR spectroscopy

Savargaonkar, N.; Oct. 17, 1996; 68p; In English

Report No.(s): DE97-002922; IS-T-1794; No Copyright; Avail: Department of Energy Information Bridge

Various hydrogenation reactions on transition metals are important commercially whereas certain hydrogenolysis reactions are useful from fundamental point of view. The kinetics of hydrogen chemisorption was studied by means of selective excitation NMR on silica supported Pt, Rh and Pt-Rh catalysts. The activation energy of hydrogen desorption was found to be lower on silica supported Pt catalysts as compared to Rh and Pt-Rh catalysts. It was found that the rates of hydrogen adsorption and desorption on Pt-Rh catalyst were similar to those on Rh catalyst and much higher as compared to Pt catalyst. The Ru-Ag bimetallic system is much simpler to study than the Pt-Rh system and serves as a model system to characterize more complicated systems such as the K/Ru system. Ag was found to decrease the amounts of adsorbed hydrogen and the hydrogen-to-ruthenium stoichiometry. Ag reduced the populations of states with low and intermediate binding energies of hydrogen on silica supported Ru catalyst. The rates of hydrogen adsorption and desorption were also lower on silica supported Ru-Ag catalyst as compared to Ru catalyst. This report contains introductory information, the literature review, general conclusions, and four appendices.

NTIS

Bimetals; Catalysts; Spectroscopic Analysis

20000066592 Department of the Navy, Washington, DC USA

Fiber-Optic Pipette (FOP) for Rapid Long Pathlength Capillary Spectroscopy

Stellman, Christopher, Inventor; Bucholtz, Frank, Inventor; Ewing, Kenneth, Inventor; Jul. 30, 1998; 13p; In English

Patent Info.: Filed 30 Jul. 1998; US-Patent-Appl-SN-09-126,221

Report No.(s): AD-D019713; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

Capillary spectroscopy is frequently used in the analysis of small-volume liquid samples. Traditionally, optical spectroscopy of samples in capillary tubes has been achieved by using simple lenses to excite the sample and collect the resulting signal of interest, Figure la. More recently, these standard optical arrangements have been replaced with fiber-optics, Figure 1b. Coupling of a fiber-optic probe to the end of a capillary tube has provided a much simpler means of sample excitation and signal collection. In addition, this arrangement has allowed for the excited and collected light to be efficiently waveguided throughout the sample medium over a long pathlength. Thus, a larger sample is interrogated (opposed to traditional capillary or non- capillary measurements) and significant signal enhancements have been achieved.

DTIC

Optical Properties; Spectroscopy; Capillary Tubes; Fiber Optics

20000067641 NASA Marshall Space Flight Center, Huntsville, AL USA

Exploiting the Temperature Dependence of Magnetic Susceptibility to Control Convection in Fundamental Studies of Solidification Phenomena

Seybert, C. D., California Univ., USA; Evans, J. W., California Univ., USA; Leslie, Fred, NASA Marshall Space Flight Center, USA; Jones, W. K., Jr., Motorola, USA; [2000]; 2p; In English; Microgravity Materials Science, 7 Jun. 2000, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

It is well known that convection is a dominant mass transport mechanism when materials are solidified on Earth's surface. This convection is caused by gradients in density (and therefore gravitational force) that are brought about by gradients in temperature, composition or both. Diffusion of solute is therefore dwarfed by convection and the study of fundamental parameters, such as dendrite tip shape and growth velocity in the absence of convection is nearly impossible. Significant experimental work has therefore been carried out in orbiting laboratories with the intent of minimizing convection by minimizing gravity. One of the best known experiments of this kind is the Isothermal Dendritic Growth Experiment (IDGE), supported by NASA. Naturally such experiments are costly and one objective of the present investigation is to develop an experimental method whereby convection can be- halted, in solidification and other experiments, on the surface. A second objective is to use the method to minimize convection resulting from the residual accelerations suffered by experiments in microgravity. The method to be used to minimize convection relies on the dependence of the magnetic susceptibility of a fluid on temperature or composition (whichever is driving convection). All materials experience a force when placed in a magnetic field gradient. The direction and magnitude of that force depend on the magnetic susceptibility of the material. Consequently the force will vary if the susceptibility varies with temperature or composition. With a magnetic field gradient in the right direction (typically upward) and of the right magnitude, this variation in the magnetic force can be made to exactly cancel the variation in the gravitational force. Expressed another way, normal buoyancy is exactly countered by a "magnetic buoyancy". To demonstrate the principle, a solution of MnC12 in water has been used. First the variation of the susceptibility of this paramagnetic solution with temperature and concentration was measured. Then a

”cell”, containing this solution and 50mm long by 15mm high by 155mm wide, was placed in a superconducting magnet at Marshall Space Flight Center. The magnetic field was measured at various positions within the bore of the magnet using a Hall effect probe. In this way, a position was found where the magnetic field gradient was predominantly upward; the magnitude of the gradient could then be adjusted by adjusting the current of the magnet. The ends of the cell consisted of machined copper blocks maintained at controlled temperatures by circulating water from constant temperature baths. The walls of the cell were of rectangular section glass tubing so that the cell contents could be seen. Velocities arising from thermal gradients within the cell were measured by particle image velocimetry (PIV). Particles used for this purpose were silver-coated hollow glass spheres of micrometers diameter and nearly the same density as the solution. A central vertical plane of the cell was illuminated by a laser beam passing through a cylindrical lens. Digital images of the particles were captured on a CCD camera and fed to a computer so that frame-to-frame movements of particles traveling with the fluid were captured. These images were employed to compute velocity maps using commercial PIV software. In a typical experiment the cold end of the cell was maintained at 10C and the warm end at 30 C. With no current in the magnet, i.e.- with natural -convection allowed to occur, the fluid was observed to circulate with an average speed of approximately 0.3 millimeters per second. It was visually apparent that this circulation was diminished as the current was increased. At currents of approximately 20A the flow was halted, to within the precision of the PIV measurements. At yet higher currents the convection was reversed with the hotter solution sinking and the cooler solution rising. At 40A this reversed convection had speeds averaging 0.43 millimeters per second. The measurements of susceptibility and density allow an estimate of the field gradient necessary to halt convection in the experiment. That estimate was 7.8T (squared) per meter and the convection was observed to halt in the magnet at a current giving 7.21T (squared) per meter from the magnetic field measurements. Calculations of the flow have been carried out using the computational fluid dynamics software FLUENT and show good agreement with the measurements.
Author
Convection; Magnetic Permeability; Solidification; Temperature Dependence; Computational Fluid Dynamics

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METALS AND METALLIC MATERIALS

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

20000061970 NASA Glenn Research Center, Cleveland, OH USA
Bithermal Low-Cycle Fatigue Evaluation of Automotive Exhaust System Alloy SS409
Lu, Gui-Ying, Arvin Exhaust Systems, USA; Behling, Mike B., Arvin Exhaust Systems, USA; Halford, Gary R., NASA Glenn Research Center, USA; [2000]; 32p; In English, 1 Nov. 1999, Cincinnati, OH, USA; Sponsored by American Society for Metals, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This investigation provides, for the first time, cyclic strainrange-controlled, thermomechanical fatigue results for the ferritic stainless steel alloy SS409. The alloy has seen extensive application for automotive exhaust system components. The data were generated to calibrate the Total Strain Version of the Strainrange Partitioning (TS-SRP) method for eventual application to the design and durability assessment of automotive exhaust systems. The thermomechanical cyclic lifetime and cyclic stress-strain constitutive behavior for alloy SS409 were measured using bithermal tests cycling between isothermal extremes of 400 and 800 C. Lives ranged up to 10,000 cycles to failure with hold-times of 0.33 to 2.0 minutes. The bithermal fatigue behavior is compared to isothermal, strain-controlled fatigue behavior at both 400 and 800 C. Thermomechanical cycling was found to have a profound detrimental influence on the fatigue failure resistance of SS409 compared to isothermal cycling. Supplementary bithermal cyclic stress-strain constitutive tests with hold-times ranging from 40 seconds up to 1.5 hours were conducted to calibrate the TS-SRP equation for extrapolation to longer lifetime predictions. Observed thermomechanical (bithermal) fatigue lives correlated well with lives calculated using the calibrated TS-SRP equations: 70% of the bithermal fatigue data fall within a factor of 1.2 of calculated life; 85% within a factor of 1.4; and 100% within a factor of 1.8.
Author
Cycles; Fatigue Life; Fatigue (Materials); Alloys; Ferritic Stainless Steels; Stress-Strain Relationships

20000064082 United Engineering Foundation, Inc., New York, NY USA
An Interdisciplinary Approach to the Science of Alloys in Metals, Minerals and Other Materials Systems, *7 Jan. 1999 - 6 Mar. 2000*
Gonis, A.; Melke, A.; Rajan, K.; Turchi, P. E.; Sep. 15, 1999; 19p; In English; 2nd; Alloy, 8-13 Aug. 1999, Davos, Switzerland
Contract(s)/Grant(s): N00014-99-1-0895
Report No.(s): AD-A368788; 99-BS; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy; Abstract Only; Abstract Only

This is a second Triennial Conference on the physical, chemical, and mechanical properties of materials, interpreted to mean simple and complex inorganic solids, i.e., metals, semiconductors, and mineral of technological and environmental significance. DTIC

Alloys; Minerals; Semiconductors (Materials); Metals

20000064094 NASA Glenn Research Center, Cleveland, OH USA

Effects of Melt Convection and Solid Transport on Macrosegregation and Grain Structure in Equiaxed Al-Cu Alloys

Rerko, Rodney S., Iowa Univ., USA; deGroh, Henry C., III, NASA Glenn Research Center, USA; Beckermann, Christoph, Iowa Univ., USA; May 2000; 118p; In English

Contract(s)/Grant(s): RTOP 101-13-0A

Report No.(s): NASA/TM-2000-210020; E-12217; NAS 1.15:210020; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Macrosegregation in metal casting can be caused by thermal and solutal melt convection, and the transport of unattached solid crystals resulting from nucleation in the bulk liquid or dendrite fragmentation. to develop a comprehensive numerical model for the casting of alloys, an experimental study has been conducted to generate benchmark data with which such a solidification model could be tested. The objectives were: (1) experimentally study the effects of solid transport and thermosolutal convection on macrosegregation and grain size; and (2) provide a complete set of boundary conditions temperature data, segregation data, and grain size data - to validate numerical models. Through the control of end cooling and side wall heating, radial temperature gradients in the sample and furnace were minimized. Thus the vertical crucible wall was adiabatic. Samples at room temperature were 24 cc and 95 mm long. The alloys used were Al-1 wt. pct. Cu, and Al- 10 wt. pct. Cu; the starting point for solidification was isothermal at 710 and 685 C respectively. to induce an equiaxed structure various amounts of the grain refiner TiB2 were added. Samples were either cooled from the top, or the bottom. Several trends in the data stand out. In attempting to model these experiments, concentrating on these trends or differences may be beneficial.

Author

Melts (Crystal Growth); Convection; Solidification; Transport Properties; Aluminum Alloys; Copper; Experimentation; Grain Size; Temperature Gradients; Free Convection; Fragmentation

20000064095 Case Western Reserve Univ., Cleveland, OH USA

Thermophysical Properties of GRCop-84 ***Final Report***

Ellis, David L., Case Western Reserve Univ., USA; Keller, Dennis J., RealWorld Quality Systems, Inc., USA; June 2000; 22p; In English

Contract(s)/Grant(s): NAS3-463; RTOP 242-23-54

Report No.(s): NASA/CR-2000-210055; E-12257; NAS 1.26:210055; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The thermophysical properties and electrical resistivity of GRCop-84 (Cu - 8 at.% Cr-4 at.% Nb) were measured from cryogenic temperatures to near its melting point. The data were analyzed using weighted regression to determine the properties as a function of temperature and assign appropriate confidence intervals. The results showed that the thermal expansion of GRCop-84 was significantly lower than NARloy-Z (Cu-3 wt. % Ag-0.5 wt. % Zr), the currently used thrust cell liner material. The lower thermal expansion is expected to translate into lower thermally induced stresses and increases in thrust cell liner lives between 2X and 41X over NARloy-Z. The somewhat lower thermal conductivity of GRCop-84 can be offset by redesigning the liners to utilize its much greater mechanical properties. Optimized designs are not expected to suffer from the lower thermal conductivity. Electrical resistivity data, while not central to the primary application, show that GRCop-84 has potential for applications where a combination of good electrical conductivity and strength is required.

Author

Copper Alloys; Chromium Alloys; Thermophysical Properties; Electrical Resistivity; Measure and Integration; Cryogenic Temperature

20000064902 NASA Lewis Research Center, Cleveland, OH USA

Thermal Studies of New Precursors to Indium-tin Oxides for Use as Sensor Materials in the Detection of NO(x)

Goldsby, J. C., NASA Lewis Research Center, USA; Kacik, T., NASA Lewis Research Center, USA; Hockensmith, C. M.; Thermochimica Acta; 1999; ISSN 0040-6031; Volume 340-1, pp. 315-322; In English; Copyright; Avail: Issuing Activity

Control of combustion product emissions in both sub and super-sonic jet engines can be facilitated by measurement of NO(x) levels with metal oxide sensors, In2O3, metal-doped SnO2, and SnO, (as well as other materials) show resistivity changes in the presence of NO(x), but often their sensitivity, stability, and selectivity are low. This study was designed to develop new synthetic

pathways to precursors that produce high purity, two phase In2O3-SnO2. The precursors were formed by complexation of tin with any oxide ligands to give the ammonium salt (NH4). Thermal studies of these precursors were carried out by thermal gravimetry (TG) and differential scanning calorimetry (DSC). Further studies by Fourier transform infrared spectroscopy (FTIR) and nuclear magnetic resonance spectroscopy (NMR) were also conducted.
Author
Thermodynamic Properties; Combustion Chemistry; Combustion Products; Ito (Semiconductors); Nitrogen Oxides; Metal Oxides

20000065664 Los Alamos National Lab., NM USA
Quantification of damage evolution for a micromechanical model of ductile fracture in spallation of tantalum
Zurek, A. K.; Thissell, W. R.; Tonks, D. L.; Hixon, R.; Addessio, F.; Dec. 31, 1997; 10p; In English; Mechanical and physical behavior of materials under dynamic loading (EURO/DYMAT)
Report No.(s): DE97-005014; LA-UR-97-791; No Copyright; Avail: Department of Energy Information Bridge
The authors present quantification of micromechanical features such as voids that comprise the ductile fracture obtained under uniaxial strain condition in a spall test of commercial purity tantalum. Two evolutionary parameters of ductile fracture void formation are quantified: (i) the void volume fraction (porosity) and its distribution with respect to the distance from the main spall fracture plane, and (ii) void diameter distribution.
NTIS
Damage; Ductility; Fracture Mechanics; Quantitative Analysis

20000067654 Florida Agricultural and Mechanical Univ., Tallahassee, FL USA
Micromechanical Characterization and Texture Analysis of Direct Cast Titanium Alloys Strips *Final Report*
Jun. 20, 2000; 73p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG1-1866; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This research was conducted to determine a post-processing technique to optimize mechanical and material properties of a number of Titanium based alloys and aluminides processed via Melt Overflow Solidification Technique (MORST). This technique was developed by NASA for the development of thin sheet titanium and titanium aluminides used in high temperature applications. The materials investigated in this study included conventional titanium alloy strips and foils, Ti-1100, Ti-24Al-11Nb (Alpha-2), and Ti-48Al-2Ta (Gamma). The methodology used included micro-characterization, heat-treatment, mechanical processing and mechanical testing. Characterization techniques included optical, electron microscopy, and x-ray texture analysis. The processing included heat-treatment and mechanical deformation through cold rolling. The initial as-cast materials were evaluated for their microstructure and mechanical properties. Different heat-treatment and rolling steps were chosen to process these materials. The properties were evaluated further and a processing relationship was established in order to obtain an optimum processing condition. The results showed that the as-cast material exhibited a Widmanstatten (fine grain) microstructure that developed into a microstructure with larger grains through processing steps. The texture intensity showed little change for all processing performed in this investigation.
Derived from text
Characterization; Mechanical Properties; Micromechanics; Textures; Titanium Alloys; Titanium Aluminides; Metal Strips; Cast Alloys

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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.

20000062452 Saclay Research Centre, Inst. National des Sciences et Techniques Nucleaires, Gif-sur-Yvette, France
Conformation and arrangement of polyelectrolytes in semi-diluted solution: A study by small angle neutrons scattering
Spiteri, M. N.; Mar. 25, 1997; 205p; In French; In English
Report No.(s): DE98-732052; FRCEA-TH-608; No Copyright; Avail: Department of Energy Information Bridge
Polyelectrolytes have particular physical and chemical properties and can thus be used for instance for petroleum production. Some of their microscopic properties have been studied in this work. With the particular zero average contrast technique, the small angle neutron scattering allows to directly know the form factors in semi-diluted solutions of polyelectrolytes where the chains are mixed. Another measure leads to the crystal structure. The electrostatic screen effects when salt is added in aqueous solutions

of completely charged PSSNa solutions (f=1) (sodium polystyrene sulfonate) are studied. It seems that the chains take a vermiform conformation. Their persistence length varies as I(sup -1/3) (I is the ionic force). The hydrophobicity effects in partially charged PSSNa solutions (f is less than 1) are given too. They lead to a progressive collapse of the chains when their charge rates decrease. The screen and condensation effects when the charge rate f of the PSSNa (f is greater than f(Manning)) varies in a polar solvent (DMSO) are studied. The vermiform chains have the same persistence length (for each f) which varies as I(sup -1/4). Lastly, the f variation effects in the case of a weakly charged hydrophilic poly-ion (f<f(Manning))aredescribed.Te results are only preliminary.
NTIS
Electrolytes; Dilution; Aqueous Solutions

20000063512 Thiokol Propulsion, Brigham City, UT USA
Improved Tensile Adhesion Specimens for High Strength Epoxy Systems in Aerospace Applications
Haddock, M. Reed, Thiokol Propulsion, USA; McLennan, Michael L., Thiokol Propulsion, USA; [2000]; 7p; In English; 36th; Joint Propulsion, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS8-38100
Report No.(s): AIAA Paper 2000-3562; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

An improved tensile adhesion button has been designed and tested that results in higher measured tensile adhesion strength while providing increased capability for testing high strength epoxy adhesive systems. The best attributes of two well-established tensile button designs were combined and refined into an optimized tensile button. The most significant design change to the tensile button was to improve alignment of the bonded tensile button specimens during tensile testing by changing the interface between the tensile button and the tensile test machine. The established or old button design uses a test fixture that pulls from a grooved annulus or anvil head while the new button design pulls from a threaded hole in the centerline of the button. Finite element (FE) analysis showed that asymmetric loading of the established anvil head tensile button significantly increases the stress concentration in the adhesive, causing failure at lower tensile test loads. The new tensile button was designed to eliminate asymmetric loading and eliminate misalignment sensitivity. Enhanced alignment resulted in improved tensile adhesion strength measurement up to 13.8 MPa (2000psi) over the established button design. Another design change increased the capability of the button by increasing the threaded hole diameter allowing it to test high strength epoxy systems up to 85 MPa(less than 12,000 psi). The improved tensile button can be used in button- to-button or button-to-panel configurations.
Author
Adhesives; Tensile Strength; Tensile Tests; Stress Concentration; Fixtures; Epoxy Resins

20000063518 NASA Glenn Research Center, Cleveland, OH USA
Effect of Air and Vacuum Storage on the Tensile Properties of X-Ray Exposed Aluminized-FEP
deGroh, Kim K., NASA Glenn Research Center, USA; Gummow, Jonathan D., Ohio Aerospace Inst., USA; May 2000; 18p; In English; 8th; 5th; Materials in a Space Environment, 5-9 Jun. 2000, Arachon, Arachon, France, France; Sponsored by Centre National d'Etudes Spatiales, France
Contract(s)/Grant(s): RTOP 632-6A-1E
Report No.(s): NASA/TM-2000-210066; E-12294; NAS 1.15:210066; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Metallized Teflon(Registered Trademark) FEP (fluorinated ethylene propylene), a common spacecraft thermal control material, from the exterior layer of the Hubble Space Telescope (HST) has become embrittled and suffers from extensive cracking. Teflon samples retrieved during Hubble servicing missions and from the Long Duration Exposure Facility (LDEF) indicate that there may be continued degradation in tensile properties over time. An investigation has been conducted to evaluate the effect of air and vacuum storage on the mechanical properties of x-ray exposed FEP. Aluminized-FEP (Al-FEP) tensile samples were irradiated with 15.3 kV Cu x-rays and stored in air or under vacuum for various time periods. Tensile data indicate that samples stored in air display larger decreases in tensile properties than for samples stored under vacuum. Air-stored samples developed a hazy appearance, which corresponded to a roughening of the aluminized surface. Optical property changes were also characterized. These findings indicate that air exposure plays a role in the degradation of irradiated FEP, therefore proper sample handling and storage is necessary with materials retrieved from space.
Author
Vacuum Effects; Air Sampling; Ethylene; Propylene; Metallizing; Tensile Properties

20000064096 NASA Glenn Research Center, Cleveland, OH USA

Mechanical, Chemical and Microstructural Characterization of Monazite-Coated Silicon Carbide Fibers

Bansal, N. P., NASA Glenn Research Center, USA; Wheeler, D. R., NASA Glenn Research Center, USA; Chen, Y. L., DYNACS Engineering Co., Inc., USA; June 2000; 24p; In English

Contract(s)/Grant(s): RTOP 523-31-13

Report No.(s): NASA/TM-2000-210208; E-12328; NAS 1.15:210208; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Tensile strengths of as-received Hi-Nicalon and Sylramic fibers and those having monazite surface coatings, deposited by atmospheric pressure chemical vapor deposition, were measured at room temperature and the Weibull statistical parameters determined. The average tensile strengths of uncoated Hi-Nicalon and Sylramic fibers were 3.19 +/- 0.73 and 2.78 +/- 0.53 GPa with a Weibull modulus of 5.41 and 5.52, respectively. The monazite-coated Hi-Nicalon and Sylramic fibers showed strength loss of approx. 10 and 15 percent, respectively, compared with the as-received fibers. The elemental compositions of the fibers and the coatings were analyzed using scanning Auger microprobe and energy dispersive X-ray spectroscopy. The LaPO4 coating on Hi-Nicalon fibers was approximately stoichiometric and about 50 nm thick. The coating on the Sylramic fibers extended to a depth of about 100 to 150 nm. The coating may have been stoichiometric LaPO4 in the first 30 to 40 nm of the layer. However, the surface roughness of Sylramic fiber made this profile somewhat difficult to interpret. Microstructural analyses of the fibers and the coatings were done by scanning electron microscopy, transmission electron microscopy, and selected area electron diffraction. Hi-Nicalon fiber consists of fine beta-SiC nanocrystals ranging in size from 1 to 30 mn embedded in an amorphous matrix. Sylramic is a polycrystalline stoichiometric silicon carbide fiber consisting of submicron beta-SiC crystallites ranging from 100 to 300 nm. Small amount of TiB2 nanocrystallites (approx. 50 nm) are also present. The LaPO4 coating on Hi-Nicalon fibers consisted of a chain of peanut shape particles having monazite-(LA) structure. The coating on Sylramic fibers consisted of two layers. The inner layer was a chain of peanut shape particles having monazite-(LA) structure. The outer layer was comprised of much smaller particles with a microcrystalline structure.

Author

Silicon Carbides; Fiber Composites; Microstructure; Mechanical Properties; Coating; Amorphous Materials; Chemical Composition

20000064098 NASA Marshall Space Flight Center, Huntsville, AL USA

Metallurgical Evaluations of Depainting Processes on Aluminum Substrate ***Final Report***

McGill, Preston, NASA Marshall Space Flight Center, USA; December 1999; 25p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In December 1993, the Environmental Protection Agency (EPA) Emission Standards Division and the National Aeronautics and Space Administration's (NASA's) Marshall Space Flight Center (MSFC) signed an Interagency Agreement (IA) initiating a task force for the technical assessment of alternative technologies for aerospace depainting operations. The USA Air Force (USAF) joined the task force in 1994. The mandates of the task force were: (1) To identify available alternative depainting systems that do not rely on methylene chloride or other ozone-depleting, chlorinated, and volatile organic carbon solvents. (2) to determine the viability, applicability, and pollution prevention potential of each identified alternative. (3) to address issues of safety, environmental impact, reliability, and maintainability. Through a Technical Implementation Committee (TIC), the task force selected and evaluated eight alternative paint stripping technologies: chemical stripping, carbon dioxide (CO2) blasting, xenon flashlamp and CO2 coatings removal (FLASHJET(R)), CO2 laser stripping, plastic media blasting (PMB), sodium bicarbonate wet stripping, high-pressure water blasting (WaterJet), and wheat starch abrasive blasting (Enviro-Strip(R)). (The CO2 blasting study was discontinued after the first depainting sequence.) This final report presents the results of the Joint EPA/NASA/USAF Interagency Depainting Study. Significant topics include: (1) Final depainting sequence data for the chemical stripping, PMB, sodium bicarbonate wet stripping, and WaterJet processes. (2) Strip rates for all eight technologies. (3) Sequential comparisons of surface roughness measurements for the seven viable depainting technologies. (4) Chronological reviews of and lessons learned in the conduct of all eight technologies. (5) An analysis of the surface roughness trends for each of the seven technologies. (6) Metallurgic evaluations of panels Summaries of corrosion and hydrogen embrittlement evaluations of chemical stripping panels, detailed descriptions of which appear in previous reports. Because the requirements for alternative systems are diverse, as are initial setup, training, and on-going operational considerations, this study does not recommend a particular product or process. Users of this study will draw their own conclusions from the data presented herein.

Author

Carbon Dioxide; Carbon Dioxide Removal; Environment Protection; Exhaust Emission; Exhaust Gases; Maintainability; Methylene; Paint Removal; Pollution Control; Technology Assessment

20000064100 NASA Langley Research Center, Hampton, VA USA

Intensity Biased PSP Measurement

Subramanian, Chelakara S., Florida Inst. of Tech., USA; Amer, Tahani R., NASA Langley Research Center, USA; Oglesby, Donald M., NASA Langley Research Center, USA; Burkett, Cecil G., Jr., NASA Langley Research Center, USA; [2000]; 9p; In English; 21st; Aerodynamic Measurement Technology and Ground Testing, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2000-2526; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

The current pressure sensitive paint (PSP) technique assumes a linear relationship (Stern-Volmer Equation) between intensity ratio (I(sub 0)/I) and pressure ratio (P/P(sub 0)) over a wide range of pressures (vacuum to ambient or higher). Although this may be valid for some PSPs, in most PSPs the relationship is nonlinear, particularly at low pressures (less than 0.2 psia when the oxygen level is low). This non-linearity can be attributed to variations in the oxygen quenching (de-activation) rates (which otherwise is assumed constant) at these pressures. Other studies suggest that some paints also have non-linear calibrations at high pressures; because of heterogeneous (non-uniform) oxygen diffusion and c quenching. Moreover, pressure sensitive paints require correction for the output intensity due to light intensity variation, paint coating variation, model dynamics, wind-off reference pressure variation, and temperature sensitivity. Therefore to minimize the measurement uncertainties due to these causes, an in- situ intensity correction method was developed. A non-oxygen quenched paint (which provides a constant intensity at all pressures, called non-pressure sensitive paint, NPSP) was used for the reference intensity (I(sub NPSP)) with respect to which all the PSP intensities (I) were measured. The results of this study show that in order to fully reap the benefits of this technique, a totally oxygen impermeable NPSP must be available.

Author

Pressure Effects; Paints; Procedures; Vacuum; Pressure Ratio; Nonlinearity; High Pressure; Afterbodies

20000064693 NASA Glenn Research Center, Cleveland, OH USA

Friction and Wear Properties of Selected Solid Lubricating Films, Part 2, Ion-Plated Lead Films

Miyoshi, Kazuhisa, NASA Glenn Research Center, USA; Iwaki, Masanori, Tsukuba Space Center, Japan; Gotoh, Kenichi, Tsukuba Space Center, Japan; Obara, Shingo, Tsukuba Space Center, Japan; Imagawa, Kichiro, Tsukuba Space Center, Japan; May 2000; 26p; In English

Contract(s)/Grant(s): RTOP 523-31-13

Report No.(s): NASA/TM-2000-209088/PT2; E-12082/PT2; NAS 1.15:209088/PT2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To evaluate commercially developed dry solid film lubricants for aerospace bearing applications, an investigation was conducted to examine the friction and wear behavior of ion-plated lead films in sliding contact with 6-mm-diameter American Iron and Steel Institute (AISI) 440C stainless steel balls. Unidirectional sliding friction experiments were conducted with a load of 5.9 N (600 g), a mean Hertzian contact pressure of 0.79 GPa (maximum Hertzian contact pressure of 1.2 GPa), and a sliding velocity of 0.2 m/s. The experiments were conducted at room temperature in three environments: ultrahigh vacuum (vacuum pressure, 7 x 10(exp -7 Pa), humid air (relative humidity, approx. 20 percent), and dry nitrogen (relative humidity, less then 1 percent). The resultant films were characterized by scanning electron microscopy, energy-dispersive X-ray spectroscopy, and surface profilometry. Marked differences in the friction and wear of the ion-plated lead films investigated herein resulted from the environmental conditions. The main criteria for judging the performance of the ion-plated lead films were coefficient of friction and wear rate, which had to be less than 0.3 and on the order of 1(exp -6) cu mm/N.m or less, respectively. The ion-plated lead films met both criteria only in ultrahigh vacuum but failed in humid air and in dry nitrogen, where the coefficient of friction was higher than the criterion. Both the lead film wear rate and the ball wear rate met that criterion in all three environments. Adhesion and plastic deformation played important roles in the friction and wear of the ion-plated lead films in contact with 440C stainless steel balls in the three environments. All sliding involved adhesive transfer of materials: transfer of lead wear debris to the counterpart 440C stainless steel and transfer of 440C stainless steel wear debris to the counterpart lead.

Author

Lubrication; Solid Lubricants; Ball Bearings; Coefficient of Friction; Plastic Deformation; Scanning Electron Microscopy; Sliding Friction

20000064694 Thiokol Propulsion, Science and Engineering Huntsville Operations, Huntsville, AL USA

A Study of Upgraded Phenolic Curing for RSRM Nozzle Rings

Smartt, Ziba, Thiokol Propulsion, USA; [2000]; 4p; In English; 36th; 36th Joint Propulsion Conference, 16-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS8-38100; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A thermochemical cure model for predicting temperature and degree of cure profiles in curing phenolic parts was developed, validated and refined over several years. The model supports optimization of cure cycles and allows input of properties based upon the types of material and the process by which these materials are used to make nozzle components. The model has been refined to use sophisticated computer graphics to demonstrate the changes in temperature and degree of cure during the curing process. The effort discussed in the paper will be the conversion from an outdated solid modeling input program and SINDA analysis code to an integrated solid modeling and analysis package (I-DEAS solid model and TMG). Also discussed will be the incorporation of updated material properties obtained during full scale curing tests into the cure models and the results for all the Reusable Solid Rocket Motor (RSRM) nozzle rings.
Author
Curing; Thermal Analysis; Upgrading

20000064704 Saclay Research Centre, Direction des Sciences de la Matiere, Gif-sur-Yvette, France
In situ study of glasses decomposition layer
Zarembowitch-Deruelle, O.; Oct. 21, 1997; 186p; In French; In English
Report No.(s): DE99-609730; FRCEA-TH-631; No Copyright; Avail: Department of Energy Information Bridge

The aim of this work is to understand the involved mechanisms during the decomposition of glasses by water and the consequences on the morphology of the decomposition layer, in particular in the case of a nuclear glass: the R(sub 7) T(sub 7). The chemical composition of this glass being very complicated, it is difficult to know the influence of the different elements on the decomposition kinetics and on the resulting morphology because several atoms have a same behaviour. Glasses with simplified composition (only 5 elements) have then been synthesized. The morphological and structural characteristics of these glasses have been given. They have then been decomposed by water. The leaching curves do not reflect the decomposition kinetics but the solubility of the different elements at every moment. The three steps of the leaching are: (1) de-alkalinization (2) lattice rearrangement (3) heavy elements solubilization. Two decomposition layer types have also been revealed according to the glass heavy elements rate.
NTIS
Decomposition; Borosilicate Glass

20000064928 Thiokol Corp., Brigham City, UT USA
Thermal Characterization of Adhesive
Spomer, Ken A., Thiokol Corp., USA; [1999]; 12p; In English; 32nd; 32nd International SAMPE Technical Conference, 21-25 May 2000, Long Beach, CA, USA; Sponsored by Society for the Advancement of Materials and Process Engineering, USA
Contract(s)/Grant(s): NAS8-97238; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The current Space Shuttle Reusable Solid Rocket Motor (RSRM) nozzle adhesive bond system is being replaced due to obsolescence. Down-selection and performance testing of the structural adhesives resulted in the selection of two candidate replacement adhesives, Resin Technology Group's Tiga 321 and 3M's EC2615XLW. This paper describes rocket motor testing of these two adhesives. Four forty-pound charge motors were fabricated in configurations that would allow side by side comparison testing of the candidate replacement adhesives and the current RSRM adhesives. The motors provided an environment where the thermal performance of adhesives in flame surface bondlines was compared. Results of the FPC testing show that: 1) The phenolic char depths on radial bond lines is approximately the same and vary depending on the position in the blast tube regardless of which adhesive was used; 2) The adhesive char depth of the candidate replacement adhesives is less than the char depth of the current adhesives; 3) The heat-affected depth of the candidate replacement adhesives is less than the heat-affected depth of the current adhesives; and 4) The ablation rates for both replacement adhesives are slower than that of the current adhesives.
Author
Adhesives; Space Shuttle Boosters; Rocket Engines; Performance Tests; Bonded Joints; Resins

20000065642 NASA Glenn Research Center, Cleveland, OH USA
International Test Program for Synergistic Atomic Oxygen and VUV Exposure of Spacecraft Materials
Rutledge, Sharon, NASA Glenn Research Center, USA; Banks, Bruce, NASA Glenn Research Center, USA; Dever, Joyce, NASA Glenn Research Center, USA; Savage, William, Cleveland State Univ., USA; May 2000; 14p; In English; 8th; 5th; Materials in a Space Environment, 5-9 Jun. 2000, Arcachon, Arcachon, France, France; Sponsored by Centre National d'Etudes Spatiales, France
Contract(s)/Grant(s): RTOP 632-6A-1E
Report No.(s): NASA/TM-2000-210054; E-12255; NAS 1.15:210054; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Spacecraft in low Earth orbit (LEO) are subject to degradation in thermal and optical performance of components and materials through interaction with atomic oxygen and vacuum ultraviolet radiation which are predominant in LEO. Due to the importance of LEO durability and performance to manufacturers and users, an international test program for assessing the durability of spacecraft materials and components was initiated. Initial tests consisted of exposure of samples representing a variety of thermal control paints and multilayer insulation materials that have been used in space. Materials donated from various international sources were tested alongside a material whose performance is well known such as Teflon FEP or Kapton H for multilayer insulation, or Z-93-P for white thermal control paints. The optical, thermal or mass loss data generated during the test was then provided to the participating material supplier. Data was not published unless the participant donating the material consented to publication. This paper presents a description of the types of tests and facilities that have been used for the test program as well as some examples of data that have been generated. The test program is intended to give spacecraft builders and users a better understanding of degradation processes and effects to enable improved prediction of spacecraft performance.
Author
Far Ultraviolet Radiation; Oxygen Atoms; Spacecraft Components; Spacecraft Construction Materials; Orbital Space Tests; Materials Tests

20000066596 Thiokol Propulsion, Brigham City, UT USA
Effective Adhesive Modulus Approach for Evaluation of Curing Stresses
Macon, David J., Thiokol Propulsion, USA; [2000]; 19p; In English
Contract(s)/Grant(s): NAS8-97238; Copyright; Avail: Issuing Activity

A study was performed to determine the most accurate approach for establishing a modulus value for measuring the curing stress in an epoxy system. In this study, the curing stress for a number of epoxy systems was measured using the bimaterial beam approach. The stress relaxation profile of the adhesive bonded to the metallic strip was compared to the relaxation profile of the bulk adhesive. It was found that the shape of the relaxation curve was consistent for both samples. but that the magnitude of the two curves differed. It is argued that the difference between the curves is a result of curing stress and that the long-term effective modulus as measured from the bonded adhesive should be used to establish the curing stress.
Author
Adhesives; Adhesive Bonding; Evaluation; Curing; Stresses; Stress Relaxation

28
PROPELLANTS AND FUELS

Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see 73 Nuclear Physics. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.

20000064700 Thiokol Corp., Brigham City, UT USA
Reclaimation of Ammonium Perchlorate from Propellant Washout Water
Berntsen, Eric, Thiokol Corp., USA; [2000]; 5p; In English; Joint Ordnance Commanders Group (JOCG) and National Defense Industrial Association (NDIA) 2000 Global Demilitarization Symposium and Exhibition, 15-18 May 2000, Coeur d'Alene, ID, USA
Contract(s)/Grant(s): NAS8-38100; Copyright; Avail: Issuing Activity

Thiokol Propulsion has developed and is operating a process which treats and recovers Ammonium Perchlorate (AP) from wash out water produced by Thiokols' propellant removal facility. The system was designed to remove the dissolved AP from the washout water by concentrating and precipitating the AP in an Evaporator. The evaporator processes the 10% AP solution at 22GPM and was designed to match the production rate of Thiokol's propellant washout facility. The AP slurry produced in the evaporator is dewatered by a centrifuge and is automatically loaded into 55-gallon drums for reuse at the rate of 1000 lbs./hr. Part of the evaporator system includes equipment which sizes the AP crystals. The recovered AP is 99% pure and could be reused in manufacturing new propellant. The end products of the process are crystalline AP and distilled water. The distilled water is recycled and returned to the Thiokol's propellant removal facility for reuse in washing out more propellant. The facility has been operating for approximately one year and has recovered 830,000 pounds of AP, and has evaporated 988,000 gallons of AP washout water. The facility was constructed using NASA and Thiokol funding. The Current contract is scheduled to be completed at the

end of this year. This paper will describe the process of recovering Ammonium Perchlorate from AP laden water generated from washing out propellant from rocket motors.
Author
Ammonium Perchlorates; Solid Rocket Propellants

20000066611 Thiokol Propulsion, Brigham City, UT USA
Space Shuttle RSRM Propellant: Properties and Transportation Procedures
Bennett, R. R., Thiokol Propulsion, USA; [2000]; 31p; In English; Florida Emergency Management Officials, Cocoa Beach, FL, USA
Contract(s)/Grant(s): NAS8-38100; Copyright; Avail: Issuing Activity

This paper presents in viewgraph form, the properties and transportation procedures for the Space Shuttle Redesigned Solid Rocket Motor (RSRM) Propellant. In summary, 1) All test results show RSRM propellant and motors to meet requirements of Hazard Division 1.3 designation. 2) Additional card gap testing has shown that RSRM propellant will not detonate under conditions that are many times more severe than the worst-case storage or transportation accident scenario. 3) All DoT requirements are closely followed for all transportation and storage of RSRM segments. 4) RSRM propellant has undergone considerable safety testing in addition to all required by DoT for shipping authorization and hazard division classification and is handled safely at all times. 5) RSRM segments are regularly shipped by rail to KSC from Utah. In about 20 years of shipments, there has never been a safety incident involving RSRMs.
Derived from text
Solid Propellant Rocket Engines; Space Shuttles; Transportation; Rocket Propellants

29
SPACE PROCESSING

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

20000064698 Alabama Univ., USA
An Indirect Mixed-Sensitivity Approach to Microgravity Vibration Isolation: The Exploitation of Kinematic Coupling In Frequency-weighting Design-Filter Selections
Hampton, R. David, Alabama Univ., USA; Whorton, Mark S., Alabama Univ., USA; [2000]; 6p; In English; 2000 American Control Conference, 28-30 Jun. 2000, Chicago, IL, USA
Contract(s)/Grant(s): NAG8-1598; RTOP 398-96-02
Report No.(s): ACC-2000; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Many space-science experiments need an active isolation system to provide them with the requisite microgravity environment. The isolation systems planned for use with the International Space Station have been appropriately modeled using relative position relative velocity, and acceleration states. In theory, frequency-weighting design filters can be applied to these state-space models, in order to develop optimal H2 or mixed-norm controllers with desired stability and performance characteristics. In practice, however, the kinematic coupling among the various states can lead, through the associated frequency-weighting-filters, to conflicting demands on the Riccati design ”machinery.” The results can be numerically ill-conditioned regulator and estimator Riccati equations and/or reduced intuition in the design process. In addition, kinematic coupling can result in a redundancy in the demands imposed by the frequency weights. Failure properly to account for this type of coupling can lead to an unnecessary increase in controller dimensionality and, in turn, controller complexity. This paper suggests a rational approach to the assignment of frequency-weighting design filters, in the presence of the kinematic coupling among states that exists in the microgravity vibration isolation problem.
Author
Microgravity; Vibration Isolators; Statistical Analysis; Kinematics; Stability; Sensitivity; Vibration

20000067646 NASA Marshall Space Flight Center, Huntsville, AL USA
Reduction of Acceleration to Effectively Microgravity Levels
Downey, James Patton, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Pressure gradients, i.e. pressure head, and buoyancy driven convection can be greatly decreased in experimental systems by acceleration of the laboratory reference frame at a rate consistent with the acceleration due to gravity. This may be done in a number of ways, the best known of which is the use of orbiting spacecraft. Other techniques include the use of aircraft following an appropriate parabolic trajectory or drop towers. The result is an experimental condition in which fluids experience virtually no outside forces relative to the laboratory reference frame. Such conditions are appropriate for the study of processes with diffusion dominated heat and/or mass Under, the study of phase transitions in the absence of pressure gradients, the study of solutal or thermal capillary convection, or containerless processes. Ways of achieving these conditions and complexities that arise in performing experiments in this environment are discussed.
Author
Microgravity; Acceleration; Pressure Gradients; Buoyancy

20000067655 NASA Marshall Space Flight Center, Huntsville, AL USA
A Technique for Rapidly Deploying a Concentration Gradient with Applications to Microgravity
Leslie, Fred, NASA Marshall Space Flight Center, USA; Ramachandran, Narayanan, Universities Space Research Association, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The latter half of the last century has seen rapid advancements in semiconductor crystal growth powered by the demand for high performance electronics in myriad applications. The reduced gravity environment of space has also been used for crystal growth tests, especially in instances where terrestrial growth has largely been unsuccessful. While reduced gravity crystal growth affords some control of the gravity parameter, many crystals grown in space, to date, have structural flaws believed to result from convective motions during the growth phase. The character of these instabilities is not well understood but is associated with thermal and solutal density variations near the solidification interface in the presence of residual gravity and g-jitter. In order to study these instabilities in a separate, controlled space experiment, a concentration gradient would first have to be artificially established in a timely manner as an initial condition. This is generally difficult to accomplish in a microgravity environment because the momentum of the fluid injected into a test cell tends to swirl around and mix in the absence of a restoring force. The use of magnetic fields to control the motion and position of liquids has received growing interest in recent times. The possibility of using the force exerted by a non-uniform magnetic field on a ferrofluid to not only achieve fluid manipulation but also to actively control fluid motion makes it an attractive candidate for space applications. This paper describes a technique for quickly establishing a linear or exponential fluid concentration gradient using a magnetic field in place of gravity to stabilize the deployment. Also discussed is a photometric technique for measuring the concentration profile using light attenuation. Results of the ground-based experiments indicate that the concentration distribution is within 3% of the predicted value. Although any range of concentations can be realized, photometric constraints are discussed which impose some limitations on measurements.
Author
Deployment; Gradients; Microgravity; Nonuniform Magnetic Fields; Concentration (Composition)

20000067686 Alabama Univ., MAE Dept., Huntsville, AL USA
Frequency-Weighting Filter Selection, for H2 Control of Microgravity Isolation Systems: A Consideration of the ”Implicit Frequency Weighting” Problem
Hampton, Roy David, Alabama Univ., USA; Whorton, Mark S., NASA Marshall Space Flight Center, USA; [1999]; 18p; In English
Contract(s)/Grant(s): NAG8-1598; RTOP 398-96-02
Report No.(s): IMTC-9184; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many space-science experiments need an active isolation system to provide them with the requisite microgravity environment. The isolation systems planned for use with the International Space Station (ISS) have been appropriately modeled using relative position, relative velocity, and acceleration states. In theory, frequency-weighting design filters can be applied to these state-space models, in order to develop optimal H2 or mixed-norm controllers with desired stability and performance characteristics. In practice, however, since there is a kinematic relationship among the various states, any frequency weighting applied to one state will implicitly weight other states. These implicit frequency-weighting effects must be considered, for intelligent frequency-weighting filter assignment. This paper suggests a rational approach to the assignment of frequency-weighting design filters, in the presence of the kinematic coupling among states that exists in the microgravity vibration isolation problem.
Author
Hydrogen; Microgravity; Vibration Isolators; Bandpass Filters; Frequencies; Spaceborne Experiments; Weighting Functions; H-2 Control

31
ENGINEERING (GENERAL)

Includes general research topics to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see categories 32 through 39.

20000061422 Air Force Research Lab., Wright-Patterson AFB, OH USA
The Multidisciplinary Engineer in the Context of Concurrent Engineering
Moorhouse, David J., Air Force Research Lab., USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 3-1 - 3-7; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

Throughout the evolution of the design of flight vehicles, the role of the individual engineer has also evolved. As aircraft have become more complex and performance envelopes have become ever larger, the role of the technical specialist has diminished in favor of the design team approach. Although the theme of the symposium deals with aerodynamic design and optimization, many comments apply to all technical disciplines. In this paper we review this design evolution very briefly. It is suggested that the evolutionary design process led to independent technical disciplines, technology development along the same lines and finally engineering education in the same engineering sciences. Concurrent engineering is discussed, together with the advantages and disadvantages from the viewpoint of the practicing engineers. It is suggested that the required approach leads to a requirement for engineers with a broader view than the traditional specialists. Next we consider the education process which, for design engineers, has evolved from apprenticeship to curricula that teach the engineering sciences. It is suggested that we may need to consider moving to the science of engineering. Finally, a possible view of future aerospace vehicle design is presented.
Author
Aerodynamics; Concurrent Engineering; Engineers; Transfer of Training; Design Analysis

20000062313 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Challenges of Packaging Photonic Devices
Lutes, George, Jet Propulsion Lab., California Inst. of Tech., USA; Tu, Meirong, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 9p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Presently used photonic packaging methods are labor intensive and often unreliable. Studies have shown laser welding to be the superior fastening technology but it must be used in combination with a compatible positioning technology. The right combination of positioning technology and fastening technology which will result in low cost, reliable photonic assemblies is yet to be developed.
Derived from text
Packaging; Low Cost; Product Development; Laser Welding; Photonics

20000063375 National Renewable Energy Lab., Golden, CO USA
Emissions and performance evaluation of a dedicated compressed natural gas saturn
Hodgson, J. W.; Taylor, J. D.; Jul. 31, 1997; 53p; In English
Report No.(s): DE97-008393; NREL/SR-540-22626; No Copyright; Avail: Department of Energy Information Bridge

The use of compressed natural gas (CNG) as a transportation fuel has been identified as one strategy that can help ameliorate some problems, which include a growing dependence on imported oil (and all its ramifications) and the persistent contributions that mobile sources make to urban air pollution, associated with the use of conventional petroleum fuels. The attributes and limitations of CNG as a fuel for spark-ignition engines have been presented by others. The attributes are associated with its high octane rating, low cost relative to other alternative fuels, its availability, the absence of running and diurnal evaporative emissions, and its demonstrated potential for producing extremely low exhaust emissions-particularly if the volatile organic compounds (VOCs) emitted are expressed in terms of reactivity adjusted non-methane organic gases (RANMOG). The limitations associated with the use of CNG include its limited refueling infrastructure, the cost of refueling facilities, the cost of on-board fuel storage tanks, and its relatively low energy density. Because one impediment to CNG use is the cost associated with producing a CNG- powered vehicle, a study was initiated at the University of Tennessee under sponsorship by the Saturn Corporation to determine how a CNG vehicle (specifically, a 1991 Saturn SL1) could be engineered so it could be produced with a minimal impact on the production of the base vehicle. The present study was undertaken to further investigate the emissions reduction potential of the Saturn CNG vehicle. In the previous study the role of exhaust gas recirculation was not thoroughly investigated. Those involved in the study

agreed that the NO(sub x) levels could be brought down well below California ULEV levels without increasing either the non-methane organic gases or the CO levels.
NTIS
Compressed Gas; Exhaust Emission; Liquefied Natural Gas

20000063496 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Advanced Interconnect Roadmap for Space Applications
Galbraith, Lissa, Jet Propulsion Lab., California Inst. of Tech., USA; May 1999; 13p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents the NASA electronic parts and packaging program for space applications. The topics include: 1) Forecasts; 2) Technology Challenges; 3) Research Directions; 4) Research Directions for Chip on Board (COB); 5) Research Directions for HDPs: Multichip Modules (MCMs); 6) Research Directions for Microelectromechanical systems (MEMS); 7) Research Directions for Photonics; and 8) Research Directions for Materials. This paper is presented in viewgraph form.
CASI
Electronic Packaging; Technology Utilization; Joining

20000064016 Institute TNO of Applied Physics, Delft, Netherlands
Integration of BATSOFT and FEM Calculations
Vermeulen, R. C. N., Institute TNO of Applied Physics, Netherlands; deJong, C. A. F., Institute TNO of Applied Physics, Netherlands; Dec. 23, 1999; 46p; In English; Original contains color illustrations
Contract(s)/Grant(s): A98/KM/131; TNO Proj. 008.00654/01.01
Report No.(s): TD-99-0060; TPD-RPT-990218; Copyright; Avail: Issuing Activity

In order to be able to predict the mobility of foundations (seating plus infinite bottom) in a simple way TNO-TPD developed the BATSOFT program. This program is very efficient because analytical approximations of the foundations are used such as beams and plates. However, sometimes the seating can not be approximated by simple beams and plates. A possible solution is then to calculate the seating mobilities by a Finite Element (FE) program. The BATSOFT program is adapted in such a way that FE results can be used. The input mobilities of three foundations are calculated using this 'hybrid' BATSOFT. An excellent agreement has been found between calculations and measurements for a solid slender beam on an infinite plane. For the MF column hybrid BATSOFT yields better results than traditional BATSOFT. For the Sea Cooling Water Pump Foundation a good similarity is found for the mobilities of the clamped FE model and the measurements. When hybrid BATSOFT is used the similarity gets worse. The reason for that is not clear and it is recommended to examine this. Moreover it is recommended to extend BATSOFT from 2D to 3D and to implement multi point effects for the coupling of seating and infinite bottom.
Author
Computer Programs; Computation; Mobility; Sea Water; Beams (Supports)

20000064071 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Chip Scale Package Implementation Challenges
Ghaffarian, Reza, Jet Propulsion Lab., California Inst. of Tech., USA; [1998]; 9p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The JPL-led MicrotypeBGA Consortium of enterprises representing government agencies and private companies have jointed together to pool in-kind resources for developing the quality and reliability of chip scale packages (CSPs) for a variety of projects. In the process of building the Consortium CSP test vehicles, many challenges were identified regarding various aspects of technology implementation. This paper will present our experience in the areas of technology implementation challenges, including design and building both standard and microvia boards, and assembly of two types of test vehicles. We also discuss the most current package isothermal aging to 2,000 hours at 100 C and 125 C and thermal cycling test results to 1,700 cycles in the range of -30 to 100 C.
Author
Packages; Quality; Reliability

20000064090 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Chip Scale Package Integrity Assessment by Isothermal Aging
Ghaffarian, Reza, Jet Propulsion Lab., California Inst. of Tech., USA; [1998]; 6p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Many aspects of chip scale package (CSP) technology, with focus on assembly reliability characteristics, are being investigated by the JPL-led consortia. Three types of test vehicles were considered for evaluation and currently two configurations have been built to optimize attachment processes. These test vehicles use numerous package types. to understand potential failure mechanisms of the packages, particularly solder ball attachment, the grid CSPs were subjected to environmental exposure. Package I/Os ranged from 40 to nearly 300. This paper presents both as assembled, up to 1, 000 hours of isothermal aging shear test results and photo micrographs, and tensile test results before and after 1,500 cycles in the range of -30/100 C for CSPs. Results will be compared to BGAs with the same the same isothermal aging environmental exposures.
Author
Packages; Reliability; Isothermal Processes; Aging (Materials)

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COMMUNICATIONS AND RADAR

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

20000061969 DYNACS Engineering Co., Inc., Brook Park, OH USA
Suspended Rectangular/Circular Patch Antennas with Electromagnetically Coupled Inverted Microstrip Feed for Dual Polarization/Frequency
Simons, Rainee N., DYNACS Engineering Co., Inc., USA; [2000]; 4p; In English; Antennas and Propagation, 16-21 Jul. 2000, Salt Lake City, UT, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): NAS3-98008; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The paper demonstrates suspended rectangular and circular patch antennas with electromagnetically coupled inverted microstrip feed for linear as well as dual linear polarization/frequency applications. The measured results include the return loss and the impedance bandwidth of the antennas.
Author
Performance Tests; Dipole Antennas; Linear Polarization; Frequencies; Electromagnetic Coupling

20000062467 NASA Glenn Research Center, Cleveland, OH USA
Internet Technologies for Space-Based Communications: State of the Art and Challenges
Bhasin, K., NASA Glenn Research Center, USA; DePaula, R., NASA, USA; Edwards, C., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 12p; In English; 18th; Communication Satellite Systems, 10-14 Apr. 2000, Oakland, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 632-6F-0C
Report No.(s): AIAA Paper 2000-1170; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Internet is rapidly changing the ways we communicate information around the globe today. The desire to provide Internet-based services to anyone, anywhere, anytime has brought satellite communications to the forefront to become an integral part of the Internet. In spite of the distances involved, satellite links are proving to be capable of providing Internet services based on Internet protocol (TCP/IP) stack. This development has led to the question particularly at NASA; can satellites and other space platforms become an Internet-node in space? This will allow the direct transfer of information directly from space to the users on Earth and even be able to control the spacecraft and its instruments. NASA even wants to extend the near earth space Internet to deep space applications where scientists and the public here on Earth may view space exploration in real time via the Internet. NASA's future solar system exploration will involve intensive in situ investigations of planets, moons, asteroids, and comets. While past missions typically involved a single fly-by or orbiting science spacecraft, future missions will begin to use fleets of small, highly intelligent robotic vehicles to carry out collaborative investigations. The resulting multi-spacecraft topologies will effectively create a wide area network spanning the solar system. However, this will require significant development in Internet technologies for space use. This paper provides the status'of the Internet for near earth applications and the potential extension of the Internet for use in deep space planetary exploration. The paper will discuss the overall challenges of implementing the space Internet and how the space Internet will integrate into the complex terrestrial systems those forms the Internet of today in a hybrid set of networks. Internet. We envision extending to the deep space environment such Internet concepts as a well-designed layered architecture. This effort will require an ability to develop and infuse new physical layer technology to increase network bandwidth at very low-bit error rates. In addition, we identify network technologies such as routers and switches needed to maintain standard application layer interfaces, while providing low-cost, efficient, modular networking solutions. We will describe the overall archi-

tectural approach to extending the concept of the Internet to space and highlight the important technological challenges and initiatives that will make it a reality.
Author
Internets; Bit Error Rate; Communication Satellites; Complex Systems; Protocol (Computers); Real Time Operation; Satellite Communication; Satellite Networks; Wide Area Networks

20000062895 NASA Glenn Research Center, Cleveland, OH USA
Current Status of Thin Film (Ba,SR)TiO3 Tunable Microwave Components for RF Communications
VanKeuls, F. W., NASA Glenn Research Center, USA; Romanofsky, R. R., NASA Glenn Research Center, USA; Mueller, C. H., NASA Glenn Research Center, USA; Warner, J. D., NASA Glenn Research Center, USA; Canedy, C. L., Maryland Univ., USA; Ramesh, R., Maryland Univ., USA; Miranda, F. A., NASA Glenn Research Center, USA; [2000]; 13p; In English; 12th; Integrated Ferroelectrics, 12-15 Mar. 2000, Aachen, Germany
Contract(s)/Grant(s): RTOP 632-6E-51; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The performance of proof-of-concept ferroelectric microwave devices has been moving steadily closer to the level needed for satellite and other rf communications applications. This paper will review recent progress at NASA Glenn in developing thin film Ba(x)SR(1-x)TiO3 tunable micro-wave components for these applications. Phase shifters for phased array antennas, tunable filters and tunable oscillators employing microstrip and coupled microstrip configurations will be presented. Tunabilities, maximum dielectric constants, and phase shifter parameters will be discussed (e.g., coupled microstrip phase shifters with phase shift over 200 deg at 18 GHz and a figure of merit of 74.3 deg/dB). Issues of post-annealing, Mn-doping and Ba(x)SR(1-x) TiO3 growth on sapphire and alumina substrates will be covered. The challenges of incorporating these devices into larger systems, such as yield, variability in phase shift and insertion loss, and protective coatings will also be addressed.
Author
Annealing; Communication Equipment; Ferroelectricity; Microwave Equipment; Phase Shift Circuits; Protective Coatings; Proving; Radio Communication; Sapphire; Substrates; Thin Films

20000062932 Honeywell Technology Center, Minneapolis, MN USA
Intuitive Policy Specification for Optimized Flow of Asynchronous C3I Transmission in Operations (IPSO FACTO) ***Final Report, Jan 1999 - May 2000***
Richardson, Jim; Miller, Chris; Johnson, Chris; Shackleton, John; Funk, Harry; May 2000; 84p; In English; Prepared in collaboration with SMA Information Flow Technologies LLC., Minneapolis, MN and Aptima Inc., Woburn, MA.
Contract(s)/Grant(s): DABT63-99-C-0003
Report No.(s): AD-A377351; DARPA-IDT-R00-001; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
We address the problem of allocating scarce communications resources in a military wide area network so that the information flows best support mission objectives. IPSO FACTO enables commanders to specify an information policy that guides automated allocation of communication resources to specific information requests. We have developed a formal mathematical model of information policy, implemented this model in software, and assessed the value of policy to resource allocation through a series of simulation experiments. We found that an explicit policy can indeed improve the total value of information conveyed in network overload conditions. However, specifying this policy is extremely time consuming. We describe a task-based, semi-automated approach to policy creation that generates policy as a side effect of mission planning. In this approach, a hierarchical mission plan is constructed from task templates; each template carries information policy elements to support the task. As the templates are arranged into a task hierarchy, the policy elements are merged to form a complete policy.
DTIC
Command and Control; Communication; Information Flow; Wide Area Networks; Information Transfer; Information Resources Management; Information Theory

20000063387 TRW Space and Electronics Group, Redondo Beach, CA USA
A Monolithic W-Band Three-Stage LNA Using 0.1 Micron InAlAs/InGaAs/InP HEMT Technology
Wang, H., TRW Space and Electronics Group, USA; Lai, R., TRW Space and Electronics Group, USA; Chen, T. H., TRW Space and Electronics Group, USA; Chow, P. D., TRW Space and Electronics Group, USA; Velebir, J., TRW Space and Electronics Group, USA; Tan, K. L., TRW Space and Electronics Group, USA; Streit, D. C., TRW Space and Electronics Group, USA; Liu, P. H., TRW Space and Electronics Group, USA; Ponchak, G., TRW Space and Electronics Group, USA; IEEE MTT-S Digest; [1993], pp. 519-522; In English
Contract(s)/Grant(s): NAS3-25930; RTOP 632-6E-51; Copyright; Avail: Issuing Activity

A monolithic W-band three-stage Low Noise Amplifiers (LNA) based on 0.1 um pseudomorphic InAlAs/InGaAs/InP (High Electron Mobility Transistors (HEMTs) has been developed. this LNA demonstrated a noise figure of 4.3 dB and an associated small signal gain of 19 dB at 100 GHz with a low dc power consumption of 20 mW. This is the best reported monolithic W-band LNA performance using InP-based HEMT technology and demonstrates the potential of InP HEMT technology for higher millimeter-wave applications.
Author
High Electron Mobility Transistors; Indium Aluminum Arsenides; Indium Gallium Arsenides; Indium Phosphides; Low Noise; Amplifiers; Integrated Circuits

20000063389 Sterling Software, Inc., Information Technology Div., Rome, NY USA
GCCS Spatial Data Base Module Extensions ***Final Report, Jun. 1996 - Jul. 1997***
Bell, Paul; Kolassa, David; McQuinn, Michael; Stoltz, Sandra; Reid, William; Jul. 1998; 40p; In English
Contract(s)/Grant(s): F30602-94-D-0007; AF Proj. R533
Report No.(s): AD-A377240; AFRL-IF-RS-TR-1998-158; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Global Command and Control Systems (GCCS) is the DoD's primary joint command, control, communications, computer, and intelligence systems. The Joint Mapping Toolkit (JMTK) provides the mapping function to the Core Operating Environment (COE) of the GCCS. JMTK is divided into three primary areas: (1) Visual, (2) Analysis (nonvisual), and (3) Spatial Data Base (SDBM). The primary objective of the SDBM effort is to define, design, develop and test mapping, charting and geodesy (MC&G) spatial data base management and data access software for the inclusion as the SDBM of the GCCS COE JMTK. The SDBM contains the following capabilities: Import NIMA data in standard formats (VPF, RPF, DTED, ITD); archive NIMA data in the original format without reformatting any data (preprocessing); and provide data access and retrieval through the use of public API functions.
DTIC
Command and Control; Communication; Computers; Artificial Intelligence

20000063492 NASA Lewis Research Center, Cleveland, OH USA
Development of Leaky Wave Antennas for Layered Ridge Dielectric Waveguide
Ponchak, George E., NASA Lewis Research Center, USA; Katehi, Linda P. B., Michigan Univ., USA; [1993]; 4p; In English; 1993 International Symposium, 28 Jun. - 2 Jul. 1993, Baltimore, MD, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): RTOP 632-6E-51; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The millimeter wave, especially above 100 GHz, and the submillimeter wave frequency spectrum offers the possibility for narrow-beam, high-resolution antennas which are critical for high definition radars required for space debris tracking, airport ground avoidance radars, and missile tracking. In addition, the frequency which most atmospheric constituents may be detected lie in this part of the frequency spectrum. Therefore, the development of electronic components for millimeter/submillimeter wave passive sensors is required for environmental monitoring of the Earth's atmosphere. Typical microwave transmission lines such as microstrip and coplanar waveguide rely on two or more electrical conductors to concentrate and guide the electromagnetic energy. Unfortunately, the surface resistance of the conductors increases as the square root of frequency. In addition, the circuit dimensions must be decreased with increasing frequency to maintain a single mode transmission line which further increases the conductor loss. An alternative family of transmission lines are formed from two or more insulating materials and rely on the differences in the permittivities between the two materials to guide the wave. No metal conductors are required although some dielectric waveguides do utilize a metallic ground plane to facilitate the interconnections of active electrical elements or to reduce the transmission line size. Examples of such transmission lines are image guides, insulated image guides, trapped image guides, ridge guide, and layered ridge dielectric waveguide (LRDW). Although most dielectric waveguides have dimensions on the order of lambda to provide sufficient field confinement, the LRDW has been shown to provide good field confinement for electrically small lines. This offers an advantage in circuit integration. It has been shown that a periodic array of metallic strips placed either along or on top of a dielectric waveguide forms an effective radiator. This antenna is easy to fabricate and there is good background of microstrip type antenna design information in the literature. This paper reports the development of the first frequency scanning antenna fed by a LRDW.
Derived from text
Dielectric Waveguides; Millimeter Waves; Submillimeter Waves; Transmission Lines; Microwaves; Waveguide Antennas; Microwave Transmission

20000064078 Physics and Electronics Lab. TNO, The Hague, Netherlands

Meeting the Needs for Mobile Communication within TCIS ***Final Report Invulling van de Mobiele Communicatiebehoefte in TCIS***

vanDam, C., Physics and Electronics Lab. TNO, Netherlands; October 1999; 68p; In Dutch

Contract(s)/Grant(s): A99/KLu/789; TNO Proj. 28720

Report No.(s): TD-99-0254; FEL-99-A236; Copyright; Avail: Issuing Activity

The goal of this report is to give support to the Royal Netherlands Air Force when making a choice for meeting the needs for mobile communication of the Tactical Helicopter Group in Out-of-Area operations. For this purpose a review has been made of the possibilities of and differences between GSM and TETRA systems. Topics such as frequency usage, functionality and services are discussed extensively. It has also been investigated which system complies with military desires on functionalities such as vulnerability, transportability and security. Finally, a calculation was made of the way in which coverage of the staging area can be realised.

Author

Mobile Communication Systems; Frequencies; Security; Vulnerability

20000064103 New Mexico State Univ., Klipsch School of Electrical and Computer Engineering, Las Cruces, NM USA

Three Corner Sat Communications System

Anderson, Bobby, New Mexico State Univ., USA; Horan, Stephen, New Mexico State Univ., USA; Jun. 08, 2000; 150p; In English

Contract(s)/Grant(s): F29601-98-D-0210; F49620-99-1-0194; NAG2-7520

Report No.(s): NMSU-ECE-00-009; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Three Corner Satellite is a constellation of three nanosatellites designed and built by students. New Mexico State University has taken on the design of the communications system for this constellation. The system includes the forward link, return link, and the crosslink. Due to size, mass, power, and financial constraints, we must design a small, light, power efficient, and inexpensive communications system. This thesis presents the design of a radio system to accomplish the data transmission requirements in light of the system constraints. In addition to the hardware design, the operational commands needed by the satellite's on-board computer to control and communicate with the communications hardware will be presented. In order for the hardware to communicate with the ground stations, we will examine the link budgets derived from the radiated power of the transmitters, link distance, data modulation, and data rate for each link. The antenna design for the constellation is analyzed using software and testing the physical antennas on a model satellite. After the analysis and testing, a combination of different systems will meet and exceed the requirements and constraints of the Three Corner Satellite constellation.

Author

Satellite Communication; Design Analysis; Satellite Constellations; Fabrication; Nanosatellites; Crosslinking; Airborne/Spaceborne Computers

20000064112 NASA Glenn Research Center, Cleveland, OH USA

A K-Band Linear Phased Array Antenna Based on Ba(0.60)SR(0.40)TiO3 Thin Film Phase Shifters

Romanofsky, R., NASA Glenn Research Center, USA; Bernhard, J., Illinois Univ., USA; Washington, G., Ohio State Univ., USA; VanKeuls, F., Ohio Aerospace Inst., USA; Miranda, F., NASA Glenn Research Center, USA; Cannedy, C., Maryland Univ., USA; May 2000; 10p; In English; Microwave, 11-13 Jun. 2000, Boston, MA, USA; Sponsored by Microwave Theory and Techniques Society, USA

Contract(s)/Grant(s): RTOP 632-6E-51

Report No.(s): NASA/TM-2000-210049; E-12195-1; NAS 1.15:210049; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper summarizes the development of a 23.675 GHz linear 16-element scanning phased array antenna based on thin ferroelectric film coupled microstripline phase shifters and microstrip patch radiators.

Author

Antenna Arrays; Microstrip Antennas; Fabrication; Scanners

20000064695 Institute for Human Factors TNO, Soesterberg, Netherlands

Evaluation of the Workshop on Search and Target Acquisition ***Interim Report***

Toet, A., Institute for Human Factors TNO, Netherlands; Oct. 05, 1999; 23p; In English

Contract(s)/Grant(s): A98/KL/316; TNO Proj. 786.1

Report No.(s): TD-99-0342; TM-99-A064; Copyright; Avail: Issuing Activity

This report presents an overview and evaluation of the papers that were presented at the Workshop on Search and Target Acquisition, that was organized by the NATO RTO Systems Concepts and Integration (SCI) Panel 12 (the former RSG-2), on ”Camouflage, Concealment and Deception (CCD) Evaluation Techniques”, and that was held in Utrecht, The Netherlands, from 21-23 June 1999. The following topics were addressed: (1) methods to evaluate the effectiveness of CCD to increase survivability; (2) search and target acquisition models incorporating CCD; (3) computational target signature metrics; and (4) the design and evaluation of CCD equipment and techniques. Two different main approaches to evaluating the effect of CCD on human visual target acquisition performance can be distinguished: (1) observer experiments and (2) computational methods. The presentations showed that: (1) At the present time, man-in-the-loop assessment is the only robust and effective method to evaluate CCD effectiveness. and (2) Computational signature analysis methods are not sufficiently mature; they do not represent the range of significant visual and cognitive processes driving target acquisition performance.
Author
Evaluation; Camouflage; Target Acquisition; Cognition; Deception

20000064901 Cranfield Univ., Coll. of Aeronautics, Cranfield, UK
Signal Analysis for an Entomological Radar with a Vertical Nutating Beam
Hobbs, S. E., Cranfield Univ., UK; Allsopp, K., Cranfield Univ., UK; Wolf, W., Department of Agriculture, USA; March 2000; 60p; In English
Report No.(s): COA-9914; ISBN 1-86194-048-3; Copyright; Avail: Issuing Activity
This report documents the signal analysis procedures developed at Cranfield University for ground based entomological radars. The radars use a nutating vertical beam, allowing target (individual insect) position and radar cross-section (RCS) parameters to be measured The model accounts for non-circular beam cross-sections and assumes a three parameter target RCS model. An iterative maximum-likelihood algorithm is used, and uses the model and system noise data to provide quantitative measures of the model’s goodness of fit to the data and of parameter uncertainties as well as the best fit solution parameters. Successful applications of the algorithm to both radar calibration and insect monitoring are illustrated with field observations using the USDA/Cranfield ground-based entomological radar system. The results show good performance for the analysis method, but do not exploit its full potential because the noise model is only approximate.
Author
Signal Analysis; Radar; Beams (Radiation); Models; Nutation; Procedures

20000064906 NASA Lewis Research Center, Cleveland, OH USA
Characterization of Asymmetric Coplanar Waveguide Discontinuities
Dib, Nihad I., Michigan Univ., USA; Katehi, Linda P. B., Michigan Univ., USA; Gupta, Minoo, Texas Instruments, Inc., USA; Ponchak, George E., NASA Lewis Research Center, USA; IEEE Transactions on Microwave Theory and Techniques; September 1993; Volume 41, No. 9, pp. 1549-1558; In English
Contract(s)/Grant(s): RTOP 632-6E-51; NSF ECS-86-57951; Copyright; Avail: Issuing Activity
A general technique to characterize asymmetric coplanar waveguide (CPW) discontinuities with air bridges where both the fundamental coplanar and slotline modes may be excited together is presented. First, the CPW discontinuity without air bridges is analyzed using the space-domain integral equation (SDIE) approach. Second, the parameters (phase, amplitude, and wavelength) of the coplanar and slotline modes are extracted from an amplitude modulated-like standing wave existing in the CPW feeding lines. Then a 2n x 2n generalized scattering matrix of the n-port discontinuity without air bridges is derived which includes the occurring mode conversion. Finally, this generalized scattering matrix is reduced to an n x n matrix by enforcing suitable conditions at the ports which correspond to the excited slotline mode. For the purpose of illustration, the method is applied to a shielded asymmetric short-end CPW shunt stub, the scattering parameters of which are compared with those of a symmetric one. Experiments are performed on both discontinuities and the results are in good agreement with theoretical data. The advantages of using air bridges in CPW circuits as opposed to bond wires are also discussed.
Author
Waveguides; Discontinuity; Characterization; Coplanarity; Planar Structures

20000064925 Institute for Human Factors TNO, Soesterberg, Netherlands

Application of Digital Signal Processing in Active Hearing Protectors ***Final Report Toepassing van Digitale Signaalverwerking in Actieve Gehoorbeschermers***

Verhave, J. A., Institute for Human Factors TNO, Netherlands; Steeneken, H. J. M., Institute for Human Factors TNO, Netherlands; Jan. 14, 2000; 26p; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): A97/CO/340; TNO Proj. 786.4

Report No.(s): TD-2000-0104; TM-00-A001; Copyright; Avail: Issuing Activity

A prototype of a digital ANR (Active Noise Reduction) earmuff was developed. Application of digital signal processing allows for a dynamic adaptation to user and environment variability's. In comparison to analogue ANR systems an improved sound attenuation and a more stable system is obtained. Also the speech intelligibility of the integrated intercom is improved and the option of monitoring the sound level under the earmuff is offered. The final goal is the realization of a system that will offer adequate hearing protection and increased intelligibility mainly, also for personnel with hearing impairment.

Author

Signal Processing; Hearing; Fabrication; Analogs; Protectors

20000064926 Defence Science and Technology Organisation, Information Technology Div., Salisbury, Australia

An Approach for Identifying and Characterizing Problems in the Iterative Development of C31 Capability

Kingston, Gina, Defence Science and Technology Organisation, Australia; Henderson, Derek, Defence Science and Technology Organisation, Australia; Vernik, Rudi, Defence Science and Technology Organisation, Australia; November 1999; 44p; In English

Report No.(s): DSTO-TN-0238; AR-011-148; Copyright; Avail: Issuing Activity

This report presents a research approach that has been used to determine the key problems faced by the Australian Defence Organization (ADO) in the iterative development of C3I capability. Repeated application of the approach, combined with knowledge of strategic and'technological changes, could be used to assess process improvement activities. The approach uses interviews of stakeholders in the Iterative Capability Development (ICD) process to gather information about the perceived problems. As well as documenting the approach used in a study of the key problems with the ICD process, this report illustrates the application of study design principles, such as methods for minimising potential biases in an interview-based study.

Author

Iterative Solution; Design Analysis; Optimization

20000065625 NASA Ames Research Center, Moffett Field, CA USA

Multichannel Spatial Auditory Display for Speed Communications

Begault, Durand R., NASA Ames Research Center, USA; Erbe, Tom, NASA Ames Research Center, USA; Journal of the Audio Engineering Society; 1994; Volume 42, pp. 819-826; In English; Copyright; Avail: Issuing Activity; Abstract Only

A spatial auditory display for multiple speech communications was developed at NASA/Ames Research Center. Input is spatialized by the use of simplifiedhead-related transfer functions, adapted for FIR filtering on Motorola 56001 digital signal processors. Hardware and firmware design implementations are overviewed for the initial prototype developed for NASA-Kennedy Space Center. An adaptive staircase method was used to determine intelligibility levels of four-letter call signs used by launch personnel at NASA against diotic speech babble. Spatial positions at 30 degree azimuth increments were evaluated. The results from eight subjects showed a maximum intelligibility improvement of about 6-7 dB when the signal was spatialized to 60 or 90 degree azimuth positions.

Author

Multichannel Communication; Radio Transmitters; Multipath Transmission; Sound Transmission; Voice Communication; Radio Communication

20000066585 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Image Steganography for Hidden Communication ***Final Report, Jan 1997-May 1999***

Marvel, Lisa M.; Apr. 2000; 91p; In English

Report No.(s): AD-A377277; ARL-TR-2200; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Modern steganographic methods, which conceal the existence of communication, are needed to exploit contemporary modes of information exchange. Measures of performance for these methods are essential to compare specific algorithms and determine appropriate uses. This report develops a methodology for steganographic data hiding. The methodology encompasses derivation of a general theory of steganographic communication, including theoretical capacity hounds, and design of an actual data-hiding technique that used digital imagery as a cover. The technique promotes maximization of payload, allows error-free recovery of

embedded date, and provides some resilience to removal while concealing the existence of the embedded information from the observer and the observer's resources (e.g., computer).
DTIC
Signal Processing; Imagery; Pulse Communication

20000066587 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Characterization of the Effects of Cavities and Canopies on Radar Target Signatures, *May-Nov 1999*
Goldman, Geoffrey H.; Feb. 2000; 22p; In English
Contract(s)/Grant(s): Proj-AH16
Report No.(s): AD-A377283; ARL-TN-154; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

I conducted a literature search on electromagnetic models for cavities and canopies and their effect on radar target signatures. This report is a simple analysis of cavities as well as a review of electromagnetic codes that simulate the radar backscatter of targets with cavities. I also review imaging and parametric techniques to describe targets with cavities and canopies. Finally, recommendations are offered for enhancing signature generation for hardware-in-the-loop (HWIL) and software-in-the-loop (SIL).
DTIC
Cavities; Radar Signatures; Imaging Techniques; Hardware-In-The-Loop Simulation

20000066589 Department of the Navy, Washington, DC USA
Spinning Focal Plane Array Camera Particularly Suited for Real Time Pattern Recognition
Garcia, Joseph P., Inventor; Nov. 23, 1999; 15p; In English; Supersedes US-Patent-Appl-SN-09131844, AD-D019025.
Patent Info.: Filed 3 Jul. 1998; US-Patent-Appl-SN-09,131,844; US-Patent-5,990,829
Report No.(s): AD-D019710; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A computer vision system is disclosed that utilizes a spinning array of photodetectors. The array is rotated about the focal plane of a lens and scans all the possible orientations and positions of the edges of the unknown object. In one embodiment, the photodetectors are elongated so as to provide for maximum light gathering ability along the direction of elongation and a minimum light gathering ability in the direction perpendicular to the direction of elongation. In other embodiments, optical means are used to focus the image onto conventional photodetectors while still having the ability to more efficiently determine edge segments of unknown objects. The system efficiently and rapidly implements the wavelet projection transform to characterize-multi-scale edge segment features of an image of an unknown object. An imaging radar system that utilizes a spinning antenna system having frequency scanning provisions is also disclosed.
DTIC
Real Time Operation; Focal Plane Devices; Computer Vision; Pattern Recognition; Imaging Radar; Cameras; Photometers

20000066594 Physics and Electronics Lab. TNO, The Hague, Netherlands
User Manual of the Prototype Soldier Digital Assistant (Leusderheide Release) *Final Report Gebruikershandleiding van het Prototype Soldier Digital Assistant (Leusderheide Release)*
Rietveld, R., Physics and Electronics Lab. TNO, Netherlands; deGroot, H., Physics and Electronics Lab. TNO, Netherlands; deJongh, J. F. C. M., Physics and Electronics Lab. TNO, Netherlands; August 1999; 21p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A98/KL/701; TNO Proj. 27789
Report No.(s): TD99-0216; FEL-99-A074; Copyright; Avail: Issuing Activity

A prototype Soldier Digital Assistant has been developed for the Royal Netherlands Army. The Soldier digital Assistant aims at improving the situational awareness of a combat soldier. Also, soldiers can communicate with fellow soldiers in the same group. In this document a User Manual of the second prototype is given. This prototype is referred to as the 'Leusderheide' release. The manual focusses on the software used. However, a brief description of the hardware is included as well. The purpose of the document is to use it in training sessions in future field trials.
Author
User Manuals (Computer Programs); Prototypes; Education; Communicating

20000066607 Institute for Human Factors TNO, Soesterberg, Netherlands

Information Flow for a Peace Patrol ***Final Report Informatiestromen Bij Vredespatrouille***

Schmidt, W. F., Institute for Human Factors TNO, Netherlands; Boer, L. C., Institute for Human Factors TNO, Netherlands; Dec. 23, 1999; 31p; In Dutch; CD-ROM contains full text document in MS Excel format in Dutch

Contract(s)/Grant(s): A99/CO/311; TNO Proj. 787.1

Report No.(s): TD-99-0373; TM-99-A083; Copyright; Avail: Issuing Activity

How is information transferred during a military operation, which are the choke-points, and how can support be given? These questions, posed to guide the Soldier Modernisation Programme, were answered for a scenario of a social patrol during with the following incidents: home visit, discovery of a landmine, and suddenly being fired upon. Experts (among others service-men who had actually ran these patrols) indicated what the choke-points were, and what could be improved. The report concludes with suggestions for soldier modernisation, including the (sometimes quite similar) outcomes of a previous project 'foot soldier on attack'. The main suggestions are the introduction of a wireless and open net for each group member to talk and listen, the introduction of an electronic map for each group member or the group commander only, and the exchange of visual footage with higher levels.

Author

Information Flow; Military Operations

20000066623 Army War Coll., Carlisle Barracks, PA USA

Protecting the USA Against Information Warfare

Brand, Gary; Apr. 01, 2000; 39p; In English

Report No.(s): AD-A377232; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The USA' reliance on computers and the Internet for everything, from banking to military command and control, has made the nation's information infrastructure highly vulnerable to infiltration and sabotage from a multitude of threats. This vulnerability is the "Achilles Heel" of U.S. global power and will be a major security challenge for the 21st Century. If the USA does not improve its ability to defend against information attacks, it may fall victim to a new and more destructive type of war, Infowar." Although the government has taken the lead to protect its information infrastructure through several initiatives, there must be cooperative efforts between the government, industry, and private agencies working together as a team to protect this critical "Center of Gravity." For the USA to adequately protect its information infrastructure against a myriad of threats, it must identify its vulnerabilities and put "teeth" into its defensive information warfare policy.

DTIC

Command and Control; Computer Information Security; Vulnerability; Warfare

20000067678 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

TE/TM Simulations of Interferometric Measurements

Houshmand, Bijan, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Interferometric synthetic aperture radar (IFSAR) measurements at X-, C-, L-, and P-band are used to derive ground topography at meter level resolution. Interpretation of the derived topography requires attention due to the complex interaction of the radar signal with ground cover. The presence of penetrable surfaces such as vegetation, and tree canopies poses a challenge since the depth of penetration depends on a number of parameters such as the operating radar frequency, polarization, incident angle, as well as terrain structure. The dependence of the reconstructed topography on polarization may lead to the characterization of the ground cover. Simulation of interferometric measurements is useful for interpretation of the derived topography (B. Houshmand, Proceedings of URSI, 314, 1997). In this talk , time domain simulations for interferometric measurement for TE- and TM- polarization are presented. Time domain simulation includes the effects of the surface material property as well geometry comparable the radar signal wavelength (B. Houshmand, Proceedings of the URSI, 25, 1998). The IFSAR simulation is carried out in two steps. First, the forward scattering data is generated based on full wave analysis. Next, the electromagnetic information is inverted to generate surface topography. This inversion is based on the well known IFSAR processing technique which is composed of signal compression, and formation of an interferogram. The full wave forward scattering data is generated by the scattered-field formulation of the FDTD algorithm. The simulation is carried out by exciting the computational domain by a radar signal. The scattered field is then computed and translated to the receiving interferometric antennas using the time-domain Huygen's principle. The inversion process starts by compressing the time-domain data. The range compressed data from both receivers are then coregistered to form an interferogram. The resulting interferogram is then related to the ground topography using the radar imag-

ing geometry. In this talk, the simulation results are compared with the C-band TM IFSAR derived topography, and the TE/TM SAR images at L-Band.
Author
Synthetic Aperture Radar; Interferometry; C Band; Ultrahigh Frequencies; Radar Imagery; Imaging Techniques

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ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment. and microelectronics and integrated circuitry. For related information see also 60 Computer Operations and Hardware; and 76 Solid-State Physics. For communications equipment and devices see 32 Communications and Radar.

20000062305 University of Central Florida, Electrical Engineering Dept., Orlando, FL USA
A Low Loss Microstrip Antenna for Radiometric Applications ***Final Report***
Wahid, Parveen, University of Central Florida, USA; May 2000; 39p; In English
Contract(s)/Grant(s): NAG1-1917; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The design and analysis of a series-fed, low-loss, inverted microstrip array antenna, operating at 1.413 GHz is presented. The antenna is composed of two subarrays. Each subarray consists of an equal number of microstrip patches all connected together with microstrip lines. In the first design microstrip array for linear polarization is presented which incorporated a series feeding technique. The next design, which is capable of dual linear polarization (V-polarization and H-polarization), utilizes a corporate feed network for the V-pol and series feed arrangement for the H-pol. The first element of each subarray for H-pol is coaxially fed with a 180 deg phase difference. This approach ensures a symmetric radiation pattern on broadside in H-pol. For the V-pol two feeds are in the same phase on the two subarrays ensuring a broadside beam in V-pol. The designs presented here are simulated using the IE3D code that utilizes the method of moments. Measured results are compared with simulated results and show good agreement.
Author
Antenna Radiation Patterns; Design Analysis; Antenna Arrays; Microstrip Transmission Lines

20000062306 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Fresh Look at Spatial Power Combining Oscillators
Pearson, L. Wilson, Jet Propulsion Lab., California Inst. of Tech., USA; Pogorzelski, Ronald J., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 38p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Spatial Power Combining is an enabling technology for achieving useful power levels from solid state devices at millimeter wavelengths. Oscillator-based combining came first, historically, but has been passed over for what practitioners believe to be more reliable amplifier based technology. Recent results in oscillator-based. combining systems offer possibilities for technology breakthrough.
Derived from text
Millimeter Waves; Oscillators; Solid State Devices

20000062454 National Inst. of Standards and Technology, Electronics and Electrical Engineering Lab., Boulder, CO USA
Design and Testing of NFRad: A New Noise Measurement System
Grosvenor, C. A.; Randa, J.; Billinger, R. L.; Mar. 2000; 46p; In English
Report No.(s): PB2000-105222; NIST/TN-1518; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NIST Noise project has constructed and tested a new, automated, coaxial (GPC-7) radiometer for the measurement of noise sources in the 8-12 GHz frequency band. It is an isolated, total-power radiometer that relies on lookup tables for relevant reflection coefficients and path asymmetry. This permits measurement at multiple frequencies much more quickly than on previous NIST systems. This paper reviews the theory, describes the design of the system and its components, and details the testing procedures and the operation of the system.
NTIS
Noise Measurement; Radiometers; Thermal Noise; Design Analysis; Performance Tests

20000062455 National Inst. of Standards and Technology, Electronics and Electrical Engineering Lab., Boulder, CO USA
RF Material Characterization Using a Large-Diameter (76.8 mm) Coaxial Air Line
Jones, C. A.; Grosvenor, J. H.; Weil, C. M.; Feb. 2000; 62p; In English
Report No.(s): PB2000-105223; NIST/TN-1517; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We report on the development of a 76.84 mm (3.025 in) diameter coaxial air line system whose purpose is to measure the dielectric and magnetic properties of bulk dielectric and ferrite materials over a frequency range of approximately 0.3 MHz to 2000 MHz. We summarize the relative advantages and disadvantages of using large-diameter coaxial air lines for material characterization, and we discuss the particular problems associated with calibrating vector network analyzers in this form of transmission line. We also present broadband measurement data for low-loss polymer and ceramic dielectrics as well as for lossy materials that included a ferrite-loaded polymer and carbon-loaded concrete.
NTIS
Characterization; Transmission Lines; Lossy Media; Magnetic Properties; Dielectric Properties; Coaxial Cables

20000062460 NASA Glenn Research Center, Cleveland, OH USA
Steady State Vacuum Ultraviolet Exposure Facility With Automated Calibration Capability
Stueber, Thomas J., DYNACS Engineering Co., Inc., USA; Sechkar, Edward A., DYNACS Engineering Co., Inc., USA; Dever, Joyce A., NASA Glenn Research Center, USA; Banks, Bruce A., NASA Glenn Research Center, USA; May 2000; 14p; In English; 8th; 5th; Materials in a Space Environment, 5-9 Jun. 2000, Arcachen, Arcachen, France, France; Sponsored by Centre National d'Etudes Spatiales, France
Contract(s)/Grant(s): RTOP 632-6A-1E
Report No.(s): NASA/TM-2000-210053; E-12254; NAS 1.15:210053; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA Glenn Research Center at Lewis Field designed and developed a steady state vacuum ultraviolet automated (SSVUVa) facility with in situ VUV intensity calibration capability. The automated feature enables a constant accelerated VUV radiation exposure over long periods of testing without breaking vacuum. This test facility is designed to simultaneously accommodate four isolated radiation exposure tests within the SSVUVa vacuum chamber. Computer-control of the facility for long, term continuous operation also provides control and recording of thermocouple temperatures, periodic recording of VUV lamp intensity, and monitoring of vacuum facility status. This paper discusses the design and capabilities of the SSVUVa facility.
Author
Far Ultraviolet Radiation; Numerical Control; Test Facilities; Vacuum Chambers; Steady State

20000063376 NASA Glenn Research Center, Cleveland, OH USA
Fuzzy Current-Mode Control and Stability Analysis
Kopasakis, George, NASA Glenn Research Center, USA; June 2000; 18p; In English; 35th; Intersociety Energy Conversion Engineering, 24-28 Jul. 2000, Las Vegas, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 632-70-0A
Report No.(s): NASA/TM-2000-210068; E-12311; NAS 1.15:210068; AIAA Paper 2000-2803; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper a current-mode control (CMC) methodology is developed for a buck converter by using a fuzzy logic controller. Conventional CMC methodologies are based on lead-lag compensation with voltage and inductor current feedback. In this paper the converter lead-lag compensation will be substituted with a fuzzy controller. A small-signal model of the fuzzy controller will also be developed in order to examine the stability properties of this buck converter control system. The paper develops an analytical approach, introducing fuzzy control into the area of CMC.
Author
Fuzzy Systems; Approach Control; Stability Tests; Electric Potential; Controllers

20000063470 NASA Lewis Research Center, Cleveland, OH USA
Evanescent Microwave Probes on High-Resistivity Silicon and its Application in Characterization of Semiconductors
Tabib-Azar, M., Case Western Reserve Univ., USA; Akinwande, D., Case Western Reserve Univ., USA; Ponchak, George E., NASA Lewis Research Center, USA; LeClair, S. R., Case Western Reserve Univ., USA; Review of Scientific Instruments; July 1999; ISSN 0034-6748; Volume 70, No. 7, pp. 3083-3086; In English
Contract(s)/Grant(s): RTOP 632-6E-51; Copyright; Avail: Issuing Activity

In this article we report the design, fabrication, and characterization of very high quality factor 10 GHz microstrip resonators on high-resistivity (high-rho) silicon substrates. Our experiments show that an external quality factor of over 13 000 can be

achieved on microstripline resonators on high-rho silicon substrates. Such a high Q factor enables integration of arrays of previously reported evanescent microwave probe (EMP) on silicon cantilever beams. We also demonstrate that electron-hole pair recombination and generation lifetimes of silicon can be conveniently measured by illuminating the resonator using a pulsed light. Alternatively, the EMP was also used to nondestructively monitor excess carrier generation and recombination process in a semiconductor placed near the two-dimensional resonator.
Author
Fabrication; Microwave Probes; Nondestructive Tests; Q Factors; Resonators; Semiconductors (Materials); Silicon; Design Analysis

20000063472 NASA Lewis Research Center, Cleveland, OH USA
Characterization of Plated Via Hole Fences for Isolation Between Stripline Circuits in LTCC Packages
Ponchak, George E., NASA Lewis Research Center, USA; Chen, Donghoon, Michigan Univ., USA; Yook, Jong-Gwan, Michigan Univ., USA; Katehi, Linda P. B., Michigan Univ., USA; IEEE MTT-S Digest; 1998, pp. 1831-1834; In English
Contract(s)/Grant(s): NSF CDA-92-14296
Report No.(s): THIF-61; ISBN 0-7803-4471-5; Copyright; Avail: Issuing Activity
Reduced coupling between adjacent striplines in LTCC packages is commonly accomplished by walls made of plated via holes. In this paper, a 3D-FEM electromagnetic simulation of stripline with filled via fences on both sides is presented. It is shown that the radiation loss of the stripline and the coupling between striplines increases if the fence is placed too close to the stripline.
Author
Isolation; Circuits

20000063516 National Inst. of Standards and Technology, Electronics and Electrical Engineering Lab., Gaithersburg, MD USA
Internet Commerce for Manufacturing Activity Model
Barkmeyer, E.; Nell, J.; Parks, C.; May 03, 2000; 36p
Report No.(s): PB2000-105432; NISTIR-6516; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper describes the activity model as proposed for use in the Internet Commerce for Manufacturing (ICM), a project of the National Advanced Manufacturing Testbed Program. This model will be used to identify those Internet-facilitated transactions as they are accomplished in the ICM testbed. The model may also facilitate the visualization of the transactions developed by ICM. Where deemed appropriate, the model may serve to facilitate evaluation of the ICM business case. Finally, the model can be used to make recommendations for extensions of the ICM Architecture beyond the current industry domain.
NTIS
Internets; Electronic Commerce; Computer Aided Manufacturing

20000063525 University of Central Florida, Orlando, FL USA
Reconfigurable Network Routing with Spatial Soliton Crossbar Switches ***Final Report, 1 Aug. 1996 - 31 Jan. 1999***
Stegeman, George I.; Canva, Michael; Fuerst, Russell; Malendevich, Roman; Friedrich, Lars; Jan. 31, 1999; 20p; In English
Contract(s)/Grant(s): F49620-96-1-0419; AF Proj. 1651
Report No.(s): AD-A376918; AFRL-SR-BL-TR-00-0170; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The ultimate goal of this program was to use spatial solitons as reconfigurable interconnects for guiding signals between multiple input and output ports. The central idea is to use the solitons as a waveguide for guiding signals. Deflecting the soliton electro-optically allows the soliton (and hence the signal) to be steered in space. The research goals were to: (1) Steer solitons electro-optically in AlGaAs slab waveguides; (2) Grow PTS crystals in bulk and waveguide from and guide solitons in them; (3) Understand some of the basic properties of spatial solitons in quadratic media. and assess their suitability for interconnects. (4) Implement rudimentary interconnects and assess performance.
DTIC
Joining; Optical Waveguides; Solitary Waves; Electro-Optics; Electric Switches; Spatial Distribution

20000063532 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Commercial Off-The-Shelf (COTS) Program: Issues and Results of Upscreening COTS Parts for NASA Flight Hardware
Sandor, Mike, Jet Propulsion Lab., California Inst. of Tech., USA; Agarwal, Shri, Jet Propulsion Lab., California Inst. of Tech., USA; Villegas, Enrique, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 8p; In English; 3rd; Commercialization of Military and Space Electronics, 1999, Unknown; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
This paper presents The Commercial Off-The-Shelf Program (COTS). The topics of discussion are: 1) Introduction of COTS; 2) MARS01 Program/Requirements; 3) MARS01 COTS Screening Flow; 4) Test Results-Electrical, C-Sam, Burn-In; 5) Value

Added Analysis (Risk Reduction); 6) Value Added Analysis (Cost); 7) Impact of COTS ++ Screening; and 8) Summary. This paper is presented in viewgraph form.
CASI
Hardware; NASA Programs; Electronic Equipment

20000063534 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Outline: Recent work at JPL Under MSREP
[2000]; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

MSREP is a multi-faceted program with radiation effects in new technologies, development of testing and hardness assurance methods, continual evaluation of space and laboratory test data and support to NASA Projects. Other work in progress includes: 1) Device Scaling and New Phenomena; 2) Radiation Effects in Microprocessors; 3) Latchup Testing and Latchup Mitigation; and 4) Revised Radiation Design Approaches. This paper is in viewgraph form.
CASI
NASA Programs; Microelectronics; Electronic Equipment Tests

20000064072 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
On-Wafer Testing of Circuits Through 220 GHz
Gaier, Todd, Jet Propulsion Lab., California Inst. of Tech., USA; Samoska, Lorene, Jet Propulsion Lab., California Inst. of Tech., USA; Oleson, Charles, Oleson Microwave Labs.; Boll, Greg, GGB Industries; [1999]; 16p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have jointly developed the capability to perform on-wafer s-parameter and noise figure measurements through 220 GHz. S-parameter test sets have been developed covering full waveguide bands of 90-140 GHz (WR-08) and 140-220 GHz (WR-05). The test sets have been integrated with coplanar probes to allow accurate measurements on-wafer. We present the design and performance of the test sets and wafer probes. We also present calibration data as well as measurements of active circuits at frequencies as high as 215 GHz.
Author
Wafers; Evaluation; Circuits

20000064073 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
160-190 GHz Monolithic Low Noise Amplifiers
Kok, Y. L., TRW Space and Electronics Group, USA; Wang, H., TRW Space and Electronics Group, USA; Huang, T. W., TRW Space and Electronics Group, USA; Lai, R., TRW Space and Electronics Group, USA; Chen, Y. C., TRW Space and Electronics Group, USA; Sholley, M., TRW Space and Electronics Group, USA; Block, T., TRW Space and Electronics Group, USA; Streit, D. C., TRW Space and Electronics Group, USA; Liu, P. H., TRW Space and Electronics Group, USA; Allen, B. R., TRW Space and Electronics Group, USA; Samoska, L., Jet Propulsion Lab., California Inst. of Tech., USA; Gaier, T., Jet Propulsion Lab., California Inst. of Tech., USA; Barsky, Mike, TRW Space and Electronics Group, USA; [1998]; 7p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents the results of two 160-190 GHz monolithic low noise amplifiers (LNAs) fabricated with 0.07-microns pseudomorphic (PM) InAlAs/InGaAs/InP HEMT technology using a reactive ion etch (RIE) via hole process. A peak small signal gain of 9 dB was measured at 188 GHz for the first LNA with a 3-dB bandwidth from 164 to 192 GHz while the second LNA has achieved over 6-dB gain from 142 to 180 GHz. The same design (second LNA) was also fabricated with 0.08-micron gate and a wet etch process, showing a small signal gain of 6 dB with noise figure 6 dB. All the measurement results were obtained via on-wafer probing. The LNA noise measurement at 170 GHz is also the first attempt at this frequency.
Author
Low Noise; Preamplifiers; Noise Measurement; Microwave Amplifiers; Transferred Electron Devices

20000064092 NASA Lewis Research Center, Cleveland, OH USA
The Development of Si and SiGe Technologies for Microwave and Millimeter-Wave Integrated Circuits
Ponchak, George E., NASA Lewis Research Center, USA; Alterovitz, Samuel A., NASA Lewis Research Center, USA; Katehi, Linda P. B., Michigan Univ., USA; Bhattacharya, Pallab K., Michigan Univ., USA; Directions for the Next Generation of MMIC Devices and Systems; 1997, pp. 223-230; In English
Contract(s)/Grant(s): RTOP 632-6E-51; Copyright; Avail: Issuing Activity

Historically, microwave technology was developed by military and space agencies from around the world to satisfy their unique radar, communication, and science applications. Throughout this development phase, the sole goal was to improve the

performance of the microwave circuits and components comprising the systems. For example, power amplifiers with output powers of several watts over broad bandwidths, low noise amplifiers with noise figures as low as 3 dB at 94 GHz, stable oscillators with low noise characteristics and high output power, and electronically steerable antennas were required. In addition, the reliability of the systems had to be increased because of the high monetary and human cost if a failure occurred. to achieve these goals, industry, academia and the government agencies supporting them chose to develop technologies with the greatest possibility of surpassing the state of the art performance. Thus, Si, which was already widely used for digital circuits but had material characteristics that were perceived to limit its high frequency performance, was bypassed for a progression of devices starting with GaAs Metal Semiconductor Field Effect Transistors (MESFETs) and ending with InP Pseudomorphic High Electron Mobility Transistors (PHEMTs). For each new material or device structure, the electron mobility increased, and therefore, the high frequency characteristics of the device were improved. In addition, ultra small geometry lithographic processes were developed to reduce the gate length to 0.1 pm which further increases the cutoff frequency. The resulting devices had excellent performance through the millimeter-wave spectrum.
Derived from text
Technology Assessment; Microwave Circuits; Millimeter Waves; Logic Circuits; High Electron Mobility Transistors; Silicon; Germanium; Field Effect Transistors

20000064111 DYNACS Engineering Co., Inc., Brook Park, OH USA
Suspended Patch Antenna Array With Electromagnetically Coupled Inverted Microstrip Feed
Simons, Rainee N., DYNACS Engineering Co., Inc., USA; May 2000; 10p; In English; 6th; Ka Band Utilization, 31 May - 2 Jun. 2000, Cleveland, OH, USA; Sponsored by Istituto Internazionale delle Comunicazioni, Italy
Contract(s)/Grant(s): NAS3-98008; RTOP 632-6E-51
Report No.(s): NASA/CR-2000-210069; E-12247; NAS 1.26:210069; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The paper demonstrates a four-element suspended patch antenna array, with a parasitic patch layer and an electromagnetically coupled inverted microstrip feed, for linear polarization at K-Band frequencies. This antenna has the following advantages over conventional microstrip antennas: First, the inverted microstrip has lower attenuation than conventional microstrip; hence, conductor loss associated with the antenna corporate feed is lower resulting in higher gain and efficiency. Second, conventional proximity coupled patch antennas require a substrate for the feed and a superstrate for the patch. However, the inverted microstrip fed patch antenna makes use of a single substrate, and hence, is lightweight and low cost. Third, electromagnetic coupling results in wider bandwidth. Details regarding the design and fabrication will be presented as well as measured results including return loss, radiation patterns and cross-polarization levels.
Author
Antenna Arrays; Performance Tests; Antenna Radiation Patterns; Cross Polarization; Fabrication; Linear Polarization; Patch Antennas

20000064661 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Second harmonics and compensation effect in ceramic superconductors
Mai Suan Li,; Sep. 30, 1998; 10p; In English
Report No.(s): DE99-609737; IC-98/141; No Copyright; Avail: Department of Energy Information Bridge

The nonlinear Alternating Current (AC) susceptibility and the compensation effect observed in ceramic superconductors which show the paramagnetic Meissner effect are studied by the Monte Carlo simulations on a three dimensional lattice model of the Josephson array with finite self-conductance. Our study is based on the possible existence of the chiral glass phase in these materials. In agreement with experiments, the compensation effect is demonstrated to be present in d-wave superconductors but not in the s-wave ones.
NTIS
Harmonics; Compensation; High Temperature Superconductors

20000064722 Naval Surface Warfare Center, Dahlgren Div., Dahlgren, VA USA
Electronic Equipment Handbook on Methods for Meeting U.S. Navy Shipboard Electrical Power Interface Requirements *Final Report*
Hall, James R.; Apr. 2000; 26p; In English
Report No.(s): AD-A377030; NSWCDD/TR-00/33; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This handbook provides guidance for the implementation of electronic equipment suitable for U.S. Navy shipboard applications. The primary focus of this handbook is on the electrical power interface between combat systems equipment and U.S. Navy

shipboard electrical power generation and distribution systems. A number of problems currently exist with this interface and electronic equipment. These problems have often resulted in decreased equipment availability and damage. In addition, there is a potential for similar design and operational problems when fielding commercial-off-the-shelf (COTS) equipment. This handbook describes these problems, as well as approaches that may be employed to resolve these problems.
DTIC
Electronic Equipment; Handbooks; Ships

20000064927 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Calibration of Rogowski Coils *Final Report Kalibratie van Rogowski-Spoelen*
vanMaasdam, R., Prins Maurits Lab. TNO, Netherlands; September 1999; 67p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A98/KM/450; TNO Proj. 014.11407
Report No.(s): TD-99-0110; PML-1999-A15; Copyright; Avail: Issuing Activity

Because of the rarity of reliable measuring equipment at extreme high current levels, it is hardly possible to compare a method of measuring with another. So it would be favourable to build a calibration circuit that does not require other current reference devices. Such a calibration circuit has been realised and is based on the intrinsic properties of an LCR circuit, with an undercritically damped ringdown oscillation current. With this method it was possible to test 15 different Rogowski coils and integrators, up to a maximum current peak of 42.9 kA and calculate the Rogowski/intergrator sensitivity with accuracy less than 1%.
Author
Calibrating; Measuring Instruments; High Current

20000064995 Heriot-Watt Univ., Dept. of Mathematics, Edinburgh UK
Fourth International Congress on Industrial and Applied Mathematics. Final Programme
Jan. 1999; 227p; In English; 4th; Insustrial and Applied Mathematics, 5-9 Jul. 1999, USA
Contract(s)/Grant(s): F61775-99-WF031
Report No.(s): AD-A366894; EOARD-CSP-99-5031--2; Copyright; Avail: Defense Technical Information Center (DTIC)

The Final Proceedings for Fourth International Congress on Industrial and Applied Mathematics, 5 July 1999-9 July 1999. This is an interdisciplinary conference. Topics include: (1) mathematical modeling in industry and commerce, (2) mathematics of biology and medicine, (3) cryptography, (4) coding, (5) computer science, (6) signal and image processing, and (7) electromagnetism, including telecommunications, semiconductors, and electronics.
DTIC
Conferences; Computer Techniques; Signal Processing; Image Processing; Industries; Telecommunication

20000065626 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Electronic Packaging for Space Applications Workshop 1999
Sandor, Mike, Jet Propulsion Lab., California Inst. of Tech., USA; Agarwal, Shri, Jet Propulsion Lab., California Inst. of Tech., USA; Villegas, Enrique, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 21p; In English, 1999, Pasadena, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents viewgraphs on the Commercial Off-The-Shelf (COTS) Program. The topics include: 1) Advocacy for COTS; 2) MARS01 Program/Requirements; 3) MARS01 COTS Screening Flow; 4) Test Results-Electrical, C-Sam, Burn-In; 5) Value Added Analysis (Risk Reduction); 6) Value Added Analysis (Cost); 7) Impact of COTS ++ Screening and 8) Summary.
CASI
Electronic Packaging; Technology Utilization; Aerospace Systems

20000065662 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Electrical Properties and Power Considerations of a Piezoelectric Actuator
Jordan, T.; Ounaies, Z.; Tripp, J.; Tcheng, P.; Feb. 2000; 9p; In English
Contract(s)/Grant(s): NAS1-97046
Report No.(s): AD-A374608; ICASE-2000-8; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper assesses the electrical characteristics of piezoelectric wafers for use in aeronautical applications such as active noise control in aircraft. Determination of capacitive behavior and power consumption is necessary to optimize the system configuration and to design efficient driving electronics. Empirical relations are developed from experimental data to predict the capacitance and loss tangent of a PZT5A ceramic as nonlinear functions of both applied peak voltage and driving frequency. Power consumed by the PZT is the rate of energy required to excite the piezoelectric system along with power dissipated due to dielectric loss and mechanical and structural damping. Overall power consumption is thus quantified as a function of peak applied voltage

and driving frequency. It was demonstrated that by incorporating the variation of capacitance and power loss with voltage and frequency, satisfactory estimates of power requirements can be obtained. These relations allow general guidelines in selection and application of piezoelectric actuators and driving electronics for active control applications.
DTIC
Piezoelectricity; Piezoelectric Ceramics; Actuators; Wafers

20000065669 Oxley Research, Inc., New Haven, CT USA
Electrolytic regeneration of acid cupric chloride printed circuit board etchant ***Final Report, 1 Aug. 1995 - 31 Oct. 1996***
Oxley, J. E.; Smialek, R. J.; Apr. 18, 1997; 33p; In English
Report No.(s): DE97-008020; DOE/EE/15650-T6; No Copyright; Avail: Department of Energy Information Bridge
The overall objective of this ERIP program was to make substantial progress in further developing a process for electrolytic regeneration of acid cupric chloride etchant. Specific objectives of the work were: (1) to define optimum system operating conditions by conducting a systematic study of process parameters, (2) to develop or find a superior electrolytic cell separator material, (3) to determine an optimum activation procedure for the flow-through carbon/graphite felt electrodes which are so critical to process performance, (4) to demonstrate - on the pre-prototype scale - electrolytic compensation for oxygen ingress - which causes etchant solution growth, and (5) to begin engineering design work on a prototype-scale regeneration unit. Parametric studies looked at the effect that key plating parameters have on copper deposit quality. Parameters tested included (a) velocity past the plating cathodes, (b) copper concentration in the catholyte solution from which the copper is being plated, (c) plating current density, and (d) catholyte cupric ion concentration. The most significant effects were obtained for velocity changes. The work showed that catholyte velocities above 0.5 ft/sec were needed to get adequate plating at 77.5 mA/sq cm and higher currents, and that even higher flow was better.
NTIS
Electrolytic Cells; Printed Circuits; Circuit Boards; Etchants

20000066591 Department of the Navy, Washington, DC USA
Helix Antenna
Josypenko, Michael J., Inventor; Jul. 19, 1999; 22p; In English
Patent Info.: Filed 19 Jul. 1999; US-Patent-Appl-SN-09,356,803
Report No.(s): AD-D019712; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
A helix antenna includes a base portion for containing a feed network including a power input, a 90 degree power splitter in communication with the power inlet, and first and second 180 degree power splitters in communication with the 90 degree power splitter. A support tube is mounted on the base portion, and a plurality of disk separators are mounted on the tube. Four elongated elements are wound around the tube and are spaced therefrom by the disk separators. The elements are connected to end-most lower and upper ones of the disk separators, the elements extending toward a center feed point of the upper disk separator. First and second radially opposite pairs of feed cables are wound around the Support tube, extending from the lower disk separator to the upper disk separator, and are in communication, respectively, with the first and second 180 degree power splitters.
DTIC
Dipole Antennas; Antenna Design; Design Analysis

20000066612 Building and Construction Research TNO, Centre for Mechanical Engineering, Delft, Netherlands
Shock Test of a Switch Over Unit, Type DP 7J.:1 Manufacturer Imtech
vanBragt, F. J., Building and Construction Research TNO, Netherlands; Jul. 30, 1999; 24p; In English; Original contains color illustrations
Contract(s)/Grant(s): A99/KM/102; TNO Proj. 006.93128/01.01
Report No.(s): TD-99-0093; Rept-99-CMC-R041; Copyright; Avail: Issuing Activity
Shock tests have been performed on a resiliently mounted switch over unit. The cabinet was mounted on wire rope mounts type K19 100-02 S2. No damage has been established and no contact rumble was observed.
Author
Shock Tests; Damage; Switches

20000067664 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Different Approaches for Ensuring Performance/Reliability of Plastic Encapsulated Microcircuits (PEMs) in Space Applications

Gerke, R. David, Jet Propulsion Lab., California Inst. of Tech., USA; Sandor, Mike, Jet Propulsion Lab., California Inst. of Tech., USA; Agarwal, Shri, Jet Propulsion Lab., California Inst. of Tech., USA; Moor, Andrew F., Johns Hopkins Univ., USA; Cooper, Kim A., Johns Hopkins Univ., USA; [2000]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Engineers within the commercial and aerospace industries are using trade-off and risk analysis to aid in reducing spacecraft system cost while increasing performance and maintaining high reliability. In many cases, Commercial Off-The-Shelf (COTS) components, which include Plastic Encapsulated Microcircuits (PEMs), are candidate packaging technologies for spacecrafts due to their lower cost, lower weight and enhanced functionality. Establishing and implementing a parts program that effectively and reliably makes use of these potentially less reliable, but state-of-the-art devices, has become a significant portion of the job for the parts engineer. Assembling a reliable high performance electronic system, which includes COTS components, requires that the end user assume a risk. to minimize the risk involved, companies have developed methodologies by which they use accelerated stress testing to assess the product and reduce the risk involved to the total system. Currently, there are no industry standard procedures for accomplishing this risk mitigation. This paper will present the approaches for reducing the risk of using PEMs devices in space flight systems as developed by two independent Laboratories. The JPL procedure involves primarily a tailored screening with accelerated stress philosophy while the APL procedure is primarily, a lot qualification procedure. Both Laboratories successfully have reduced the risk of using the particular devices for their respective systems and mission requirements.

Author

Aerospace Industry; Encapsulated Microcircuits; Reliability; Technology Utilization; Plastics; NASA Space Programs

20000067674 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Effects of Hydrogen on Tantalum Nitride Resistors

Weiler, James, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

In this paper we report on observations of degradation of thin film Tantalum Nitride chip resistors in a hermetically sealed hybrid. The observations have been attributed to the reaction of residual Palladium with desorbed Hydrogen on the surface of the resistor film. Hydrogen gas has been observed to desorb from various sources within the sealed hybrid as a result of temperature elevation. The hydrogen gas has been reported to undergo a reaction with elements such as Platinum and Palladium causing device degradation in Gallium Arsenide Field Effect Transistors. The experimental procedures and data relating to this observation along with a discussion of available risk mitigation techniques will be presented.

Author

Hydrogen; Tantalum Nitrides; Resistors; Degradation; Thin Films

34
FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also 02 Aerodynamics.

20000062307 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

A Priori Subgrid Scale Modeling for a Droplet Laden Temporal Mixing Layer

Okongo, Nora, Jet Propulsion Lab., California Inst. of Tech., USA; Bellan, Josette, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Subgrid analysis of a transitional temporal mixing layer with evaporating droplets has been performed using a direct numerical simulation (DNS) database. The DNS is for a Reynolds number (based on initial vorticity thickness) of 600, with droplet mass loading of 0.2. The gas phase is computed using a Eulerian formulation, with Lagrangian droplet tracking. Since Large Eddy Simulation (LES) of this flow requires the computation of unfiltered gas-phase variables at droplet locations from filtered gas-phase variables at the grid points, it is proposed to model these by assuming the gas-phase variables to be given by the filtered variables plus a correction based on the filtered standard deviation, which can be computed from the sub-grid scale (SGS) standard deviation. This model predicts unfiltered variables at droplet locations better than simply interpolating the filtered variables. Three

methods are investigated for modeling the SGS standard deviation: Smagorinsky, gradient and scale-similarity. When properly calibrated, the gradient and scale-similarity methods give results in excellent agreement with the DNS.
Author
Models; Scale (Ratio); Computational Grids; Direct Numerical Simulation; Evaporation; Interpolation; Lagrangian Function; Mixing Layers (Fluids)

20000062308 NASA Glenn Research Center, Cleveland, OH USA
Numerical Simulation of Non-Rotating and Rotating Coolant Channel Flow Fields, Part 1
Rigby, David L., NASA Glenn Research Center, USA; [2000]; 26p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Future generations of ultra high bypass-ratio jet engines will require far higher pressure ratios and operating temperatures than those of current engines. For the foreseeable future, engine materials will not be able to withstand the high temperatures without some form of cooling. In particular the turbine blades, which are under high thermal as well as mechanical loads, must be cooled. Cooling of turbine blades is achieved by bleeding air from the compressor stage of the engine through complicated internal passages in the turbine blades (internal cooling, including jet-impingement cooling) and by bleeding small amounts of air into the boundary layer of the external flow through small discrete holes on the surface of the blade (film cooling and transpiration cooling). The cooling must be done using a minimum amount of air or any increases in efficiency gained through higher operating temperature will be lost due to added load on the compressor stage. Turbine cooling schemes have traditionally been based on extensive empirical data bases, quasi-one-dimensional computational fluid dynamics (CFD) analysis, and trial and error. With improved capabilities of CFD, these traditional methods can be augmented by full three-dimensional simulations of the coolant flow to predict in detail the heat transfer and metal temperatures. Several aspects of turbine coolant flows make such application of CFD difficult, thus a highly effective CFD methodology must be used. First, high resolution of the flow field is required to attain the needed accuracy for heat transfer predictions, making highly efficient flow solvers essential for such computations. Second, the geometries of the flow passages are complicated but must be modeled accurately in order to capture all important details of the flow. This makes grid generation and grid quality important issues. Finally, since coolant flows are turbulent and separated the effects of turbulence must be modeled with a low Reynolds number turbulence model to accurately predict details of heat transfer.
Derived from text
Flow Distribution; Rotation; Coolants; Cooling; Jet Engines; Three Dimensional Models

20000062852 Technische Univ., Faculty of Mathematical Sciences, Twente, Netherlands
Accurate Boundary-Element Method for Stokes Flow in Partially Covered Cavities
Driesen, C. H.; Kuerten, J. G. M.; May 1998; 44p; In English
Report No.(s): PB2000-104912; MEMO-1442; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The two-dimensional flow of a viscous fluid over an etched hole is computed with a boundary-element method. The etch-hole geometry contains sharp corners at which the solution of the traction boundary-integral equation is singular. Therefore, only the regular part of the solution is computed with the boundary-element method, using a singularity-subtraction method, and the singular part of the solution is added. However, there are regions in which these regular and singular parts are of almost equal magnitude, but different in sign. to avoid the subtraction and addition of large quantities where quantities of smaller order are computed a domain-decomposition technique is introduced. The authors show that the accuracy indeed increases by the described techniques. After extrapolation the results for a rectangular geometry agree very well with results obtained earlier with a semi-analytical method.
NTIS
Boundary Element Method; Boundary Integral Method; Two Dimensional Flow; Steady Flow; Stokes Flow; Viscous Fluids

20000062853 NASA Glenn Research Center, Cleveland, OH USA
A Compact Dual-Crystal Modulated Birefringence-Measurement System for Microgravity Applications
Mackey, Jeffrey R., NASA Glenn Research Center, USA; Das, Kamal K., NASA Glenn Research Center, USA; Anna, Shelley L., Massachusetts Inst. of Tech., USA; McKinley, Gareth H., Massachusetts Inst. of Tech., USA; Measurement Science and Technology; 1999; ISSN 0957-0233; Volume 10, pp. 946-955; In English; Sponsored in part by Fannie and John Hertz Foundation
Contract(s)/Grant(s): NCC3-610; RTOP 101-33-00; Copyright; Avail: Issuing Activity

A compact modulated birefringence-measurement system has been developed for use in microgravity fluid physics applications with non-Newtonian fluids such as polymer solutions. This instrument uses a dual-crystal transverse electro-optical modulator capable of modulation frequencies in excess of 100 MHz. The two crystals are modulated 180 deg. out of phase from each

other, The theoretical framework governing the development of this instrument using the Mueller-Stokes polarization matrices is discussed. Several ground-based experiments are performed to compare this system with the theoretical results. Results from this transverse electro-optical modulator-based birefringence-measurement system agree well with the theory. The instrument is also very stable and robust, making it suitable for the extreme acceleration environment to be encountered in a NASA Black Brandt sounding rocket.
Author
Birefringence; Microgravity Applications; Modulators; Measure and Integration

20000063505 Hampton Univ., School of Engineering and Technology, VA USA
Advanced Methods for Acoustic and Thrust Benefits for Aircraft Engine Nozzles ***Final Report, 1 Jun. 1996 - 31 Dec. 1999***
Morgan, Morris H., III, Hampton Univ., USA; Gilinsky, Mikhail M., Hampton Univ., USA; March 2000; 19p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG1-1835; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Fluid Mechanics and Acoustics Laboratory (FM&AL) was established At Hampton University in June of 1996. In addition, the FM&AL jointly conducted research with the Central AeroHydrodynamics Institute (TsAGI, Moscow) in Russia under a 2.5 year Civilian Research and Development Foundation (CRDF). The goals of the FM&AL programs are two fold: 1) to improve the working efficiency of the FM&AL team in generating new innovative ideas and in conducting research in the field of fluid dynamics and acoustics, basically for improvement of supersonic and subsonic aircraft engines, and 2) to attract promising minority students to this research and training and, in cooperation with other HU departments, to teach them basic knowledge in Aerodynamics, Gas Dynamics, and Theoretical and Experimental Methods in Aeroacoustics and Computational Fluid Dynamics (CFD). The research at the FM&AL supports reduction schemes associated with the emission of engine pollutants for commercial aircraft and concepts for reduction of observables for military aircraft. These research endeavors relate to the goals of the NASA Strategic Enterprise in Aeronautics concerning the development of environmentally acceptable aircraft. It is in this precise area, where the US aircraft industry, academia, and Government are in great need of trained professionals and which is a high priority goal of the Minority University Research and Education (MUREP) Program, that the HU FM&AL can make its most important contribution. This project already benefits NASA and HU because: First, the innovation, testing, and further development of new techniques for advanced propulsion systems are necessary for the successful attainment of the NASA Long Term Goals in Aeronautics and Space Transportation Technology (ASTT) including Global Civil Aviation, Revolutionary Technology Leaps, Access to Space, R&D Services, and the economic competitiveness of the US Aircraft Industry in the 2 1 st century. Secondly, the joint theoretical and experimental research and training by the GRC-HU Teams aids: using advanced methods and experience in Aerospace Engineering for domestic industries and training of HU students for interesting innovative work in the numerical simulation field as well as engineering and experimental research. HU students use and modify existing numerical codes for the solution of actual applied problems of the NASA Langley Research Center (LaRC)
Derived from text
Nozzle Efficiency; Engine Design; Aircraft Engines; Aeroacoustics; Gas Dynamics; Hydrodynamics; Thrust

20000064066 Instituto Nacional de Tecnica Aeroespacial, Torrejon de Ardoz, Spain
Results of Measurements from Convective Heat Transfer Tests in a Plane Circular Cylinder ***Resultados de las Medidas en Ensayos de Transferencia de Calor Convectivo en un Cilindro Circular Liso***
Otero, M. Urdiales, Instituto Nacional de Tecnica Aeroespacial, Spain; October 1999; 28p; In Spanish
Report No.(s): INTA-AT/TNO/4410/023/INTA/00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this document is included the set of temperature measurements get during different wind tunnel tests, in order to achieve the heat transference coefficient. The test were made in a circular cylinder with a plane exterior surface
Author
Temperature Measurement; Convective Heat Transfer

20000064114 NASA Glenn Research Center, Cleveland, OH USA
Investigation of Density Fluctuations in Supersonic Free Jets and Correlation with Generated Noise
Panda, J., Modern Technologies Corp., USA; Seasholtz, R. G., NASA Glenn Research Center, USA; [2000]; 26p; In English; 6th; Aeroacoustics, 12-14 Jun. 2000, Lahaina, HI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-2099; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The air density fluctuations in the plumes of fully-expanded, unheated free jets were investigated experimentally using a Rayleigh scattering based technique. The point measuring technique used a continuous wave laser, fiber-optic transmission and photon counting electronics. The radial and centerline profiles of time-averaged density and root-mean-square density fluctuation pro-

vided a comparative description of jet growth. to measure density fluctuation spectra a two-Photomultiplier tube technique was used. Crosscorrelation between the two PMT signals significantly reduced electronic shot noise contribution. Turbulent density fluctuations occurring up to a Strouhal number (SR) of 2.5 were resolved. A remarkable feature of density spectra, obtained from the same locations of jets in 0.5is less than Mis less than 1.5 range, is a constant Strouhal frequency for peak fluctuations. A detailed survey at Mach numbers M = 0.95, 1.4 and 1.8 showed that, in general, distribution of various Strouhal frequency fluctuations remained similar for the three jets. In spite of the similarity in the flow fluctuation the noise characteristics were found to be significantly different. Spark schlieren photographs and near field microphone measurements confirmed that the eddy Mach wave radiation was present in Mach 1.8 jet, and was absent in Mach 0.95 jet. to measure correlation between the flow and the far field sound pressure fluctuations, a microphone was kept at a distance of 50 diameters, 30 deg. to the flow direction, and the laser probe volume was moved from point to point in the flow. The density fluctuations in the peripheral shear layer of Mach 1.8 jet showed significant correlation up to the measurement limit of SR = 2.5, while for Mach 0.95 jet no correlation was measured. Along the centerline measurable correlation was found from the end of the potential core and at the low frequency range (SR less than 0.5). Usually the normalized correlation values increased with an increase of the jet Mach number. The experimental data point out eddy Mach waves as a strong source of sound generation in supersonic jets and fail to locate the primary noise mechanism in subsonic jets. Author

Density (Mass/Volume); Air Conditioning; Supersonic Jet Flow; Correlation; Cross Correlation; Flow Characteristics; Flow Distribution; Pressure Oscillations; Turbulent Flow

20000064591 NASA Ames Research Center, Moffett Field, CA USA

Functionality Improvements to Overaero

Gee, Ken, MCAT Inst., USA; Rizk, Yehia M., NASA Ames Research Center, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The functionality of the overset, static aeroelasticity, Navier-Stokes flow solver OVERAERO was increased by adding capability to the flow solver and enhancing code performance. Improvements were made to the fluids/structure interface, an MLP version of the parallel OVERAERO code was developed, and the OVERAERO-MPI code was ported to the Cray T3E. The OVERFLOW-MPI and OVERAERO-MPI codes were tested successfully on the IPG testbed and a means of reducing communication overhead within OVERFLOW-MPI was investigated. to solve an aeroelastic problem computationally, a structures grid surface definition and a fluids grid surface definition are required. Typically, the structures grid surface has a lower fidelity than the fluids grid surface. Thus, the methods developed to transfer data between the two grid systems are vital to the accuracy and efficiency of the aeroelasticity code. The fluids/structures interface developed for the OVERAERO code was improved to more accurately treat fluids surfaces that bridge between two different structural surfaces. For example, the method allowed the forward portion of a flap track fairing to deform with the wing and the aft end of the fairing to deform with the flap. A tightly-coupled version of the code based on OVERFLOW-MLP was developed to improve code performance on the SGI Origin 2000. This required a new parallelization strategy to couple the fluids and structures codes. The OVERAERO-MPI code was ported to the Cray T3E to extend the usability of the code. The port required extensive use of dynamic memory management techniques to fit large problems within the memory limitations of the T3E. The OVERFLOW-MPI and OVERAERO-MPI codes were tested on the IPG testbed being developed within NASA. For small problems with minimal data transfer between grids, there was little to no performance penalty spreading the computation across two machines. For very large problems, methods were developed to minimize intermachine communication via the grid partitioning scheme. by minimizing the intermachine communication requirements of the problem, it may still be beneficial to run a tightly-coupled flow solver across two machines within the IPG. Author

Aeroelasticity; Computational Grids; Distributed Processing; Computer Systems Design; Distributed Memory

20000064601 Boeing Commercial Airplane Co., Seattle, WA USA

Large Scale Navier-Stokes Calculations of a Transport Airplane Configuration

Yu, N. J., Boeing Commercial Airplane Co., USA; Kao, T. J., Boeing Commercial Airplane Co., USA; Bogue, D. R., Boeing Commercial Airplane Co., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Large scale Navier-Stokes calculations of a transport airplane configuration at cruise as well as at off-design conditions are presented. Computational results show good correlation with wind tunnel data both in lift and in pitching moment. At flight Reynolds number, the effects of vortex generators on wing pressures and shock movements are also predicted correctly. The study utilizes multi-block, structured grids to solve thin layer Navier-Stokes equations for a complete twin-engine airplane configuration. Point matched, multiblock grids are used for most cases. However, at flight Reynolds number, patched or mismatched multiblock grids are used in vortex generator regions in order to resolve local flow field details generated by vortex generators. Included

figures compare the lift and pitching moment with wind tunnel data. Computational results predict airplane lift and pitch characteristics correctly, including the onset angle of attack for pitch up and pitch down. The maximum lift is lower than test data due primarily to larger separation regions predicted by the present analysis. Another figure shows effects of vortex generators on wing pressures at cruise Mach, flight Reynolds number, and maximum lift condition. With vortex generators deployed, the size of shock induced separation reduces significantly, and thus improves outboard wing loading and airplane pitch characteristics. The present study utilizes 15 to 21 million grid points. Calculations were carried out on NAS Origin 2000 machine using 36 to 60 CPUs concurrently. A parallel efficiency of 90 - 95% was achieved through the use of Message Passing Interface (MPI) in the TLNS3DMB code developed at NASA Langley. This work shows that efficient, large scale aerodynamic calculations can be done on fast, parallel machines. Additional information is contained in the original.
Author
Computational Grids; Multiblock Grids; Navier-Stokes Equation; Reynolds Number; Transport Aircraft; Vortex Generators

20000064607 San Jose State Univ., Coll. of Engineering, CA USA
NASA Flow Solvers Support Environments: Maximizing Legacy Code Investment with Java and CORBA
Smith, Lance, San Jose State Univ., USA; Fatoohi, Rod, San Jose State Univ., USA; Harkey, Dan, San Jose State Univ., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This is a project for integrating Computational Fluid Dynamics (CFD) applications within a Java/CORBA environment. The overall goal of this project is to focus on computational aerosciences, and investigate issues in, and develop solutions to, efficient execution of these applications in heterogeneous, object-oriented environments. One of these applications is a two-dimensional incompressible Navier-Stokes solver exemplified by the code INS2D. Batches of INS2D jobs are currently run via a collection of C shell scripts. As demands have grown, the scripts have become more complex. Changes in platforms, paths and maximum process runtimes are all hard coded. The scripts are difficult to understand and time consuming to maintain. The first stage of this research is to provide a Java/CORBA solution for running the INS2D legacy code. Java, a platform independent language, maximizes code reuse. CORBA, the Object Management Group's Common Object Request Broker Architecture, masks the details of multiplatform inter-object communication. A client/server model is used where one client provides multiple servers with jobs to run. The implementation of four technologies is explored in this research: a) the Unified Modeling Language (UML) - to provide a simplified way of visualizing, constructing and documenting software components-, b) well-known software design patterns - to offer a collection of frameworks for object collaboration-, c) Java - to wrap legacy codes and adapt them to modern object oriented techniques-, and d) CORBA and its services - to provide a location independent communications bus. by combining and applying these technologies a legacy application can be insulated from the distributed world around it. Thusly, the lifetime of legacy applications can be extended without extensive rewriting. The architecture, implementation and design issues are presented in detail. Integration issues with existing job schedulers are examined. Wrapping legacy objects "whole" verses breaking them down as well as relationships between application specific components and CORBA services are discussed. Software patterns are used in order to provide the clear interface boundaries required for integration of legacy codes with object oriented components. Object communication via CORBA IDL is examined. UML and visual support tools are used to map out object collaboration scenarios. Competing scenarios are then examined and design tradeoffs are compared. Management of resource intensive production queues is explored. Finally, cross platform installation issues and concluding remarks are provided.
Author
Java (Programming Language); Object-Oriented Programming; Software Engineering; Software Reuse

20000064609 Boeing Commercial Airplane Co., Seattle, WA USA
Navier-Stokes Prediction of Inlet Flow Fields
Reyhner, Theodore A., Boeing Commercial Airplane Co., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Boeing Company has a well-developed process to design the inlets used on its commercial jet aircraft. The process uses potential flow analysis and empirical rules for determining when the flow separates. A project has been underway for some time to determine if existing Navier-Stokes analysis capability has reached the stage where improved designs can be achieved, particularly for configurations outside the envelope that was used for generating the empirical rules. This requires that both separated and attached flow fields be accurately predicted. The current work on this project involves the use of two government Navier-Stokes computer codes, tlns3d-mb and Wind. Both codes are designed to run in a parallel mode to reduce wall clock time. Parallel computing is done using zone decomposition with one of more zones assigned to a processor. Parallel computing has used MPI and PVM message passing. Parallel computing has proven essential to obtaining results within a reasonable time period. This paper will specifically report on an effort to use Navier-Stokes analysis to predict the performance of an advanced inlet. The origi-

nal design did not perform as well as expected in model-scale, wind-tunnel testing. The object of this project was to determine why and develop a reliable tool to be used for an improved design. Predictions were done for the inlet operating in the presence of a ground plane (runway) with a crosswind at zero forward speed, a critical design point for inlet operation. The Wind Navier-Stokes code was used with structured Chimera grids having about five million grid points and divided into 30 to 40 zones. Fine grid calculations used 30 processors. The computations were made using the NAS SGI Origin computing cluster. Analysis predictions agreed with data, predicting the onset of separation and the details of the flow field for attached and separated flows, including the effects of the ground vortex. The analysis proved capable of predicting the influence of the wind-tunnel walls on the measured flow field. Part of the effort was directed at determining grid topology and density requirements and identifying the best procedure for running the code. A process has been developed that can provide flow prediction results in several days for a new design. Predictions correspond well with experiment, but additional test cases are needed to increase confidence in the procedure.
Author
Computational Fluid Dynamics; Inlet Flow; Navier-Stokes Equation; Parallel Processing (Computers); Structured Grids (Mathematics); Engine Inlets

20000064614 NASA Ames Research Center, Moffett Field, CA USA
Fast Particle Methods for Multiscale Phenomena Simulations
Koumoutsakos, P., NASA Ames Research Center, USA; Wray, A., NASA Ames Research Center, USA; Shariff, K., NASA Ames Research Center, USA; Pohorille, Andrew, NASA Ames Research Center, USA; Welcome to the NASA High Performance Computing and Communications Computational Aerosciences (CAS) Workshop 2000; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We are developing particle methods oriented at improving computational modeling capabilities of multiscale physical phenomena in : (i) high Reynolds number unsteady vortical flows, (ii) particle laden and interfacial flows, (iii)molecular dynamics studies of nanoscale droplets and studies of the structure, functions, and evolution of the earliest living cell. The unifying computational approach involves particle methods implemented in parallel computer architectures. The inherent adaptivity, robustness and efficiency of particle methods makes them a multidisciplinary computational tool capable of bridging the gap of micro-scale and continuum flow simulations. Using efficient tree data structures, multipole expansion algorithms, and improved particle-grid interpolation, particle methods allow for simulations using millions of computational elements, making possible the resolution of a wide range of length and time scales of these important physical phenomena.The current challenges in these simulations are in : [i] the proper formulation of particle methods in the molecular and continuous level for the discretization of the governing equations [ii] the resolution of the wide range of time and length scales governing the phenomena under investigation. [iii] the minimization of numerical artifacts that may interfere with the physics of the systems under consideration. [iv] the parallelization of processes such as tree traversal and grid-particle interpolations We are conducting simulations using vortex methods, molecular dynamics and smooth particle hydrodynamics, exploiting their unifying concepts such as : the solution of the N-body problem in parallel computers, highly accurate particle-particle and grid-particle interpolations, parallel FFT's and the formulation of processes such as diffusion in the context of particle methods. This approach enables us to transcend among seemingly unrelated areas of research.
Author
Computer Techniques; Data Structures; Parallel Computers; Computerized Simulation; Particles

20000064696 Sverdrup Technology, Inc., Huntsville, AL USA
Interfacing the Generalized Fluid System Simulation Program with the SINDA/G Thermal Program
Schallhorn, Paul, Sverdrup Technology, Inc., USA; Palmiter, Christopher, Sverdrup Technology, Inc., USA; Farmer, Jeffery, NASA Marshall Space Flight Center, USA; Lycans, Randall, Sverdrup Technology, Inc., USA; Tiller, Bruce, NASA Marshall Space Flight Center, USA; [2000]; 13p; In English; 34th; 34th Thermophysics Conference, 19-22 Jun. 2000, Denver, CO, USA Contract(s)/Grant(s): NAS8-40386; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A general purpose, one dimensional fluid flow code has been interfaced with the thermal analysis program SINDA/G. The flow code, GFSSP, is capable of analyzing steady state and transient flow in a complex network. The flow code is capable of modeling several physical phenomena including compressibility effects, phase changes, body forces (such as gravity and centrifugal) and mixture thermodynamics for multiple species. The addition of GFSSP to SINDA/G provides a significant improvement in convective heat transfer modeling for SINDA/G. The interface development was conducted in two phases. This paper describes the first (which allows for steady and quasi-steady - unsteady solid, steady fluid - conjugate heat transfer modeling). The second (full transient conjugate heat transfer modeling) phase of the interface development will be addressed in a later paper. Phase 1 development has been benchmarked to an analytical solution with excellent agreement. Additional test cases for each develop-

ment phase demonstrate desired features of the interface. The results of the benchmark case, three additional test cases and a practical application are presented herein.
Author
One Dimensional Flow; Computer Programs; Thermal Analysis; Computerized Simulation; Fluid Dynamics; Steady State; Unsteady State; Quasi-Steady States

20000064720 NASA Ames Research Center, Moffett Field, CA USA
Compressibility Effects on the Passive Scalar Flux Within Homogeneous Turbulence
Blaisdell, G. A., Purdue Univ., USA; Mansour, N. N., NASA Ames Research Center, USA; Reynolds, W. C., Stanford Univ., USA; Physics of Fluids; October 1994; ISSN 1070-6631; Volume 6, No. 10, pp. 3498-3500; In English
Contract(s)/Grant(s): F49620-86-K-0022; Copyright; Avail: Issuing Activity

Compressibility effects on turbulent transport of a passive scalar are studied within homogeneous turbulence using a kinematic decomposition of the velocity field into solenoidal and dilatational parts. It is found that the dilatational velocity does not produce a passive scalar flux, and that all of the passive scalar flux is due to the solenoidal velocity.
Author
Compressibility Effects; Compressible Flow; Homogeneous Turbulence; Isotropic Turbulence; Turbulent Flow; Shear Flow

20000067660 NASA Marshall Space Flight Center, Huntsville, AL USA
Observations on Rotating Cavitation and Cavitation Surge from the Development of the Fastrac Engine Turbopump
Zoladz, Thomas F., NASA Marshall Space Flight Center, USA; [2000]; 9p; In English; 36th; Joint Propulsion, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-3403; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

Observations regarding rotating cavitation and cavitation surge experienced during the development of the Fastrac engine turbopump are discussed. Detailed observations acquired from the analysis of both water flow and liquid oxygen test data are offered in this paper. Scaling and general comparison of rotating cavitation between water flow and liquid oxygen testing are discussed. Complex data features linking the localized rotating cavitation mechanism of the inducer to system surge components are described in detail. Finally a description of a lumped-parameter hydraulic system model developed to better understand observed data is given.
Author
Cavitation Flow; Rotation; Fabrication; Turbine Pumps

20000067663 NASA Glenn Research Center, Cleveland, OH USA
Experimental Investigation of Boundary Layer Behavior in a Simulated Low Pressure Turbine
Shyne, Rickey J., NASA Glenn Research Center, USA; Sohn, Ki-Hyeon, Toledo Univ., USA; DeWitt, Kenneth J., Toledo Univ., USA; [1999]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

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

35
INSTRUMENTATION AND PHOTOGRAPHY

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 Avionics and Aircraft Instrumentation; and 19 Spacecraft Instrumentation.

20000061971 NASA Glenn Research Center, Cleveland, OH USA
Detection Angle Calibration of Pressure-Sensitive Paints
Bencic, Timothy J., NASA Glenn Research Center, USA; [2000]; 10p; In English; 46th; Instrumentation, 30 Apr. - 4 May 2000, Bellevue, WA, USA; Sponsored by Instrument Society of America, USA
Contract(s)/Grant(s): RTOP 519-20-53; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Uses of the pressure-sensitive paint (PSP) techniques in areas other than external aerodynamics continue to expand. The NASA Glenn Research Center has become a leader in the application of the global technique to non-conventional aeropropulsion applications including turbomachinery testing. The use of the global PSP technique in turbomachinery applications often requires detection of the luminescent paint in confined areas. With the limited viewing usually available, highly oblique illumination and detection angles are common in the confined areas in these applications. This paper will describe the results of pressure, viewing and excitation angle dependence calibrations using three popular PSP formulations to get a better understanding of the errors associated with these non-traditional views.
Author
Detection; Angles (Geometry); Calibrating; Technology Assessment; Luminescence; Paints

20000062018 NASA Langley Research Center, Hampton, VA USA
Three Averaging Techniques for Reduction of Antenna Temperature Variance Measured by a Dicke Mode, C-Band Radiometer
Mackenzie, Anne I., NASA Langley Research Center, USA; Lawrence, Roland W., NASA Langley Research Center, USA; May 2000; 34p; In English
Contract(s)/Grant(s): RTOP 258-70-21-06
Report No.(s): NASA/TM-2000-210283; L-17987; NAS 1.15:210283; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As new radiometer technologies provide the possibility of greatly improved spatial resolution, their performance must also be evaluated in terms of expected sensitivity and absolute accuracy. As aperture size increases, the sensitivity of a Dicke mode radiometer can be maintained or improved by application of any or all of three digital averaging techniques: antenna data averaging with a greater than 50% antenna duty cycle, reference data averaging, and gain averaging. An experimental, noise-injection, benchtop radiometer at C-band showed a 68.5% reduction in DT after all three averaging methods had been applied simultaneously. For any one antenna integration time, the optimum 34.8% reduction in DT was realized by using an 83.3% antenna/reference duty cycle.
Author
Dicke Radiometers; Spatial Resolution; Digital Data; Microwave Imagery; Noise Temperature; Temperature Effects; Error Analysis; Antenna Components

20000062468 NASA Ames Research Center, Moffett Field, CA USA
AIRES: An Airborne Infra-Red Echelle Spectrometer for SOFIA
Dotson, Jessie J., Search for Extraterrestrial Intelligence Inst., USA; Erickson, Edwin F., NASA Ames Research Center, USA; Haas, Michael R., NASA Ames Research Center, USA; Colgan, Sean W. J., NASA Ames Research Center, USA; Simpson, Janet P., NASA Ames Research Center, USA; Telesco, Charles M., Florida Univ., USA; Pina, Robert K., Florida Univ., USA; Wolf, Juergen, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Young, Erick T., Arizona Univ., USA; [1999]; 10p; In English; Thermal, 28-30 Apr. 1999, Houston, TX, USA
Contract(s)/Grant(s): NCC2-647; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

SOFIA will enable astronomical observations with unprecedented angular resolution at infrared wavelengths obscured from the ground. to help open this new chapter in the exploration of the infrared universe, we are building AIRES, an Airborne Infra-Red Echelle Spectrometer. AIRES will be operated as a first generation, general purpose facility instrument by USRA, NASA's prime contractor for SOFIA. AIRES is a long slit spectrograph operating from 17 - 210 microns. In high resolution mode the spectral resolving power is approx. 10(exp 6) microns/A or approx. 10(exp 4) at 100 microns. Unfortunately, since the conference, a low

resolution mode with resolving power about 100 times lower has been deleted due to budgetary constraints. AIRES includes a slit viewing camera which operates in broad bands at 18 and 25 microns.
Author
Airborne Equipment; High Resolution; Infrared Radiation; Infrared Spectra; Spectrographs

20000062720 Joint Inst. for Nuclear Research, Flerov Lab. of Nuclear Reactions, Dubna, USSR
Modelling of the new FLNR magnetic analyzer vacuum channel
Bashevoj, V. V.; Majdikov, V.; Dec. 31, 1998; 8p; In English
Report No.(s): DE99-607968; JINR-E-13-98-38; No Copyright; Avail: Department of Energy Information Bridge

The quality of any magnetic analyzer directly depends on the area of radial cross section of its volume filled with the ions trajectories. The conception of new magnetic spectrometer vacuum channel is based on computer modelling of the maximum filling of the spectrometer acceptance with given pole pieces width and the gap height of the magnetic dipole together with the maximum transmission of under reflected in magnetic field emission from the target at the angle of measurements. The correct correlation of the aperture of the vacuum channel with durability, engineering and ease of handling characteristics combined with ion-optical properties of the spectrometer determines its construction in the whole.
NTIS
Magnetic Fields; Vacuum; Analyzers

20000063471 NASA Lewis Research Center, Cleveland, OH USA
0.4 Microns Spatial Resolution with 1 GHz (lambda = 30 cm) Evanescent Microwave Probe
Tabib-Azar, M., Case Western Reserve Univ., USA; Su, D.-P., Case Western Reserve Univ., USA; Pohar, A., Case Western Reserve Univ., USA; LeClair, S. R., Air Force Research Lab., USA; Ponchak, George E., NASA Lewis Research Center, USA; Review of Scientific Instruments; March 1999; ISSN 0034-6748; Volume 70, No. 3, pp. 1725-1729; In English
Contract(s)/Grant(s): RTOP 632-6E-51; Copyright; Avail: Issuing Activity

In this article we describe evanescent field imaging of material nonuniformities with a record resolution of 0.4 microns at 1 GHz (lambda(sub g)/750000), using a resonant stripline scanning microwave probe. A chemically etched tip is used as a point-like evanescent field emitter and a probe-sample distance modulation is employed to improve the signal-to-noise ratio. Images obtained by evanescent microwave probe, by optical microscope, and by scanning tunneling microscope are presented for comparison. Probe was calibrated to perform quantitative conductivity measurements. The principal factors affecting the ultimate resolution of evanescent microwave probe are also discussed.
Author
Spatial Resolution; Imaging Techniques; Microwave Probes; Optical Microscopes

20000063502 NASA Langley Research Center, Hampton, VA USA
Three Averaging Techniques for Reduction of Antenna Temperature Variance Measured by a Dicke Mode, C-Band Radiometer
Mackenzie, Anne I., NASA Langley Research Center, USA; Lawrence, Roland W., NASA Langley Research Center, USA; May 2000; 36p; In English
Contract(s)/Grant(s): RTOP 258-70-21-06
Report No.(s): NASA/TM-2000-210283; L-17987; NAS 1.15:210283; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As new radiometer technologies provide the possibility of greatly improved spatial resolution, their performance must also be evaluated in terms of expected sensitivity and absolute accuracy. As aperture size increases, the sensitivity of a Dicke mode radiometer can be maintained or improved by application of any or all of three digital averaging techniques: antenna data averaging with a greater than 50% antenna duty cycle, reference data averaging, and gain averaging. An experimental, noise-injection, benchtop radiometer at C-band showed a 68.5% reduction in Delta(T) after all three averaging methods had been applied simultaneously. For any one antenna integration time, the optimum 34.8% reduction in Delta(T) was realized by using an 83.3% antenna/reference duty cycle.
Author
Average; Temperature Measurement; Brightness Temperature; Variance (Statistics); Microwave Radiometers

20000064076 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Interferometer Designs for the Terrestrial Planet Finder

Lawson, P. R., Jet Propulsion Lab., California Inst. of Tech., USA; Dumont, P. J., Jet Propulsion Lab., California Inst. of Tech., USA; Colavita, M. M., Jet Propulsion Lab., California Inst. of Tech., USA; Optical and IR Interferometry from Ground and Space; 1999, pp. 207-212; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Terrestrial Planet Finder (TPF) is a space-based infrared interferometer that will combine high sensitivity and spatial resolution to detect and characterize planetary systems within 15 pc of our sun. TPF is a key element in NASA's Origins Program and is currently under study in its Pre-Project Phase. We review some of the interferometer designs that have been considered for starlight nulling, with particular attention to the architecture and subsystems of the central beam-combiner.

Author

Infrared Interferometers; Infrared Detectors; Terrestrial Planets; Planetary Systems; Space Exploration

20000064529 Geological Survey, Denver, CO USA

Geometric Correction of AVIRIS Imagery Using On-Board Navigation and Engineering Data

Clark, Roger N., Geological Survey, USA; Livo, K. Eric, Geological Survey, USA; Kokaly, Raymond F., Geological Survey, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 57-65; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

From 1989 through 1997 the NASA Airborne Visible and Infrared Imaging Spectrometer (AVIRIS) has been flown on multiple flights on an ER-2 aircraft at approximately 20 km altitude. At the USGS, AVIRIS data have been used to make materials maps (e.g. see our web site http://speclab.cr.usgs.gov) but registration to a map base using classical control point registration methods with n-term polynomial or rubber sheeting image warping techniques has not fulfilled our expectations or needs, despite significant investment in people time. The Jet Propulsion Laboratory AVIRIS Data Facility delivers numerous engineering, aircraft state, and Global Positioning System (GPS) data sets that can be used to facilitate geometrical rectification of the imagery. Using the JPL data, combined with Digital Elevation Models (DEM), which can crudely, but adequately, be derived from atmospheric absorptions in the AVIRIS data, complete geometric correction appears possible. This paper derives the equations and compares the magnitudes of effects of the ER-2 plane motions on the AVIRIS imagery using example 1995 data over Arches National Park.

Derived from text

Data Processing; Geometric Accuracy; Geometric Rectification (Imagery); Image Processing

20000064534 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Quantum Efficient Detectors for Use in Absolute Calibration

Faust, Jessica, Jet Propulsion Lab., California Inst. of Tech., USA; Eastwood, Michael, Jet Propulsion Lab., California Inst. of Tech., USA; Pavri, Betina, Jet Propulsion Lab., California Inst. of Tech., USA; Raney, James, Jet Propulsion Lab., California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 97-103; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The trap or quantum efficient detector has a quantum efficiency of greater than 0.98 for the region from 450 to 900 nm. The region of flattest response is from 600 to 900 nm. The QED consists of three windowless Hamamatsu silicon detectors. The QED was mounted below AVIRIS to monitor the Spectralon panel for changes in radiance during radiometric calibration. The next step is to permanently mount the detector to AVIRIS and monitor the overall radiance of scenes along with calibration.

Author

Airborne Equipment; Calibrating; Infrared Spectrometers; Radiance; Radiometers; Ion Traps (Instrumentation); Radiation Detectors

20000064535 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Thermal Stability of the AVIRIS On-Board Calibrator

Faust, Jessica, Jet Propulsion Lab., California Inst. of Tech., USA; Eastwood, Michael, Jet Propulsion Lab., California Inst. of Tech., USA; Sarture, Chuck, Jet Propulsion Lab., California Inst. of Tech., USA; Williams, Orlesa, Jet Propulsion Lab., California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 105-110; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The AVIRIS On-Board Calibrator (OBC) provides essential data for refining the calibration of each AVIRIS data run. Annual improvement to the AVIRIS sensor and laboratory calibration accuracy has resulted in increasingly high demands on the stability of the OBC. Since the 1995 flight season, the OBC could track the stability of the spectrometer alignment to the 2% level, a significant improvement over previous years. The major contributor to this 2% stability was the conversion from a constant-current bulb power supply to an intensity-based active feedback power supply. Given the high sensor signal-to-noise ratio, improving the OBC

to track 1% or 0.5% changes was highly desirable. Achieving stability better than 2% required an examination of the mechanisms affecting stability.
Derived from text
Airborne Equipment; Calibrating; Thermal Stability; Infrared Spectrometers; Optical Filters

20000064545 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Inflight Validation of AVIRIS Calibration in 1996 and 1997
Green, Robert O., Jet Propulsion Lab., California Inst. of Tech., USA; Pavri, Betina, Jet Propulsion Lab., California Inst. of Tech., USA; Faust, Jessica, Jet Propulsion Lab., California Inst. of Tech., USA; Williams, Orlesa, Jet Propulsion Lab., California Inst. of Tech., USA; Chovit, Chris, Jet Propulsion Lab., California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 193-203; In English; See also 20000064520; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) measures spectral radiance in the solar reflected spectrum from 400 to 2500 nm. Spectra are measured through 224 spectral channels with nominally 10-nm sampling and 10-nm full width at half maximum (FWHM). From a NASA ER-2 aircraft flying at 20,000 m altitude, these spectra are acquired as images with an 11-km width by up to 800-km length. The spatial sampling is 17 m, and the instantaneous field of view (IFOV) 20 m. The objective of AVIRIS is to acquire calibrated spectra that are used to derive properties of the Earth's land, water, and atmosphere for scientific research and environmental applications. to achieve this objective, the AVIRIS spectra must be calibrated. The AVIRIS sensor is calibrated in the laboratory before and after each flight season, however, the spectra acquired by AVIRIS for science investigators are acquired in the Q-bay of the ER-2 at 20 km altitude. The objective of the AVIRIS inflight calibration experiment is to validate the calibration of AVIRIS spectral images in the low pressure, low temperature operating environment of the ER-2. Inflight calibration experiments have been orchestrated for AVIRIS in every year of flight operations.
Derived from text
Airborne Equipment; Calibrating; Imaging Spectrometers; Infrared Spectrometers; Radiance; Spectrum Analysis; Spectral Signatures

20000064546 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
On-Orbit Calibration of ADEOS OCTS with an AVIRIS Underflight
Green, Robert O., Jet Propulsion Lab., California Inst. of Tech., USA; Pavri, Betina, Jet Propulsion Lab., California Inst. of Tech., USA; Boardman, Joseph W., Jet Propulsion Lab., California Inst. of Tech., USA; Shimada, Masanobu, Jet Propulsion Lab., California Inst. of Tech., USA; Oaku, Hiromi, Jet Propulsion Lab., California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 205-212G; See also 20000064520; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Ocean Color Temperature Scanner (OCTS) onboard the Advanced Earth Observation Satellite (ADEOS) was launched on August 17, 1996. Calibration of OCTS is required for use of the on-orbit measured data for retrieval of physical properties of the ocean. In the solar reflected portion of the electromagnetic spectrum, OCTS measures images with nominally 700-m spatial resolution through eight multispectral bands. The objective of this research was to establish the absolute radiometric calibration of OCTS on orbit through an underflight by the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). AVIRIS is a NASA Earth-observing imaging spectrometer designed, built and operated by the Jet Propulsion Laboratory (JPL). AVIRIS acquires data from 20-km altitude on a NASA ER-2 aircraft, above most of the Earth's atmosphere. AVIRIS measures the solar reflected spectrum from 370 nm to 2500 nm through 224 contiguous spectral channels. The full width at half maximum (FWHM) of the spectral channels is nominally 10-nm. AVIRIS spectra are acquired as images of 11 km by up to 800 km extent with 20-m spatial resolution. The high spectral resolution of AVIRIS data allows direct convolution to the spectral response functions of the eight multispectral bands of OCTS. The high spatial resolution of AVIRIS data allows for spatial re-sampling of the data to match the ADEOS sensors spatial resolution. In addition, the AVIRIS high spatial resolution allows assessment of the scaling effects due to environmental factors of thin cirrus clouds, sub-pixel cloud cover, white caps, ocean foam, sun-glint, and bright-target adjacency. The platform navigation information recorded by AVIRIS allows calculation of the position and observation geometry of each spectrum for matching to the OCTS measurement. AVIRIS is rigorously characterized and calibrated in the laboratory prior to and following the flight season. The stability and repeatability of AVIRIS calibration have been validated through an extensive series of inflight calibration experiments. In the OCTS portion of the spectrum, using pre- and post-flight runway calibrations of AVIRIS coupled with the on-board calibrator an absolute calibration accuracy of better than 3% spectral, 2% radiometric, and 5% spatial, has been

achieved. An analogous satellite underflight calibration experiment was performed with AVIRIS and the Optical Sensor (OPS) onboard the Japanese Earth Resources Satellite (JERS).
Derived from text
Intercalibration; Imaging Spectrometers; Infrared Spectrometers; Ocean Color Scanner; Remote Sensors; Earth Observations (From Space)

20000064697 Texas Univ., William B. Hanson Center for Space Studies, Dallas, TX USA
Ion Mass Spectrometer for Sporadic-E Rocket Experiments
Heelis, R. A., Texas Univ., USA; Earle, G. D., Texas Univ., USA; Pfaff, Robert, NASA Goddard Space Flight Center, USA; [2000]; 13p; In English
Contract(s)/Grant(s): NAG5-5086
Report No.(s): UTD-FINS-630635; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA grant NAG5-5086 provided funding for the William B. Hanson Center for Space Sciences at the University of Texas at Dallas (UTD) to design, fabricate, calibrate, and ultimately fly two ion mass spectrometer instruments on a pair of sounding rocket payloads. Drs. R.A. Heelis and G.D. Earle from UTD were co-investigators on the project. The principal investigator for both rocket experiments was Dr. Robert Pfaff of the Goddard Space Flight Center. The overall project title was ”Rocket/Radar Investigation of Lower Ionospheric Electrodynamics Associated with Intense Mid-Latitude Sporadic-E Layers”. This report describes the overall objectives of the project, summarizes the instrument design and flight experiment details, and presents representative data obtained during the flights.
Derived from text
Mass Spectrometers; Fabrication; Aerospace Engineering; Sounding Rockets; Aerodynamics

20000065618 Institute for Human Factors TNO, Soesterberg, Netherlands
Evaluation of CCD Camera Systems for the Fennek Vehicle ***Final Report Evaluatie van CCD Camera’s Ten Behoeve van de Fennek***
Valeton, J. M., Institute for Human Factors TNO, Netherlands; Kooi, F. L., Institute for Human Factors TNO, Netherlands; Bijl, P., Institute for Human Factors TNO, Netherlands; Aug. 25, 1999; 40p; In Dutch
Contract(s)/Grant(s): A98/KL/317; TNO Proj. 786.1
Report No.(s): TD-99-0335; TM-99-A057; Copyright; Avail: Issuing Activity

The usefulness of a number of CCD camera systems for the German/Dutch Fennek observation pod has been explored in a field test. The observation capabilities (target detection, recognition, and identification) for stationary vehicles at a known, distant location were measured. Seven camera-display combinations have been directly compared to determine the effect of the following parameters: 1. type of camera (Fennek, RGB reference with contrast-stretching, i-Sight) 2. color versus back-and-white 3. field of view (2.5 deg: wide field-of-view, 0.9 deg: narrow field-of-view) 4. display size (9”, 14”). The observer task in the field experiment was target identification. The experimental design was such that recognition and ’detection’ performance could be obtained from the identification scores. NOTE: this ’detection’ performance concerns determining whether a target is present at a certain, known location, and is therefore different from the detection in a search task. Target search was not investigated in this study. The results indicate how the camera system presently used in the Fennek could be improved for target identification. The display size has no effect on the scores. The ’detection’, recognition, and identification scores with the RGB reference camera are 10% to 15% higher, due to the 20% better resolution and the contrast-stretching. The 2.7 times stronger tele-lens (narrow field-of-view) improves the scores by 20%. Color improves the recognition and identification of the vehicles by 7% to 10% but has no effect on detection. to summarize, of the four variables the field-of-view has the largest effect followed by resolution / stretching and color. Though these improvements in the scores cannot directly be converted to an improvement in acquisition range, the effects should be easily noticeable. Only a relatively small effect of color was found in this experiment because of the large distance (atmosphere effects), the limited color discrimination capability of the human eye for small objects, and the low color contrast of the targets (camouflage patterns). The color contrast stretching and the high resolution of the CCD cameras apparently are not enough to compensate for these effects. It is expected however, that color will have a much larger effect on performance for other tasks, such as visual search, and peace-keeping operations.
Author
Evaluation; CCD Cameras; Target Acquisition; Targets; Detection

20000067643 NASA Marshall Space Flight Center, Huntsville, AL USA

A Simple Approach for Calibrating Imaging Systems with a Solid-State Sensor

Leslie, Fred W., NASA Marshall Space Flight Center, USA; Cha, Soyoung S., Illinois Univ., USA; Ramachandran, Narayanan, Universities Space Research Association, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Solid-state array imaging has become an indispensable tool for various modem scientific instrumentation and industrial applications. Often in experiments, use of an imaging system with linear response is very desirable. The linearity of commercial products, however, has yet to be accurately determined in order to assess their nonlinearity effects. Linearity is affected both by sensors and electronics. It is also very desirables to employ low-cost products if we can provide the performance comparable of expensive ones through calibration. Here, we present a very simple approach for approximately checking linearity of imaging systems and also a simple calibration method for precisely measuring intensity ratio or relative intensity variation. These methods can be readily implemented with existing equipment. The calibration method works well with an intermediate-grade analog sensor interfaced by a frame grabber. In our initial attempt for calibration, the nonlinearity of the camera can be reduced from about five percent to much less than one percent in standard deviation.

Author

Calibrating; Imaging Techniques; Sensors; Solid State Devices; Linear Arrays

20000067653 NASA Marshall Space Flight Center, Huntsville, AL USA

The National Aeronautics and Space Administration's Gilmore Load Cell Machine: Load Cell Calibrations to 2.22 x 10(exp 7) Newtons

Haynes, Michael W., NASA Marshall Space Flight Center, USA; {1 March 2000]; 7p; In English, 16 Jul. 2000, Toronto, Canada; Sponsored by Standards Labs., Unknown; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Designed in 1964 and erected in 1966, the mission of the Gilmore Load Cell Machine was to provide highly accurate calibrations for large capacity load cells in support of NASA's Apollo Program. Still in use today, the Gilmore Machine is a national treasure with no equal.

Derived from text

Calibrating; Loads (Forces); Measuring Instruments

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LASERS AND MASERS

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

20000063487 Texas Technological Univ., Dept. of Electrical Engineering, Lubbock, TX USA

WDM Laser Sources for the Defense University (Testbed) Research Internet Program (DUTRIP) ***Final Report, 30 Sep. 1996 - 30 Sep. 1998***

Temkin, Henryk; Jan. 31, 1999; 53p; In English

Contract(s)/Grant(s): F49620-96-1-0476; AF Proj. 3484

Report No.(s): AD-A377085; TTU-1303-44-4608; AFRL-SR-BL-TR-00-0171; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

These specification were discussed with a number of vendors. Ortel Corporation was identified as a low cost supplier capable of satisfying all of the above specifications. Ortel Corporation fabricated and delivered 52 arrays of WDM lasers, each operating at four wavelengths, as specified above. We have established a testing methodology for these WDM arrays and conducted extensive test. The results are summarized in an attached paper, presented at the 1999 SPIE Photonics West in San Jose.

DTIC

Distributed Feedback Lasers; Wavelength Division Multiplexing

20000063488 Brown Univ., Providence, RI USA

Infra-Structure Support for the Laboratory for Lightwave Technology ***Final Report, 15 Mar. 1997 - 14 Mar. 1998***

Morse, T. F.; Mar. 14, 1998; 2p; In English

Contract(s)/Grant(s): F49620-97-1-0178; AF Proj. 2301

Report No.(s): AD-A377115; AFRL-SR-BL-TR-00-0172; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The instrumentation funding for the Laboratory of Lightwave Technology permitted a significant extension of our experimental capabilities. The largest single item was the Purchase of a Coherent FReD Laser.
DTIC
Lasers; Optical Measuring Instruments

20000064685 NASA Marshall Space Flight Center, Huntsville, AL USA
Performance Modeling of an Experimental Laser Propelled Lightcraft
Wang, Ten-See, NASA Marshall Space Flight Center, USA; Chen, Yen-Sen, Engineering Sciences, Inc., USA; Liu, Jiwen, Engineering Sciences, Inc., USA; Myrabo, Leik N., Rensselaer Polytechnic Inst., USA; Mead, Franklin B., Jr., Air Force Research Lab., USA; [2000]; 33p; In English; 31st; Plasmadynamics and Lasers, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A computational plasma aerodynamics model is developed to study the performance of an experimental laser propelled lightcraft. The computational methodology is based on a time-accurate, three-dimensional, finite-difference, chemically reacting, unstructured grid, pressure- based formulation. The underlying physics are added and tested systematically using a building-block approach. The physics modeled include non-equilibn'um thermodynamics, non-equilibrium air-plasma finite-rate kinetics, specular ray tracing, laser beam energy absorption and equi refraction by plasma, non-equilibrium plasma radiation, and plasma resonance. A series of transient computations are performed at several laser pulse energy levels and the simulated physics are discussed and compared with those of tests and literature. The predicted coupling coefficients for the lightcraft compared reasonably well with those of tests conducted on a pendulum apparatus.
Author
Computational Fluid Dynamics; Coupling Coefficients; Kinetics; Models; Lasers; Propeller Drive; Plasmas (Physics)

20000064721 City Univ. of New York, Research Foundation, NY USA
Optical Amplification and Nonlinear Optical Processes in Random Scattering Media
Alfano, R. R.; Liu, F.; Guo, Y.; Liu, C. H.; Ying, J.; Apr. 20, 2000; 7p; In English
Contract(s)/Grant(s): F49620-96-1-0004
Report No.(s): AD-A377025; CUNY-47361-00-01; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objective of the research program was to investigate nonlinear optical phenomena and optical amplification and lasing in highly scattering active and non-active random media. The aim of research was to develop a deeper fundamental understanding of light propagation in active random media for future generation of optical display, imaging techniques and laser devices. Two photon excited fluorescence and second harmonic generation tomographic imaging of biomedical tissues were demonstrated. Lasing and optical amplification from dyed active turbid media and biological tissues were explored. A feedback mechanism from scattering walls was proposed to describe lasing characteristics in random media. We have published 12 papers and submitted two patent applications.
DTIC
Nonlinear Optics; Lasers; Lasing; Optical Properties; Amplification; Light Scattering

20000064725 California Univ., Dept. of Electrical and Computer Engineering, Santa Barbara, CA USA
Low-Power VCSEL-Based Smart Pixels With Simplified Optics ***Final Report, 1 Aug. 1996-31 Mar. 2000***
Coldren, Larry A.; Mar. 31, 2000; 283p; In English
Contract(s)/Grant(s): F49620-96-1-0342; AF Proj. 2305
Report No.(s): AD-A377066; CU-ECE-00-06; AFRL-SR-BL-TR-00-0173; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

Over the last four years, vast improvements have been made in the area of VCSEL technology, moving them toward integration as smart pixels. VCSEL design such as tapered oxide apertures, mirror doping schemes, and improved active regions have benefited greatly during this time period. Finally, an easy to use graphical user interface and modeling program has been developed to estimate the optical scattering losses in oxide-defined VCSELs.
DTIC
Semiconductor Lasers; Surface Emitting Lasers

37
MECHANICAL ENGINEERING

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

20000064017 NASA Marshall Space Flight Center, Huntsville, AL USA

NASA Fastrac Engine Gas Generator Component Test Program and Results

Dennis, Henry J., Jr., NASA Marshall Space Flight Center, USA; Sanders, T., NASA Marshall Space Flight Center, USA; [2000]; 11p; In English; 36th; 36th Joint Propulsion Conference, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-3401; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Low cost access to space has been a long-time goal of the National Aeronautics and Space Administration (NASA). The Fastrac engine program was begun at NASA's Marshall Space Flight Center to develop a 60,000-pound (60K) thrust, liquid oxygen/hydrocarbon (LOX/RP), gas generator-cycle booster engine for a fraction of the cost of similar engines in existence. to achieve this goal, off-the-shelf components and readily available materials and processes would have to be used. This paper will present the Fastrac gas generator (GG) design and the component level hot-fire test program and results. The Fastrac GG is a simple, 4-piece design that uses well-defined materials and processes for fabrication. Thirty-seven component level hot-fire tests were conducted at MSFC's component test stand #116 (TS116) during 1997 and 1998. The GG was operated at all expected operating ranges of the Fastrac engine. Some minor design changes were required to successfully complete the test program as development issues arose during the testing. The test program data results and conclusions determined that the Fastrac GG design was well on the way to meeting the requirements of NASA's X-34 Pathfinder Program that chose the Fastrac engine as its main propulsion system.

Author

Gas Generators; NASA Programs; Engine Parts; Engine Tests; Engine Design; Oxygen-Hydrocarbon Rocket Engines

20000064612 NASA Glenn Research Center, Cleveland, OH USA

Object Based Numerical Zooming Between the NPSS Version 1 and a 1-Dimensional Meanline High Pressure Compressor Design Analysis Code

Follen, G., NASA Glenn Research Center, USA; Naiman, C., NASA Glenn Research Center, USA; auBuchon, M., Pratt and Whitney Aircraft, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Within NASA's High Performance Computing and Communication (HPCC) program, NASA Glenn Research Center is developing an environment for the analysis/design of propulsion systems for aircraft and space vehicles called the Numerical Propulsion System Simulation (NPSS). The NPSS focuses on the integration of multiple disciplines such as aerodynamics, structures, and heat transfer, along with the concept of numerical zooming between 0- Dimensional to 1-, 2-, and 3-dimensional component engine codes. The vision for NPSS is to create a "numerical test cell" enabling full engine simulations overnight on cost-effective computing platforms. Current "state-of-the-art" engine simulations are 0-dimensional in that there is there is no axial, radial or circumferential resolution within a given component (e.g. a compressor or turbine has no internal station designations). In these 0-dimensional cycle simulations the individual component performance characteristics typically come from a table look-up (map) with adjustments for off-design effects such as variable geometry, Reynolds effects, and clearances. Zooming one or more of the engine components to a higher order, physics-based analysis means a higher order code is executed and the results from this analysis are used to adjust the 0-dimensional component performance characteristics within the system simulation. by drawing on the results from more predictive, physics based higher order analysis codes, "cycle" simulations are refined to closely model and predict the complex physical processes inherent to engines. As part of the overall development of the NPSS, NASA and industry began the process of defining and implementing an object class structure that enables Numerical Zooming between the NPSS Version I (0-dimension) and higher order 1-, 2- and 3-dimensional analysis codes. The NPSS Version I preserves the historical cycle engineering practices but also extends these classical practices into the area of numerical zooming for use within a companies' design system. What follows here is a description of successfully zooming I-dimensional (row-by-row) high pressure compressor results back to a NPSS engine 0-dimension simulation and a discussion of the results illustrated using an advanced data visualization tool. This type of high fidelity system-level analysis, made possible by the zooming capability of the NPSS, will

greatly improve the fidelity of the engine system simulation and enable the engine system to be ”pre-validated” prior to commitment to engine hardware.
Author
Component Reliability; Design Analysis; Propulsion System Performance; Computerized Simulation

20000064613 NASA Langley Research Center, Hampton, VA USA
Optimization of Car Body under Constraints of Noise, Vibration, and Harshness (NVH), and Crash
Kodiyalam, Srinivas, Lockheed Martin Missiles and Space, USA; Yang, Ren-Jye, Ford Research Labs., USA; Sobieszczanski-Sobieski, Jaroslaw, Editor, NASA Ames Research Center, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

To be competitive on the today’s market, cars have to be as light as possible while meeting the Noise, Vibration, and Harshness (NVH) requirements and conforming to Government-man dated crash survival regulations. The latter are difficult to meet because they involve very compute-intensive, nonlinear analysis, e.g., the code RADIOSS capable of simulation of the dynamics, and the geometrical and material nonlinearities of a thin-walled car structure in crash, would require over 12 days of elapsed time for a single design of a 390K elastic degrees of freedom model, if executed on a single processor of the state-of-the-art SGI Origin2000 computer. of course, in optimization that crash analysis would have to be invoked many times. Needless to say, that has rendered such optimization intractable until now. The car finite element model is shown. The advent of computers that comprise large numbers of concurrently operating processors has created a new environment wherein the above optimization, and other engineering problems heretofore regarded as intractable may be solved. The procedure, shown, is a piecewise approximation based method and involves using a sensitivity based Taylor series approximation model for NVH and a polynomial response surface model for Crash. In that method the NVH constraints are evaluated using a finite element code (MSC/NASTRAN) that yields the constraint values and their derivatives with respect to design variables. The crash constraints are evaluated using the explicit code RADIOSS on the Origin 2000 operating on 256 processors simultaneously to generate data for a polynomial response surface in the design variable domain. The NVH constraints and their derivatives combined with the response surface for the crash constraints form an approximation to the system analysis (surrogate analysis) that enables a cycle of multidisciplinary optimization within move limits. In the inner loop, the NVH sensitivities are recomputed to update the NVH approximation model while keeping the Crash response surface constant. In every outer loop, the Crash response surface approximation is updated, including a gradual increase in the order of the response surface and the response surface extension in the direction of the search. In this optimization task, the NVH discipline has 30 design variables while the crash discipline has 20 design variables. A subset of these design variables (10) are common to both the NVH and crash disciplines. In order to construct a linear response surface for the Crash discipline constraints, a minimum of 21 design points would have to be analyzed using the RADIOSS code. On a single processor in Origin 2000 that amount of computing would require over 9 months! In this work, these runs were carried out concurrently on the Origin 2000 using multiple processors, ranging from 8 to 16, for each crash (RADIOSS) analysis. Another figure shows the wall time required for a single RADIOSS analysis using varying number of processors, as well as provides a comparison of 2 different common data placement procedures within the allotted memories for each analysis. The initial design is an infeasible design with NVH discipline Static Torsion constraint violations of over 10%. The final optimized design is a feasible design with a weight reduction of 15 kg compared to the initial design. This work demonstrates how advanced methodology for optimization combined with the technology of concurrent processing enables applications that until now were out of reach because of very long time-to-solution.
Author
Concurrent Processing; Design Analysis; Finite Element Method; Mathematical Models; Automobiles; Computerized Simulation; Crashes

20000064625 NASA Marshall Space Flight Center, Huntsville, AL USA
Towards Flange-to-Flange Turbopump Simulations for Liquid Rocket Engines
Kiris, Cetin, MCAT Inst., USA; Williams, Robert, NASA Marshall Space Flight Center, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The primary objective of this research is to support the design of liquid rocket systems for the Advanced Space Transportation System. Since the space launch systems in the near future are likely to rely on liquid rocket engines, increasing the efficiency and reliability of the engine components is an important task. One of the major problems in the liquid rocket engine is to understand fluid dynamics of fuel and oxidizer flows from the fuel tank to plume. Understanding the flow through the entire turbopump geometry through numerical simulation will be of significant value toward design. This will help to improve safety of future space missions. One of the milestones of this effort is to develop, apply and demonstrate the capability and accuracy of 3D CFD methods as efficient design analysis tools on high performance computer platforms. The development of the MPI and MLP versions of the INS3D code is currently underway. The serial version of INS3D code is a multidimensional incompressible Navier-Stokes

solver based on overset grid technology. INS3D-MPI is based on the explicit massage-passing interface across processors and is primarily suited for distributed memory systems. INS3D-MLP is based on multi-level parallel method and is suitable for distributed-shared memory systems. For the entire turbopump simulations, moving boundary capability and an efficient time-accurate integration methods are build in the flow solver. To handle the geometric complexity and moving boundary problems, overset grid scheme is incorporated with the solver that new connectivity data will be obtained at each time step. The Chimera overlapped grid scheme allows subdomains move relative to each other, and provides a great flexibility when the boundary movement creates large displacements. The performance of the two time integration schemes for time-accurate computations is investigated. For an unsteady flow which requires small physical time step, the pressure projection method was found to be computationally efficient since it does not require any subiterations procedure. It was observed that the artificial compressibility method requires a fast convergence scheme at each physical time step in order to satisfy incompressibility condition. This was obtained by using a GMRES-ILU(0) solver in our computations. When a line-relaxation scheme was used, the time accuracy was degraded and time-accurate computations became very expensive. The current geometry for the LOX boost turbopump has various rotating and stationary components, such as inducer, stators, kicker, hydrolic turbine, where the flow is extremely unsteady. Figure 1 shows the geometry and computed surface pressure of the inducer. The inducer and the hydrolic turbine rotate in different rotational speed.
Author
Computational Fluid Dynamics; Design Analysis; Grid Generation (Mathematics); Liquid Propellant Rocket Engines; Navier-Stokes Equation; Mathematical Models

20000064687 NASA Marshall Space Flight Center, Huntsville, AL USA
Microgravity Isolation Control System Design Via High-Order Sliding Mode Control
Shkolnikov, Ilya, Alabama Univ., USA; Shtessel, Yuri, Alabama Univ., USA; Whorton, Mark S., NASA Marshall Space Flight Center, USA; Jackson, Mark, NASA Marshall Space Flight Center, USA; [2000]; 11p; In English; American Control, 28-30 Jun. 2000, Chicago, IL, USA
Contract(s)/Grant(s): RTOP 398-96-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Vibration isolation control system design for a microgravity experiment mount is considered. The controller design based on dynamic sliding manifold (DSM) technique is proposed to attenuate the accelerations transmitted to an isolated experiment mount either from a vibrating base or directly generated by the experiment, as well as to stabilize the internal dynamics of this nonminimum phase plant. An auxiliary DSM is employed to maintain the high-order sliding mode on the primary sliding manifold in the presence of uncertain actuator dynamics of second order. The primary DSM is designed for the closed-loop system in sliding mode to be a filter with given characteristics with respect to the input external disturbances.
Author
Microgravity; Control Systems Design; Sliding; Vibration Isolators; Controllers

20000065643 Cornell Univ., Cornell Fracture Group, Ithaca, NY USA
Simulating Fatigue Crack Growth in Spiral Bevel Gears *Final Report*
Spievak, Lisa E., Cornell Univ., USA; Wawrzynek, Paul A., Cornell Univ., USA; Ingraffea, Anthony R., Cornell Univ., USA; May 2000; 126p; In English
Contract(s)/Grant(s): NAG3-1993; RTOP 581-30-13; DA Proj. 1L1-62211-A-47-A
Report No.(s): NASA/CR-2000-210062; E-12287; NAS 1.26:210062; ARL-CR-451; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The majority of helicopter transmission systems utilize spiral bevel gears to convert the horizontal power from the engine into vertical power for the rotor. Due to the cyclical loading on a gear's tooth, fatigue crack propagation can occur. In rotorcraft applications, a crack's trajectory determines whether the gear failure will be benign or catastrophic for the aircraft. As a result, the capability to predict crack growth in gears is significant. A spiral bevel gear's complex shape requires a three dimensional model of the geometry and cracks. The boundary element method in conjunction with linear elastic fracture mechanics theories is used to predict arbitrarily shaped three dimensional fatigue crack trajectories in a spiral bevel pinion under moving load conditions. The predictions are validated by comparison to experimental results. The sensitivity of the predictions to variations in loading conditions and crack growth rate model parameters is explored. Critical areas that must be understood in greater detail prior to predicting more accurate crack trajectories and crack growth rates in three dimensions are identified.
Author
Crack Propagation; Fatigue (Materials); Spiral Bevel Gears; Computerized Simulation; Mathematical Models; Rotary Wing Aircraft

20000067635 NASA Marshall Space Flight Center, Huntsville, AL USA

A Survey of Active Vibration Isolation Systems for Microgravity Applications

Grodsinsky, Carlos M., Bicron Corp., USA; Whorton, Mark S., NASA Marshall Space Flight Center, USA; [2000]; 45p; In English

Contract(s)/Grant(s): RTOP 398-96-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In view of the utility of space vehicles as orbiting science laboratories, the need for vibration isolation systems for acceleration sensitive experiments has gained increasing visibility. to date, three active microgravity vibration isolation systems have successfully been demonstrated in flight. This paper provides a tutorial discussion of the microgravity vibration isolation problem including a description of the acceleration environment of the International Space Station and attenuation requirements as well as a comparison of the dynamics of passive isolation, active rack-level isolation, and active payload-level isolation. This paper also surveys the flight test results of the three demonstrated systems: Suppression of Transient Accelerations by Levitation (STABLE); the Microgravity Vibration Isolation Mount (MIM); and the Active Rack Isolation System (ARIS).

Author

Isolation; Systems Engineering; Vibration Isolators; Microgravity

20000067649 Boeing Co., Rocketdyne Propulsion and Power, Canoga Park, CA USA

Laser Brazing of High Temperature Braze Alloy

Gao, Y. P., Boeing Co., USA; Seaman, R. F., Boeing Co., USA; McQuillan, T. J., Boeing Co., USA; Martiens, R. F., Boeing Co., USA; [2000]; 2p; In English, Apr. 2000, Chicago, IL, USA; Sponsored by American Welding Society, USA

Contract(s)/Grant(s): NAS8-45000; No Copyright; Avail: Issuing Activity; Abstract Only

The Space Shuttle Main Engine (SSME) consists of 1080 conical tubes, which are furnace brazed themselves, manifolds, and surrounding structural jacket making almost four miles of braze joints. Subsequent furnace braze cycles are performed due to localized braze voids between the coolant tubes. SSME nozzle experiences extremely high heat flux (180 mW/sq m) during hot fire. Braze voids between coolant tubes may result in hot combustion gas escape causing jacket bulges. The nozzle can be disqualified for flight or result in mission failure if the braze voids exceed the limits. Localized braze processes were considered to eliminate braze voids, however, damage to the parent materials often prohibited use of such process. Being the only manned flight reusable rocket engine, it has stringent requirement on the braze process. Poor braze quality or damage to the parent materials limits the nozzle service life. The objective of this study was to develop a laser brazing process to provide quality, localized braze joints without adverse affect on the parent materials. Gold (Au-Cu-Ni-Pd-Mn) based high temperature braze alloys were used in both powder and wire form. Thin section iron base superalloy A286 tube was used as substrate materials. Different Laser Systems including CO2 (10.6 micrometers, 1kW), ND:YAG (1.06 micrometers, 4kW). and direct diode laser (808nm. 150W) were investigated for brazing process. The laser process variables including wavelength. laser power, travel speed and angle of inclination were optimized according to bead geometry and braze alloy wetting at minimum heat input level, The properties of laser brazing were compared to that of furnace brazing. Microhardness profiles were used for braze joint property comparison between laser and furnace brazing. The cooling rate of laser brazing was compared to furnace brazing based on secondary dendritic arm spacing, Both optical and Scanning Electron Microscope (SEM) were used to evaluate the microstructures of the braze materials and tube substrate. Metallography of the laser braze joint was compared to the furnace braze. SEM Energy Disperse X-Ray Spectra (EDX) and back scattered imaging were used to analyze braze alloy segregation. Although all of the laser systems, CO2, ND:YAG, and direct diode laser produced good braze joint, the direct diode laser was selected for its system simplicity, compactness and portability. Excellent laser and braze alloy coupling is observed with powder alloy compared to braze alloy wire. Good wetting is found with different gold based braze alloys. The laser brazing process can be optimized so that the adverse affect on the parent materials can be eliminated. Metallography of the laser braze joint has shown that quality braze joint was produced with laser brazing process. Penetration of the laser braze to the substrate is at neglectable level. Zero penetration is observed. Microstructure examinations shown that no observable changes of the microstructure (grain structure and precipitation) in the HAZ area between laser braze and furnace braze. Wide gaps can be laser brazed with single pass for up to 0.024 inches. Finer dendritic structure is observed in laser brazing compared with equiaxial and coarser grain of the furnace brazing microstructure. Greater segregation is also found in the furnace braze. Higher hardness of the laser braze joint comparing to furnace braze is observed due to the fast cooling rate and Finer microstructure in the laser brazing. Laser braze joint properties meet or exceed the furnace joint properties. Direct diode laser for thin section tube brazing with high temperature braze alloys have been successfully demonstrated. The laser's high energy density and precise control has shown significant advantages in reducing process heat input to the substrates and provide high quality braze joints comparing to other localized braze process such as torch, TIG, and MPTA processes. Significant cost savings can be realized particularly with localized braze comparing to a full furnace braze cycle.

Author

Brazing; Heat Resistant Alloys; High Temperature; Furnaces; Semiconductor Lasers

20000067659 NASA Marshall Space Flight Center, Huntsville, AL USA

Pin Load Control Applied to Retractable Pin Tool Technology and its Characterization

Oelgoetz, Peter, Boeing Co., USA; [2000]; 17p; In English; AeroMat 2000, 28 Jun. 2000, Bellevue, WA, USA

Contract(s)/Grant(s): NASA Order H-31946-D; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Until the development of retractable pin tool (RPT) technology, friction stir welding (FSW) was limited to constant thickness joining of aluminum materials and the choices of keyhole elimination focused on traditional fusion and plug weld repair techniques. An invention, US Patent Number 5,893.507, ”Auto-Adjustable Pin Tool for Friction Stir Welding” assigned to NASA, demonstrated an approach to resolve these serious drawbacks. This approach brings forth a technique that allows the crater, or keyhole, to be closed out automatically at the end of the weld joint without adding any additional equipment or material. Also the probe length can be varied automatically in the weld joint to compensate for material thickness changes, such as, in a tapered joint. This paper reports the effects of pin extension and retraction rates in the weld joint and its correlation to weld quality. The investigation utilized a pin load-detecting device that was integrated in the Phase 2A RPT designed by Boeing for NASA/MSFC. The RPT modification provided pin load data that was accessed and used to eliminate root side indications and determine pin manipulation rates necessary to produce consistence homogeneous joints.

Author

Friction Welding; Welded Joints; Retractable Equipment; Pins

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QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, inspection, maintainability, and standardization.

20000065660 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

NDE and Advanced Actuators for Space Applications at JPL

Bar-Cohen, Yoseph, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 20p; In English, Jun. 1999, Japan; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Nondestructive Evaluation and Advanced Actuators (NDEAA) are presented. The focus areas are on mechanisms and devices that are driven by acoustic or elastic waves. The topics include: 1) Nondestructive Evaluation; 2) Advanced Actuators; 3) Ultrasonic Medical Diagnostics and Treatment; and 4) Telerobotics.

CASI

Actuators; Nondestructive Tests; Technology Utilization; Ultrasonics

39
STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structure. For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance.

20000063501 Ohio Aerospace Inst., Cleveland, OH USA

Cumulative Axial and Torsional Fatigue: An Investigation of Load-Type Sequencing Effects

Kalluri, Sreeramesh, Ohio Aerospace Inst., USA; Bonacuse, Peter J., Army Research Lab., USA; [2000]; 48p; In English; Multiaxial Fatigue and Deformation: Testing and Prediction, 19-20 May 1999, Seattle, WA, USA; Sponsored by American Society for Testing and Materials, USA

Contract(s)/Grant(s): RTOP 505-23-AM

Report No.(s): Paper 8013; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Cumulative fatigue behavior of a wrought cobalt-base superalloy, Haynes 188 was investigated at 538 C under various single-step sequences of axial and torsional loading conditions. Initially, fully-reversed, axial and torsional fatigue tests were conducted under strain control at 538 C on thin-walled tubular specimens to establish baseline fatigue life relationships. Subsequently, four sequences (axial/axial, torsional/torsional, axial/torsional, and torsional/axial) of two load-level fatigue tests were conducted to characterize both the load-order (high/low) and load-type sequencing effects. For the two load-level tests, summations of life fractions and the remaining fatigue lives at the second load-level were computed by the Miner’s Linear Damage Rule (LDR) and a nonlinear Damage Curve Approach (DCA). In general, for all four cases predictions by LDR were unconservative. Predictions

by the DCA were within a factor of two of the experimentally observed fatigue lives for a majority of the cumulative axial and torsional fatigue tests.
Author
Axial Loads; Sequencing; Torsion; Cobalt; Heat Resistant Alloys; Fatigue (Materials)

20000063504 Mississippi State Univ., Dept. of Mechanical Engineering, Mississippi State, MS USA
A Strip-Yield Model for Predicting the Growth of Part-Through Cracks Under Cyclic Loading
Daniewicz, S. R., Mississippi State Univ., USA; Jun. 22, 2000; 13p; In English
Contract(s)/Grant(s): NAG1-2003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Flaws exist in aircraft structures due to manufacturing operations and material defects. Under variable amplitude cyclic loading, these flaws grow as part-through cracks reducing the residual strength of structural components. To meet damage tolerant design requirements, accurate flaw growth predictions are needed which account for continual changes in crack shape as well as crack growth retardation and acceleration. Predicting the growth of part-through cracks under cyclic loading using an innovative and computationally efficient model is the focus of the research summarized in this report. In this research effort, a slice synthesis methodology was developed and used to construct a modified strip-yield model for the part-through semi-elliptical surface flaw, enabling prediction of plasticity-induced closure along the crack front and subsequent fatigue crack growth under constant amplitude and variable amplitude loading. While modeling the plasticity-induced closure in a part-through flaw may be performed using three dimensional elastic-plastic finite element analysis, this type of effort is impractical from an engineering perspective. A modified strip-yield model similar to that used in FASTRAN for part-through flaws is a much needed engineering design tool, particularly when computational resources are limited.
Derived from text
Procedures; Crack Arrest; Crack Propagation; Dimensional Analysis; Fatigue (Materials); Mathematical Models; Plastic Properties; Surface Defects

20000064588 Washington Univ., Dept. of Aeronautics and Astronautics, Seattle, WA USA
Efficient Nonlinear CFD-Based Aeroelastic Analysis for Multiple Load Cases in Preliminary Design
Knill, Duane, Washington Univ., USA; Bhatia, Kumar, Boeing Co., USA; Tamigniaux, Thierry, Boeing Co., USA; Yaghmaee, Sasan, Boeing Co., USA; Rausch, Russ, Boeing Co., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Predicting reliable aeroelastic loads information for the design of real subsonic transport airplanes is an expensive, time-consuming process of critical importance to the design effort as a whole. The importance of the aeroelastic loads process indicates that the most accurate nonlinear computational fluid dynamics (CFD) tools should be used. On the other hand, the computational expense of performing the numerous aerodynamic analyses that are required for loads analysis on complete aircraft configurations (wing, fuselage, strut/nacelle, empennage, control surfaces, vortex generators) operating under critical flight conditions has traditionally forced the use of wind tunnel corrected linear aerodynamic models instead of nonlinear CFD. The 3-Stage Aeroelastic Loads Process being developed at The Boeing Company is designed to recognize the importance of using accurate nonlinear CFD solutions while appreciating the facts that the aeroelastic loads process requires analysis of thousands of load cases and accurate nonlinear CFD analyses of real configurations are costly and time consuming. The Boeing 3-Stage Aeroelastic Loads Process uses detailed CFD models and their sensitivities with respect to shape variations of a base configuration to bridge the gap between linear loads methods and nonlinear CFD-based loads methods. The initial focus of this research is on the development and testing of a prototype 3-Stage Aeroelastic Loads Process. In this step, a simplified wing-fuselage-empennage configuration will be analyzed within a relatively coarse aeroelastic loads database. This will serve to lay the groundwork for developing the general procedure and evaluating the necessary tools for use in the next step, which will focus on the application of the 3-Stage Process in a realistic industry aircraft loads setting using a complete subsonic transport aircraft geometry. For the preliminary design analysis, the Boeing target is to complete a loads analysis within a multidisciplinary optimization environment in 2-3 days of flow time. Achieving this aggressive goal will require the use and advancement of high-performance parallel computing capabilities. In the development step of this research, Navier-Stokes solutions are obtained using the HiMAP/G03D solver. Studies have benchmarked the code's accuracy with respect to industry standards and parallel computing capabilities on large numbers of processors on the NAS/HPCCP Origin-2000 cluster. The goals of this work are to provide more accurate loads analysis for subsonic transports, thereby reducing uncertainty, allowing smaller margins, reducing required rework, and ultimately reducing cost. This research is being conducted in a realistic industry Structures and Loads environment, and is expected to make an impact on loads prediction throughout the aerospace industry. Additional information is contained in the original.
Author
Aerodynamic Loads; Aeroelasticity; Aircraft Configurations; Body-Wing Configurations; Computational Fluid Dynamics; Navier-Stokes Equation; Nonlinearity; Design Analysis

20000064621 Rensselaer Polytechnic Inst., Mechanical Engineering, Aeronautical Engineering and Mechanics, Troy, NY USA
Rule Extraction for Cellular Automata Based Computations in Elasticity
Hajela, Prabhat, Rensselaer Polytechnic Inst., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Problems of structural analysis and design have grown considerably in scope, a development motivated in part by the availability of an impressive array of new computational hardware. At the same time, however, there is an emerging awareness that existing methods of structural synthesis are ill-suited to the parallel architecture of new computers, and that radically different techniques, more naturally amenable to these machines, must be developed. The paper will focus on the role of decentralized, spatially-extended computing systems referred to as cellular automata, in problems of structural analysis and design. Cellular automata models are predicated on a logic that any system may be represented by a number of discrete particles or cells, and where the state of any particle is determined through interaction with the state of its immediate neighbors; the collective state of these particles is representative of the state of the system. When implemented on parallel machines the approach is expected to yield near-linear improvement in performance with an increase in the number of parallel processors. The central requirement for a successful implementation of this approach is to develop the appropriate rules for interaction among neighboring cell sites, which when invoked, evolve the state of the cells to desired acceptable solutions. The paper provides an overview of such rule extraction procedures that have been implemented in 2-D elasticity problems. These procedures use the genetic algorithm (GA) based global search method for rule discovery, and fall into two distinct categories. The first strategy assumes that the solution for a given problem is available as a close-form analytical solution or from a numerical approach such as the finite element method. Here, various forms of rules of interaction (with built-in degrees of freedom) can be assumed, and the appropriate form of the rule established through a GA based determination of the degrees of freedom. Sample results comparing an FEM generated solution and that obtained from rules of varying complexity within the CA based approach are shown. A second strategy does not assume the existence of a known solution; instead it uses well established global principles in elasticity (such as the energy principle) to determine the independent degrees of freedom in the assumed model of the rules of of interaction. Results of the strain distribution for an elastic beam loaded with a tip shear load are shown. Weighting coefficients and appropriate neighborhood for interaction were established using a GA based rule extraction scheme.
Author
Automata Theory; Genetic Algorithms; Parallel Processing (Computers); Structural Analysis; Parallel Programming

20000064688 Hawaii Univ., Dept. of Civil Engineering, Honolulu, HI USA
Stress Recovery and Error Estimation for 3-D Shell Structures *Final Report*
Riggs, H. R., Hawaii Univ., USA; [2000]; 5p; In English
Contract(s)/Grant(s): NAG1-1850; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The C1-continuous stress fields obtained from finite element analyses are in general lower- order accurate than are the corresponding displacement fields. Much effort has focussed on increasing their accuracy and/or their continuity, both for improved stress prediction and especially error estimation. A previous project developed a penalized, discrete least squares variational procedure that increases the accuracy and continuity of the stress field. The variational problem is solved by a post-processing, 'finite-element-type' analysis to recover a smooth, more accurate, C1-continuous stress field given the 'raw' finite element stresses. This analysis has been named the SEA/PDLS. The recovered stress field can be used in a posteriori error estimators, such as the Zienkiewicz-Zhu error estimator or equilibrium error estimators. The procedure was well-developed for the two-dimensional (plane) case involving low-order finite elements. It has been demonstrated that, if optimal finite element stresses are used for the post-processing, the recovered stress field is globally superconvergent. Extension of this work to three dimensional solids is straightforward. Attachment: Stress recovery and error estimation for shell structure (abstract only). A 4-node, shear-deformable flat shell element developed via explicit Kirchhoff constraints (abstract only). A novel four-node quadrilateral smoothing element for stress enhancement and error estimation (abstract only).
Derived from text
Three Dimensional Models; Shells (Structural Forms); Error Analysis; Stress Distribution; Statistical Analysis; Deformation

20000066616 Institute TNO of Applied Physics, Delft, Netherlands
Estimation of the Driving Point Mobility of Thick Plates and Deep Beams *Final Report*
deJong, C. A. F., Institute TNO of Applied Physics, Netherlands; Oct. 11, 1999; 80p; In English; Original contains color illustrations
Contract(s)/Grant(s): A97/KM/134; TNO Proj. 008.00654/01.01
Report No.(s): TD-98-0123; TPD-HAG-RPT-980157; Copyright; Avail: Issuing Activity

The driving point mobility matrix of a machinery seating structure determines how much structural acoustic power is transmitted by the force vector that is applied at each machine mount. In the current research programme analytical estimation procedures have been developed for the mobility components that have a more extended validity than those based upon the ”thin beam” or ”thin plate” assumption. These expressions are summarized, discussed and compared with the results of numerical integration of the equations of the two- or three-dimensional theory of elasticity. They are validated against experimental results. A good agreement has been found between predictions and the results of the validation experiments. ne estimation procedures have shown to be sufficiently accurate for preliminary design studies. The results of numerical integration show an excellent agreement with the experimental results, so this approach can be chosen confidently when more precise results are required, on the basis of a further developed design.
Author
Elastic Properties; Measure and Integration; Numerical Integration; Supports

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GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see categories 41 through 48.

20000062456 Forest Service, Pacific Northwest Research Station, Portland, OR USA
Guide to Ozone Injury in Vascular Plants of the Pacific Northwest
Bruce, S.; Peterson, D. L.; Bowers, D.; Sep. 1999; 76p; In English; Original contains color illustrations
Report No.(s): PB2000-105972; FSGTR-PNW-446; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This guide reports visual and descriptive documentation of ozone injury symptoms for common tree, shrub, and herbaceous species in the region. Symptoms observed in leaves of these species include chlorotic mottle, pigmented stipple, necrosis, and premature senescence, with considerable variation among and within species. Resource managers and scientists can use the photodocumentation in this guide to identify potential injury to plants in the field, and to distinguish ozone injury from other pathological conditions.
NTIS
Ozone; Pathology; Signs and Symptoms; Plants (Botany); Damage

20000062471 NASA Goddard Space Flight Center, Greenbelt, MD USA
Separation of Atmospheric and Surface Spectral Features in Mars Global Surveyor Thermal Emission Spectrometer (TES) Spectra
Smith, Michael D., NASA Goddard Space Flight Center, USA; Bandfield, Joshua L., Arizona State Univ., USA; Christensen, Philip R., Arizona State Univ., USA; [2000]; 32p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We present two algorithms for the separation of spectral features caused by atmospheric and surface components in Thermal Emission Spectrometer (TES) data. One algorithm uses radiative transfer and successive least squares fitting to find spectral shapes first for atmospheric dust, then for water-ice aerosols, and then, finally, for surface emissivity. A second independent algorithm uses a combination of factor analysis, target transformation, and deconvolution to simultaneously find dust, water ice, and surface emissivity spectral shapes. Both algorithms have been applied to TES spectra, and both find very similar atmospheric and surface spectral shapes. For TES spectra taken during aerobraking and science phasing periods in nadir-geometry these two algorithms give meaningful and usable surface emissivity spectra that can be used for mineralogical identification.
Author
Algorithms; Mars Global Surveyor; Spectra; Spectrometers; Thermal Emission; Surface Properties; Mars Atmosphere

20000064116 Minnesota Univ., Minneapolis, MN USA
Analytic Element Modeling of Coastal Aquifers ***Final Report, Sep. 1994 - Sep. 1997***
Bakker, M.; Kraemer, S. R.; deLange, W. J.; Strack, O. D. L.; Jan. 2000; 94p; In English
Report No.(s): PB2000-101970; EPA/600/R-99/110; No Copyright; Avail: National Technical Information Service (NTIS)
Four topics were studied concerning the modeling of groundwater flow in coastal aquifers with analytic elements: (1) practical experience was obtained by constructing a groundwater model of the shallow aquifers below the Delmarva Peninsula USA using the commercial program MVAEM; (2) a significant increase in performance was obtained by implementing the theory for variable density flow in a computer program that ran on a supercomputer using vectorization; (3) a new representation for the density variation was developed that can simulate the change from brackish to fresh water more accurately; and (4) it was shown

that for a specific example of a bell-shaped transition zone a Dupuit model gives accurate results unless the bell-shape is too narrow compared to the thickness of the aquifer.
NTIS
Aquifers; Hydrology Models; Water Flow

20000064520 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998, Volume 1, AVIRIS Workshop
Green, Robert O., Editor, Jet Propulsion Lab., California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; 442p; In English; Sponsored by Jet Propulsion Lab., California Inst. of Tech., USA; See also 20000064521 through 20000064578
Contract(s)/Grant(s): NAS7-1407
Report No.(s): JPL-Publ-97-21-Vol-1; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

This publication contains the summaries for the Seventh JPL Airborne Earth Science Workshop, held in Pasadena, California, on January 12-16, 1998. The main workshop is divided into three smaller workshops, and each workshop has a volume as follows: (1) Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) Workshop; (2) Airborne Synthetic Aperture Radar (AIRSAR) Workshop; and (3) Thermal Infrared Multispectral Scanner (TIMS) Workshop. This Volume 1 publication contains 58 papers taken from the AVIRIS workshop.
Derived from text
Airborne Equipment; Imaging Spectrometers; Infrared Imagery; Infrared Spectrometers; Conferences; Remote Sensing

20000064690 California Univ., Inst. for Computational Earth Systems Science, Santa Barbara, CA USA
Infrastructure for Training and Partnershipes: California Water and Coastal Ocean Resources *Final Report*
Siegel, David A., California Univ., USA; Dozier, Jeffrey, California Univ., USA; Gautier, Catherine, California Univ., USA; Davis, Frank, California Univ., USA; Dickey, Tommy, California Univ., USA; Dunne, Thomas, California Univ., USA; Frew, James, California Univ., USA; Keller, Arturo, California Univ., USA; MacIntyre, Sally, California Univ., USA; Melack, John, California Univ., USA; [2000]; 9p; In English
Contract(s)/Grant(s): NAG5-6478; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The purpose of this project was to advance the existing ICESS/Bren School computing infrastructure to allow scientists, students, and research trainees the opportunity to interact with environmental data and simulations in near-real time. Improvements made with the funding from this project have helped to strengthen the research efforts within both units, fostered graduate research training, and helped fortify partnerships with government and industry. With this funding, we were able to expand our computational environment in which computer resources, software, and data sets are shared by ICESS/Bren School faculty researchers in all areas of Earth system science. All of the graduate and undergraduate students associated with the Donald Bren School of Environmental Science and Management and the Institute for Computational Earth System Science have benefited from the infrastructure upgrades accomplished by this project. Additionally, the upgrades fostered a significant number of research projects (attached is a list of the projects that benefited from the upgrades). As originally proposed, funding for this project provided the following infrastructure upgrades: 1) a modem file management system capable of interoperating UNIX and NT file systems that can scale to 6.7 TB, 2) a Qualstar 40-slot tape library with two AIT tape drives and Legato Networker backup/archive software, 3) previously unavailable import/export capability for data sets on Zip, Jaz, DAT, 8mm, CD, and DLT media in addition to a 622Mb/s Internet 2 connection, 4) network switches capable of 100 Mbps to 128 desktop workstations, 5) Portable Batch System (PBS) computational task scheduler, and vi) two Compaq/Digital Alpha XP1000 compute servers each with 1.5 GB of RAM along with an SGI Origin 2000 (purchased partially using funds from this project along with funding from various other sources) to be used for very large computations, as required for simulation of mesoscale meteorology or climate.
Author
Computers; Earth Sciences; Education; Environment Simulation; International Trade; Management Systems; Mesometeorology; Research; Simulation; Water Resources

20000064728 Naval Air Weapons Station, China Lake, CA USA
Coso Monitoring Program, October 1998 Through September 1999 *Final Report, Oct. 1998-ct. 1998-*
Lager, S. D.; Johnson, B. R.; Feb. 2000; 62p; In English
Report No.(s): AD-A377092; NAWS-CL-TP-012; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Coso Monitoring Program is a continuing effort in support of the Navy's geothermal resources within the Coso Known Geothermal Resource Area (Coso KGRA). A substantial body of reports has been established on this project (16 technical publica-

tions) and the project is essentially the same year to year, therefore much of the text of each report reiterates previously published information.
DTIC
Geothermal Resources; Environmental Monitoring

43
EARTH RESOURCES AND REMOTE SENSING

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

20000062017 Woods Hole Research Center, MA USA
Predicting Fire Susceptibility in the Forests of Amazonia*, 1 Feb. 1997 - 31 Jan. 2000*
Nepstad, Daniel C., Woods Hole Research Center, USA; Brown, I. Foster, Woods Hole Research Center, USA; Setzer, Alberto, Instituto Nacional de Pesquisas Espacias, Brazil; Jun. 01, 2000; 8p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG5-3934; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Although fire is the single greatest threat to the ecological integrity of Amazon forests, our ability to predict the occurrence of Amazon forest fires is rudimentary. Part of the difficulty encountered in making such predictions is the remarkable capacity of Amazon forests to tolerate drought by tapping moisture stored in deep soil. These forests can avoid drought-induced leaf shedding by withdrawing moisture to depths of 8 meters and more. Hence, the absorption of deep soil moisture allows these forests to maintain their leaf canopies following droughts of several months duration, thereby maintaining the deep shade and high relative humidity of the forest interior that prevents these ecosystems from burning. But the drought- and fire-avoidance that is conferred by this deep-rooting phenomenon is not unlimited. During successive years of drought, such as those provoked by El Nino episodes, deep soil moisture can be depleted, and drought-induced leaf shedding begins. The goal of this project was to incorporate this knowledge of Amazon forest fire ecology into a predictive model of forest flammability.
Author
Amazon Region (South America); Combustion; Drought; Flammability; Forest Fires; Predictions

20000062304 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Estimating Vegetation Parameters from Interferometric and Polarimetric Radar Using Physical Scattering Models
Treuhaft, Robert N., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Radar data from vegetated land surfaces depend on many structural and compositional parameters describing the terrain. Because early, noninterferometric radar systems usually constituted an insufficient observation set from which to estimate parameters of the terrain, statistical regression techniques were used which incorporated some level of apriori knowledge or field measurements. With the advent of radar interferometry and polarimetric interferometry, potentially at multiple baselines, the observation set is now approaching that required to quantitatively estimate the parameters describing a vegetated land surface. Quantitative estimation entails formulating a physical scattering model relating the radar observations to the vegetation and surface parameters on which they depend. This paper describes the physics of candidate scattering models, and shows how the models determine the estimable parameter set. It also indicates the measurement accuracy of parameters such as vegetation height, height-to-base-of-live-crown, and surface topography with multibaseline polarimetric interferometry.
Author
Accuracy; Estimating; Interferometry; Observation; Vegetation; Terrain

20000062310 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Global Boreal Forest Mapping with JERS-1: North America
Williams, Cynthia L., Alaska Synthetic Aperature Radar Facility, USA; McDonald, Kyle, Jet Propulsion Lab., California Inst. of Tech., USA; Chapman, Bruce, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 3p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Collaborative effort is underway to map boreal forests worldwide using L-band, single polarization Synthetic Aperture Radar (SAR) imagery from the Japanese Earth Resources (JERS-1) satellite. Final products of the North American Boreal Forest Mapping Project will include two continental scale radar mosaics and supplementary multitemporal mosaics for Alaska, central Canada, and eastern Canada. For selected sites, we are also producing local scale (100 km x 100 km) and regional scale maps (1000

km x 1000 km). As with the nearly completed Amazon component of the Global Rain Forest Mapping project, SAR imagery, radar image mosaics and SAR-derived texture image products will be available to the scientific community on the World Wide Web. Image acquisition for this project has been completed and processing and image interpretation is underway at the Alaska SAR Facility.
Author
Image Processing; Thematic Mapping; Rain Forests; Radar Imagery; North America

20000062933 Nature Conservancy, Arlington, VA USA
The Gulf Coastal Plain Ecosystem Partnership: Development of Conservation Strategies and Projects ***Final Report, 5 May 1998 - 4 May 2000***
Compton, Vernon; May 2000; 274p; In English
Contract(s)/Grant(s): DAMD17-98-2-8015
Report No.(s): AD-A377316; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

The Gulf Coastal Plain Ecosystem Partnership (GCPEP) is a unique collaboration among Eglin AFB, The Nature Conservancy (TNC), Champion International Corporation, Blackwater River State Forest, Northwest Florida Water Management District and National Forests in Alabama and Florida, who cooperate under the auspices of a 1996 multi party Memorandum of Understanding. The partners manage more than 840,000 acres in one of the most important conservation landscapes in the Southeast. of the 115 species of plants and animals and 29% natural communities identified by TNC as being targets for conservation action in the 42 million acre Eastern Gulf Coastal Plain ecoregion, 37% of species and 38% of natural communities occur on GCPEP lands, despite GCPEP being only 2% of the ecoregional land area. The GCPEP has undertaken a joint planning process, including identifying site conservation targets and assessing the stresses and sources of stress. Eighteen total conservation targets were identified, ranging from single species (e.g., red-cockaded woodpeckers) to large, matrix-forming ecosystem types, (e.g., longleaf pine matrix). Major threats to targets include residential development, incompatible fire, forestry and agricultural practices, unstable management funding and roads/utility corridors. Cooperative conservation strategies were developed in the project's second phase.
DTIC
Gulfs; Coastal Ecology; Ecosystems

20000064524 Colorado Univ., Cooperative Inst. for Research in Environmental Sciences, Boulder, CO USA
Sources of Variability in Plant Canopy Hyperspectral Data in a Savanna Ecosystem
Asner, Gregory P., Colorado Univ., USA; Wessman, Carol A., Colorado Univ., USA; Bateson, C. Ann, Colorado Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 23-31; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The relative importance of the plant structural, biophysical, and biochemical attributes of vegetation that determine a hyperspectral reflectance signal have not been well quantified. Vegetation reflectance is primarily a function of tissue optical properties (leaf, woody stem, standing litter), canopy structural attributes (e.g. leaf and stem area), soil reflectance, illumination conditions, and viewing geometry. Foliage and non-photosynthetic vegetation (NPV) affect the radiation field through their reflectance and transmittance characteristics. Leaf optical properties are a function of leaf structure, water content, and the concentration of biochemicals (e.g. lignin, cellulose, nitrogen). However, several studies have demonstrated that leaf-level variability in carbon and nitrogen chemistry plays a small role in determining canopy reflectance characteristics in comparison to leaf water content and leaf area index (LAI). In this paper, we use a combination of field and modeling techniques to quantify the relative contribution of leaf, stem, and litter optical properties, and canopy and landscape structural attributes, to the hyperspectral reflectance characteristics of a spatially complex savanna ecosystem. In contrast to recent studies focused on scaling within-leaf biochemical characteristics to leaf and canopy scales, this study approaches the scaling problem from the observed variability in tissue optical properties, then examines the importance of this tissue-level variability in comparison to canopy structural variability at landscape scales using a plant canopy radiative transfer model.
Derived from text
Spectrum Analysis; Canopies (Vegetation); Leaf Area Index; Optical Properties; Mathematical Models; Remote Sensing

20000064525 Brazil Univ., Inst. of Geosciences, Rio de Janeiro, Brazil

Use of AVIRIS Data for Mineralogical Mapping in Tropical Soils, in the District of Sao Joao D'Alianca, Goias

deMello Baptista, Gustavo Macedo, Brazil Univ., Brazil; deSouza Martins, Eder, Brazil Univ., Brazil; deCarvalho, Osmar Abilio, Jr., Brazil Univ., Brazil; Meneses, Paulo Roberto, Brazil Univ., Brazil; daSilva Madeira Netto, Jose, Centro de Pesquisas Agropecuaria dos Cerrados, Brazil; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 33-42; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Soil cartography in Central Brazil is available only in large scales. The increased agriculture pressure over these lands require basic soil knowledge obtainable in more detailed surveys. Data collected by hyperspectral sensors may represent a valuable source of information for soil scientists, mainly in the distinction of mineralogical classes. Previous studies have shown the possibility of using indices developed from high-resolution diffuse reflectance spectra obtained in laboratory to estimate hematite content, and the Ki ratio (molecular ratio of SiO, and Al2O3). In this work we use AVIRIS data to verify the possibilities offered by hyperspectral data to differentiate tropical soils mineralogy. AVIRIS data from Sao Joao D'Alianca district, Goias state (950816L2 scene 3) after atmospheric correction and reflectance transformation were used. Field work was conducted to sample the main soil units. The location of the sampled points was obtained with a GPS, which allowed the precise plotting in the image. Samples were air-dried and sieved to 2 mm before being used for laboratory determination of 400 to 2500 nm spectral reflectance. X ray diffractions of these samples were also obtained. Most of the scenes considered were covered by crop residues, pasture and native Cerrado vegetation with only a few hundred hectares of bare soils. The bare soil areas were considered in this work. Kaolinite, goethite and quartz were present in all samples. Gibbsite and hematite were also present in some sampled soils. Features attributable to kaolinite, gibbsite, hematite and goethite were clearly detected in the spectra obtained in the laboratory and in the AVIRIS data. The occurrence of these minerals was confirmed by the X-ray diffraction data.
Derived from text

Minerals; Soil Mapping; Iron Oxides; Remote Sensing; Spectrum Analysis

20000064526 Colorado Univ., Cooperative Inst. for Research in Environmental Sciences, Boulder, CO USA

Incorporating Endmember Variability into Spectral Mixture Analysis Through Endmember Bundles

Bateson, C. Ann, Colorado Univ., USA; Asner, Gregory P., Colorado Univ., USA; Wessman, Carol A., Colorado Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 43-52; In English; See also 20000064520
Contract(s)/Grant(s): NAGw-4689; NAGw-2662; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Variation in canopy structure and biochemistry induces a concomitant variation in the top-of-canopy spectral reflectance of a vegetation type. Hence, the use of a single endmember spectrum to track the fractional abundance of a given vegetation cover in a hyperspectral image may result in fractions with considerable error. One solution to the problem of endmember variability is to increase the number of endmembers used in a spectral mixture analysis of the image. For example, there could be several tree endmembers in the analysis because of differences in leaf area index (LAI) and multiple scatterings between leaves and stems. However, it is often difficult in terms of computer or human interaction time to select more than six or seven endmembers and any non-removable noise, as well as the number of uncorrelated bands in the image, limits the number of endmembers that can be discriminated. Moreover, as endmembers proliferate, their interpretation becomes increasingly difficult and often applications simply need the aerial fractions of a few land cover components which comprise most of the scene. In order to incorporate endmember variability into spectral mixture analysis, we propose representing a landscape component type not with one endmember spectrum but with a set or bundle of spectra, each of which is feasible as the spectrum of an instance of the component (e.g., in the case of a tree component, each spectrum could reasonably be the spectral reflectance of a tree canopy). These endmember bundles can be used with nonlinear optimization algorithms to find upper and lower bounds on endmember fractions. This approach to endmember variability naturally evolved from previous work in deriving endmembers from the data itself by fitting a triangle, tetrahedron or, more generally, a simplex to the data cloud reduced in dimension by a principal component analysis. Conceptually, endmember variability could make it difficult to find a simplex that both surrounds the data cloud and has vertices that are realistic endmember spectra with reflectances between 0 and 1. In this paper, we create endmember bundles and bounding fraction images for an AVIRIS subscene simulated with a plant canopy radiative transfer model. The simulated subscene is spatially patterned after a subscene from the AVIRIS image acquired August, 1993 over La Copita, Texas. In addition, for comparison, we performed a traditional unmixing with image endmembers.
Derived from text

Spectral Reflectance; Spectrum Analysis; Principal Components Analysis; Remote Sensing; Canopies (Vegetation); Mathematical Models

20000064527 Analytical Imaging and Geophysics, LLC, Boulder, CO USA

Post-ATREM Polishing of AVIRIS Apparent Reflectance Data Using EFFORT: A Lesson in Accuracy Versus Precision

Boardman, Joseph W., Analytical Imaging and Geophysics, LLC, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 53; In English; See also 20000064520; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Since the focal plane refit before the 1995 flight season, AVIRIS has consistently produced calibrated spectral radiance data of extremely high precision. This high precision has not translated directly into high accuracy in the spectral radiance data or in the apparent surface reflectance spectra derived from them. The reason for this is the limited accuracy of the combined chain of absolute standards, calibrations, models and measurements that connect the high precision raw DN to the final output of relatively low accuracy apparent surface reflectance. Sources of error including: errors in the NIST standard bulbs; spectral and radiometric calibration uncertainty; in-flight system changes; solar irradiance model errors, inaccuracy in atmospheric parameter estimation; and radiative transfer code errors combine to limit the accuracy of the final apparent reflectance data to no better than several percent. Filtered by this relatively inaccurate signal processing chain, the very high precision (1 part in thousands) of the new AVIRIS data is under-utilized. It is like a very high quality rifle in the hands of a near-sighted marksman, lots of precision but limited accuracy. We have developed a process, EFFORT (the Empirical Flat Field Optimal Reflectance Transformation), to bootstrap a linear adjustment to the data to recover accuracy that matches the precision. It has its roots in the Empirical Line method, often used to reduce data from uncalibrated sensors using field measured spectra. However, in our application we use no ground data, and only apply the empirical gains and offsets after a theoretical data reduction has been done using the ATREM radiative transfer code. EFFORT asks a simple question, ”Is there a mild linear transformation, a gain near unity and an offset near zero for each channel, that will make the spectra look more like real material spectra?”. Since 1995, we have found that such a mild correction does exist and the application of these statistically insignificant adjustments, well within the error budget to the data calibration and reduction process, makes a profound improvement in the AVIRIS apparent reflectance spectra. It is like a guiding hand, gently steering our near-sighted marksman back to the bull’s-eye. After EFFORT adjustment, comparison to library-based spectra is much improved. We believe that high quality imaging spectrometers will for ever more have precision that exceeds the accuracy of the atmospheric models needed to reduce them to reflectance. Thus, EFFORT seems sure to play a role in future applications requiring cutting-edge spectral fidelity.

Derived from text

Data Reduction; Emission Spectra; Spectral Reflectance; Precision; Accuracy; Transformations (Mathematics); Data Processing

20000064528 Analytical Imaging and Geophysics, LLC, Boulder, CO USA

Leveraging the High Dimensionality fo AVIRIS Data for Improved Sub-Pixel Target Unmixing and Rejection of False Positives: Mixture Tuned Matched Filtering

Boardman, Joseph W., Analytical Imaging and Geophysics, LLC, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 55; In English; See also 20000064520; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Much headway has been made by the direct application of the well-known signal processing technique of Matched Filtering to imaging spectrometry studies, especially applications involving detection and mapping of sub-pixel targets. The Matched Filter technique has long been used by electrical engineers for the detection of known signals in mixed backgrounds, especially in radio and radar applications. Its popularity derives from the proof that it is the optimal linear detector in such situations, maximizing the suppression of the background while simultaneously maximizing the target-to-background contrast. These dual properties make it appear to be the optimal detection method. However, in our case, the remote sensing mixed pixel case, it is most certainly not optimal. The underlying assumption of the ”proof” used in radio and radar applications is one of unbounded superposition. Adding target signature in this case boosts the signal and one ”hears” or ”sees” the linear sum of the background and the target. This addition is wholly unbounded. In the imaging spectrometry case we have an undeniable and physically-meaningful bound on the signal: every pixel is only 100% full. As we add target material to a pixel it covers up some background, satisfying the unit-sum constraint. It does not add ”area” to the pixel, as an additive radio signal adds ”power” to its mixture. This simple but fundamental difference can be exploited to give an algorithm that then appears to have ”super-optimal” performance, and shows the risk in a blanket application to remote sensing of techniques developed under different physical models and assumptions. We use these difference to our advantage in a technique called Mixture Tuned Matched Filtering (MTMF). MTMF combines the best parts of the Linear Spectral Mixing model and the statistical Matched Filter model while avoiding the drawbacks of each parent method. From Matched Filtering it inherits the advantage of its ability to map a single known target without knowing the other background endmember signatures, unlike traditional Spectra Mixture modeling. From Spectral Mixture modeling it inherits the leverage arising from the mixed pixel model, the constraints on feasibility including the unit-sum and positivity requirements,

unlike the Matched Filter which does not employ these fundamental facts. As a result MTMF can outperform either method, especially in cases of subtle, sub-pixel occurrences. In fact, using MTMF we have found a previously undetected, and very subtle, occurrence of ammonium minerals at the heavily studied site of Cuprite, Nevada! The MTMF method leverages the high dimensionality of AVIRIS data, using the high dimensional space to its advantage, to greatly increase detectability and selectivity. It routinely demonstrates single 3% to 5% abundance sub-pixel occurrences along with outstanding false-positive rejection and target selectivity. Question proofs of optimality.
Derived from text
Matched Filters; Signal Processing; Image Processing; Mathematical Models; Optimization; Remote Sensing; Algorithms; Spectrum Analysis

20000064530 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Mineral Mapping with Imaging Spectroscopy: The Ray Mine, AZ
Clark, Roger N., Geological Survey, USA; Vance, J. Sam, Environmental Protection Agency, USA; Livo, K. Eric, Geological Survey, USA; Green, Robert O., Jet Propulsion Lab., California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 67-75; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Mineral maps generated for the Ray Mine, Arizona were analyzed to determine if imaging spectroscopy can provide accurate information for environmental management of active and abandoned mine regions. The Ray Mine, owned by the ASARCO Corporation, covers an area of 5700 acres and is situated in Pinal County, Arizona about 70 miles north of Tucson near Hayden, Arizona. This open-pit mine has been a major source of copper since 1911, producing an estimated 4.5 million tons of copper since its inception. Until 1955 mining was accomplished by underground block caving and shrinkage stope methods. (excavation by working in stepped series usually employed in a vertical or steeply inclined orebody) In 1955, the mine was completely converted to open pit method mining with the bulk of the production from sulfide ore using recovery by concentrating and smelting. Beginning in 1969 a significant production contribution has been from the leaching and solvent extraction-electrowinnowing method of silicate and oxide ores. Published reserves in the deposit as of 1992 are 1.1 billion tons at 0.6 percent copper. The Environmental Protection Agency, in conjunction with ASARCO, and NASA/JPL obtained AVIRIS data over the mine in 1997 as part of the EPA Advanced Measurement Initiative (AMI) (Tom Mace, Principal Investigator). This AVIRIS data set is being used to compare and contrast the accuracy and environmental monitoring capabilities of remote sensing technologies: visible-near-IR imaging spectroscopy, multispectral visible and, near-IR sensors, thermal instruments, and radar platforms. The goal of this effort is to determine if these various technologies provide useful information for envirorunental management of active and abandoned mine sites in the arid western USA. This paper focuses on the analysis of AVIRIS data for assessing the impact of the Ray Mine on Mineral Creek. Mineral Creek flows to the Gila River. This paper discusses our preliminary AVIRIS mineral mapping and environmental findings.
Derived from text
Infrared Imagery; Infrared Spectrometers; Mineral Deposits; Remote Sensing; Thematic Mapping; Infrared Spectroscopy; Mines (Excavations); Mineral Exploration

20000064532 Geological Survey, Denver, CO USA
Mapping of Acid-Generating and Acid-Buffering Minerals in the Animas Watershed by AVIRIS Spectroscopy
Dalton, J. Brad, Geological Survey, USA; King, Trude V. V., Geological Survey, USA; Bove, Dana J., Geological Survey, USA; Kokaly, Raymond, F., Geological Survey, USA; Clark, Roger N., Geological Survey, USA; Vance, J. Sam, Geological Survey, USA; Swayze, Gregg A., Geological Survey, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 79-83; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Animas River Watershed is the site of a coordinated effort to characterize the extent and severity of environmental effects from acid water drainage. This water originates both from numerous abandoned mine sites that date as far back as the late 1800s, and from extensive areas of natural altered and mineralized outcrops. The headwaters of the Animas River are within the San Juan and Silverton calderas, which were responsible for creating large fractures and faults suitable for later mineralization. As part of the Abandoned Mine Lands (AML) Project of the USA Geological Survey (USGS), data were obtained over the San Juan Mountains and Animas Watershed using the Jet Propulsion Laboratory's Airborne Visible and InfraRed Imaging Spectrometer (AVIRIS) and are being used in conjunction with field geologic mapping, geochemistry and geophysics to determine the relative extent of natural and anthropogenic sources of acid water runoff, and its effect on water quality in the drainage.
Derived from text
Infrared Imagery; Environment Effects; Thematic Mapping; Mineral Deposits; Remote Sensing; Watersheds; Water Runoff

20000064533 Austin State Univ., Dept. of Geology, Nacogdoches, TX USA

X-Ray Diffraction Verification of AVIRIS Clay Mineral Identification, Summitville Ares, Soutwestern Colorado

Duncan, W. S., Austin State Univ., USA; Ledger, E. B., Austin State Univ., USA; Whitehead, V. S., Austin State Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 85-95; In English; See also 20000064520; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The eastern San Juan Mountains of southwestern Colorado are the site of mid- and late-Tertiary volcanic activity. The volcanic activity had two effects on the state of Colorado. Some of the eruptions were extremely large, and magmas formed thick geologic rock units that contributed to the scenic nature of the area. The other effect was that magmas brought precious metals to the earth's near surface that could be exploited by mining. In the last ten or twenty million years after most of the activity ended, the volcanic bedrock underwent extensive erosion due to the high relief, and chemical weathering of the volcanic rock produced clay minerals in the soil. The original mineralization also emplaced sulfide minerals (mostly non-ore minerals called gangue) that reacted to form very acidic conditions due to sulfide-to-sulfate reactions. The clay minerals that form in such an environment depend on time (duration) of chemical reactions forming the clays, the parent volcanic rock composition and texture, and the present weathering conditions, including pH. Clay minerals are natural aluminosilicates that form at the earth's surface in response to chemical alteration of higher temperature minerals such as feldspars and mica. Feldspars and mica are K, Na, and Ca aluminosilicates that can form from magmas. They do not form at ambient temperatures, but rather alter to clay. Analysis of clay minerals is not easy, because they are layer aluminosilicates that can change their structures (d-spacings) in response to their chemical environment, sometimes in a matter of seconds. Standard techniques have been developed over the last eighty or so years to identify various clay minerals using X-ray diffraction (XRD). Even with diagnostic chemical preparation in the controlled environment of the laboratory, clay minerals sometimes require elaborate means to get an unambiguous identification using XRD. A non-laboratory method of clay mineral identification is claimed by a group at the USA Geological Survey (USGS) that uses analysis of visible and near-infrared (NIR) spectra reflected from the ground, and detected from an airplane flying over the area of interest. The purpose of this study is to analyze by traditional means claims regarding clay mineral identification using the AVIRIS system. A specific study of clay mineral interpretations was conducted on an image of the Summitville mine site in southwestern Colorado. This study centers on verifying clay mineral identifications made by Clark et al. (1995). Most clay mineral structures were originally determined in the 1930s using XRD. This method was developed and applied to minerals by Nobel laureate Linus Pauling. We used XRD to analyze the mineral constituents in the area interpreted by Clark et al. (1995). The characterization of clay minerals as distinct crystalline materials as opposed to amorphous material was not proven until XRD was used to verify this in the 1930s. Since then XRD has remained the standard method of clay mineral identification. The objective of this study was to use XRD to attempt to verify a new method, imaging spectroscopy.

Derived from text

Clays; Mineral Deposits; Mineral Exploration; Remote Sensing; X Ray Diffraction; Infrared Spectroscopy

20000064536 California State Univ., Dept. of Biology and Microbiology, Los Angeles, CA USA

A Multi-Scale Sampling Strategy for Detecting Physiologically Significant Signals in AVIRIS Imagery

Gamon, John A., California State Univ., USA; Lee, Lai-Fun, California State Univ., USA; Qiu, Hong-Lie, California State Univ., USA; Davis, Stephen, Pepperdine Univ., USA; Roberts, Dar A., California Univ., USA; Ustin, Susan L., California Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 111-120; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Models of photosynthetic production at ecosystem and global scales require multiple input parameters specifying physical and physiological surface features. While certain physical parameters (e.g., absorbed photosynthetically active radiation) can be derived from current satellite sensors, other physiologically relevant measures (e.g., vegetation type, water status, carboxylation capacity, or photosynthetic light-use efficiency), are not generally directly available from current satellite sensors at the appropriate geographic scale. Consequently, many model parameters must be assumed or derived from independent sources, often at an inappropriate scale. An abundance of ecophysiological studies at the leaf and canopy scales suggests strong physiological control of vegetation-atmosphere CO2 and water vapor fluxes, particularly in evergreen vegetation subjected to diurnal or seasonal stresses. For example hot, dry conditions can lead to stomatal closure, and associated "downregulation" of photosynthetic biochemical processes, a phenomenon often manifested as a "midday photosynthetic depression". A recent study with the revised simple biosphere (SiB2) model demonstrated that photosynthetic downregulation can significantly impact global climate. However, at the global scale, the exact significance of downregulation remains unclear, largely because appropriate physiological measures are generally unavailable at this scale. Clearly, there is a need to develop reliable ways of extracting physiologically relevant information from remote sensing. Narrow-band spectrometers offer many opportunities for deriving physiological parameters needed for ecosystem and global scale photosynthetic models. Experimental studies on the ground at the leaf- to stand-scale have indicated that several narrow-band features can be used to detect plant physiological status. One physiological signal is caused

by xanthophyll cycle pigment activity, and is often expressed as the Photochemical Reflectance Index (PRI). Because the xanthophyll cycle pigments are photoregulatory pigments closely linked to photosynthetic function, this index can be used to derive relative photosynthetic rates. An additional signal with physiological significance is the 970 nm water absorption band, which provides a measure of liquid water content. This feature has been quantified both using a simple 2-band ratio (900/970 nm, here referred to as the ”Water Band Index” or WBI;), and using the ”continuum removal” method. Current atmospheric correction methods for AVIRIS imagery also obtain quantitative expressions of surface liquid water absorption based on the 970 nm water band and may be comparable to ground-based estimates of water content using this feature. However, physiological interpretations of both the PRI and the WBI are best understood at the leaf and canopy scales, where complications of atmospheric interference and complex stand and landscape features can be minimized, and where experimental manipulations can be readily applied. Currently it is not known whether these physiological indices can be used to derive meaningful physiological information from AVIRIS imagery. In addition to the problem of atmospheric interference, another challenge is that any simple physiological index can be confounded by multiple factors unrelated to physiology, and this problem can become more severe at progressively larger spatial scales. For example, previous work has suggested that both the PRI and the WBI, are strongly correlated with other optical measures of canopy structure (e.g., the Normalized Difference Vegetation Index or green vegetation fraction), indicating a confounding effect of structure on physiological signals at the larger, landscape scale. Furthermore, the normal operating mode of most imaging spectrometers does not allow simultaneous, ground truthing at a level of detail needed for physiological sampling. Additionally, manipulative experiments of physiology are difficult to apply at a geographic scale suitable for comparison with remote imagery, which often works at spatial scales that are several orders of magnitude larger than those typically used for physiological studies. These limitations require the consideration of alternative approaches to validating physiological information derived from AVIRIS data. In this report, we present a multi-scale sampling approach to detecting physiologically significant signals in narrow-band spectra. This approach explores the multi-dimensional data space provided by narrow-band spectrometry, and combines AVIRIS imagery at a large scale, with ground spectral sampling at an intermediate scale, and detailed ecophysiological measurements at a fine scale, to examine seasonally and spatially changing relationships between multiple structural and physiological variables. Examples of this approach are provided by simultaneous sampling of the Normalized Difference Vegetation Index (NDVI), an index of fractional PAR interception and green vegetation cover, the Water Band Index (WBI, an index of liquid water absorption, and the Photochemical Reflectance Index (PRI, an index of xanthophyll cycle pigment activity and photosynthetic light-use efficiency. By directly linking changing optical properties sampled on the ground with measurable physiological states, we hope to develop a basis for interpreting similar signals in AVIRIS imagery.
Author

Sampling; Remote Sensing; Imaging Spectrometers; Infrared Spectrometers; Spectroscopy; Vegetative Index; Narrowband; Spectrum Analysis; Spectral Reflectance

20000064538 Naval Research Lab., Washington, DC USA

A New and Fast Method for Smoothing Spectral Imaging Data

Gao, Bo-Cai, Naval Research Lab., USA; Liu, Ming, Science Applications International Corp., USA; Davis, Curtiss O., Naval Research Lab., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 131-140; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Airborne Visible Infrared Imaging Spectrometer (AVIRIS) acquires spectral imaging data covering the 0.4 - 2.5 micron wavelength range in 224 10-nm-wide channels from a NASA ER-2 aircraft at 20 km. More than half of the spectral region is affected by atmospheric gaseous absorption. Over the past decade, several techniques have been used to remove atmospheric effects from AVIRIS data for the derivation of surface reflectance spectra. An operational atmosphere removal algorithm (ATREM), which is based on theoretical modeling of atmospheric absorption and scattering effects, has been developed and updated for deriving surface reflectance spectra from AVIRIS data. Due to small errors in assumed wavelengths and errors in line parameters compiled on the HITRAN database, small spikes (particularly near the centers of the 0.94- and 1.14-micron water vapor bands) are present in this spectrum. Similar small spikes are systematically present in entire ATREM output cubes. These spikes have distracted geologists who are interested in studying surface mineral features. A method based on the ”global” fitting of spectra with low order polynomials or other functions for removing these weak spikes has recently been developed by Boardman (this volume). In this paper, we describe another technique, which fits spectra ”locally” based on cubic spline smoothing, for quick post processing of ATREM apparent reflectance spectra derived from AVIRIS data. Results from our analysis of AVIRIS data acquired over Cuprite mining district in Nevada in June of 1995 are given. Comparisons between our smoothed spectra and those derived with the empirical line method are presented.
Author

Data Smoothing; Remote Sensing; Atmospheric Effects; Spline Functions; Curve Fitting; Spectrum Analysis; Emission Spectra; Mathematical Models; Image Processing

20000064539 California Univ., Inst. for Computational Earth System Science, Santa Barbara, CA USA

Improved Atmospheric Correction for AVIRIS Spectra from Inland Waters

Gastil, Mary, California Univ., USA; Melack, John M., California Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 141-148; In English; See also 20000064520

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Remote sensing reflectance (Rrs) cannot be measured directly. Comparison of Rrs calculated from field measurements to Rrs calculated from AVIRIS spectra and the atmospheric radiative transfer model modtran provides a measure of the accuracy of our method. That and other comparisons are presented here as a validation of a method of retrieving Rrs from inland waters from AVIRIS radiance. The method of collecting field measurements for Rrs is described in Hamilton, 1993. Retrieval of Rrs from AVIRIS using modtran was developed from Carder, 1993. AVIRIS radiance is reduced by the path radiance modeled by modtran and divided by one-way transmission. Skylight, modeled by modtran, specularly reflected from the lake surface, is then subtracted from this radiance, leaving only that radiance which has come from under water. This water-leaving radiance is then normalized by the downwelling irradiance incident at the surface as modeled by modtran. Our improved retrieval of Rrs has allowed us to fit a single curve to a set of 134 pairs of AVIRIS Rrs and measured chlorophyll gathered on eight experiments at Mono Lake. Previously, spectra from different surveys varied more due to lingering atmospheric effects and/or radiometric calibration imprecision than they varied due to chlorophyll.

Derived from text

Atmospheric Correction; Atmospheric Effects; Radiance; Remote Sensing; Inland Waters; Spectral Reflectance; Applications Programs (Computers)

20000064540 NASA, Washington, DC USA

DOI Use of AVIRIS Data in Natural Resources Management: A Technology Transfer Project Status Report

Getter, James R., Geological Survey, USA; Wickland, Diane, NASA, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 149-157; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A meeting was held in December 1996, attended by representatives from Department of the Interior (DOI) and National Aeronautical and Space Administration (NASA) at the request of Department of the Interior Secretary, Bruce Babbitt and NASA, Administrator Director Dan Goldin, to discuss the use of hyperspectral systems and related remote sensing technologies in addressing environmental issues of environmental importance to the (DOI). It was determined that NASA/DOI Coordination be established, comprised of representatives from each agency, designated to address the environmental issues and resulting technologies. A steering committee was formed consisting of representatives from NASA Headquarters, NASA PI's from University California-Davis, University of Colorado-Boulder, University of New Hampshire and DOI Bureaus (Indian Affairs, Land Management, Reclamation, National Park Service, and US Geological Survey).

Derived from text

Data Management; Earth Resources; Remote Sensing; Resources Management; Technology Transfer

20000064541 Colorado Univ., Center for the Study of Earth from Space, Boulder, CO USA

Using Ground Spectral Irradiance for Model Correction of AVIRIS Data

Goetz, Alexander F. H., Colorado Univ., USA; Heidebrecht, Kathleen B., Colorado Univ., USA; Kindel, Bruce, Colorado Univ., USA; Boardman, Joseph W., Analytical Imaging and Geophysics, LLC, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 159-168; In English; See also 20000064520

Contract(s)/Grant(s): 95-B26; NAG5-4447; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Over the last decade a series of techniques has been developed to correct hyperspectral imaging sensor data to apparent surface reflectance. The techniques range from the empirical line method that makes use of ground target measurements to model-based methods such as ATREM that derive parameters from the data themselves to convert radiance to reflectance, and combinations of the above. Here we describe a technique that combines ground measurements of spectral irradiance with existing radiative transfer models to derive the model equivalent of an empirical line method correction without the need for uniform ground targets of different reflectance.

Derived from text

Spectral Emission; Spectral Reflectance; Surface Properties; Mathematical Models; Irradiance

20000064542 NASA Ames Research Center, Moffett Field, CA USA

Issues in Absolute Spectral Radiometric Calibration: Intercomparison of Eight Sources

Goetz, Alexander F. H., Colorado Univ., USA; Kindel, Bruce, Colorado Univ., USA; Pilewskie, Peter, NASA Ames Research Center, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 169-174; In English; See also 20000064520

Contract(s)/Grant(s): 95-B26; NAG5-4447; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The application of atmospheric models to AVIRIS and other spectral imaging data to derive surface reflectance requires that the sensor output be calibrated to absolute radiance. Uncertainties in absolute calibration are to be expected, and claims of 92% accuracy have been published. Measurements of accurate surface albedos and cloud absorption to be used in radiative balance calculations depend critically on knowing the absolute spectral-radiometric response of the sensor. The Earth Observing System project is implementing a rigorous program of absolute radiometric calibration for all optical sensors. Since a number of imaging instruments that provide output in terms of absolute radiance are calibrated at different sites, it is important to determine the errors that can be expected among calibration sites. Another question exists about the errors in the absolute knowledge of the exoatmospheric spectral solar irradiance.

Derived from text

Calibrating; Optical Measuring Instruments; Radiance; Atmospheric Models; Radiometers

20000064543 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Apparent Surface Reflectance of the DOE ARM SGP CART Central Site Derived from AVIRIS Spectral Images

Green, Robert O., Jet Propulsion Lab., California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 175-184; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The primary objective of the Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) Program at the Southern Great Plains (SGP) Cloud and Radiation Testbed (CART) is to acquire in situ and remote sensing data to improve cloud and atmospheric radiative models and parameterizations. As a consequence of this program, a large number of atmosphere and surface measurements are being acquired at the ARM SGP CART central site. NASA's Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) overflew this site on August 1, 1997. AVIRIS measures the upwelling spectral solar radiance from 400 to 2500 nm at 10-nm intervals. From 20 km altitude, these calibrated spectra are acquired as images of 11 by up to 800 km with 20-by-20 m spatial resolution. These data were acquired at the ARM SGP CART Central Site to first investigate derivation of atmospheric parameters from the measured spectra, second study the variation of these parameters, and third demonstrate the inversion of the calibrated radiance spectra to apparent surface reflectance. These objectives have been pursued with AVIRIS data at other sites for atmospheric water vapor and derivation of apparent surface reflectance.

Derived from text

Parameterization; Remote Sensing; Spectral Reflectance; Surface Properties; Radiance

20000064544 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Minimum High Fire Temperatures Detected in AVIRIS Spectral Measurements from Brazil in 1995

Green, Robert O., Jet Propulsion Lab., California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 185-192A; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In August and September of 1995 the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) was deployed to Brazil as part of the NASA Smoke Cloud Aerosol and Radiation experiment in Brazil (SCAR-B). AVIRIS measures spectra from 400 to 2500 nm at 10-nm intervals. These spectra are acquired as images with dimensions of 11 by up to 800 km with 20-m spatial resolution. Spectral images measured by AVIRIS are spectrally, radiometrically, and spatially calibrated. During the SCAR-B deployment, AVIRIS measured more than 300 million spectra of regions of Brazil. A portion of these spectra were acquired over areas of actively burning fires. Actively burning fires emit radiance in the AVIRIS spectral range as a function of temperature. This emitted radiance is expressed from the 2500-nm end of the AVIRIS spectrum to shorter wavelengths as a function of intensity and modeled by the Planck function.. The objective of this research and analysis was to use spectroscopic methods to determine the minimum high temperature of the most intense fires measured in the SCAR-B AVIRIS data set. Spectra measured by AVIRIS with hot sources have been previously examined for volcanic lava and fires in Brazil.

Derived from text

Forest Fires; Imaging Spectrometers; Infrared Imagery; Radiance; Spectrum Analysis; Remote Sensing; High Temperature

20000064547 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Mapping Agricultural Crops with AVIRIS Spectra in Washington State

Green, Robert, Jet Propulsion Lab., California Inst. of Tech., USA; Pavri, Betina, Jet Propulsion Lab., California Inst. of Tech., USA; Roberts, Dar, Jet Propulsion Lab., California Inst. of Tech., USA; Ustin, Susan, Jet Propulsion Lab., California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 213-220B; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Spectroscopy is used in the laboratory to measure the molecular components and concentrations of plant constituents to answer questions about the plant type, status, and health. Imaging spectrometers measure the upwelling spectral radiance above the Earth's surface as images. Ideally, imaging spectrometer data sets should be used to understand plant type, plant status, and health of plants in an agricultural setting. An Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) data set was acquired over agricultural fields near Wallula, Washington on July 23rd, 1997. AVIRIS measures upwelling radiance spectra through 224 spectral channels with contiguous 10-nm sampling from 400 to 2500 nm in the solar-reflected spectrum. The spectra are measured as images of 11 by up to 800 km with 20-m spatial resolution. The spectral images measured by AVIRIS represent the integrated signal resulting from: the solar irradiance; two way transmittance and scattering of the atmosphere; the absorptions and scattering of surface materials; as well as the spectral, radiometric and spatial response functions of AVIRIS. This paper presents initial research to derive properties of the agricultural fields near Wallula from the calibrated spectral images measured by AVIRIS near the top of the atmosphere.

Author

Thematic Mapping; Spectrum Analysis; Remote Sensing; Infrared Imagery; Farm Crops

20000064550 Oregon State Univ., Forest Sciences Lab., Corvallis, OR USA

A BRDF-Related Brightness Gradient in AVIRIS Imagery: Lesson from an Empirical Compensation Method

Kennedy, Robert E., Oregon State Univ., USA; Cohen, Warren B., Pacific Northwest Forest and Range Experiment Station, USA; Takao, Gen, Ministry of Agriculture, Forestry, and Fisheries, Japan; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 225-231; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A brightness gradient was observed in the cross-track dimension of 1994 AVIRIS imagery acquired over a densely-forested study area in Oregon's Cascade Mountains. to compensate for the effect, Kennedy et al. (1997) tested four empirical methods based on simple quadratic fitting of the gradient. Interpretation of the fitting coefficients suggested that the gradient was caused primarily by vegetative bidirectional reflectance characteristics. In this paper, we discuss how the character of the brightness gradient may affect common analysis techniques of AVIRIS imagery such as classification, multi-image matching, and endmember selection.

Derived from text

Image Motion Compensation; Image Processing; Bidirectional Reflectance; Gradients; Infrared Imagery; Brightness Distribution

20000064551 Cornell Univ., Inst. for Resource Information Systems, Ithaca, NY USA

Automated Spectral Unmixing Using Unsupervised Classification

Kim, Minsu, Cornell Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 233; In English; See also 20000064520; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Automated unmixing is one of the most interesting ideas in spectral analysis. We have data points in the reference space whose dimension is reduced by the principal component analysis or MNF transformation. Any kind of automated unmixing algorithm self-models the data system by finding endmember points solely based on the distribution of the data points in the reference space, so this algorithm was called a self-modeling technique in chemometrics of analytical chemistry. The key is how to find the appropriate linear transformation matrix for the diagonal reference coordinate vectors of the reduced space. Many researchers suggested reasonable methods. In this paper, a few automated unmixing algorithms and related sensitivity analysis about the number of required data points to get significant results are suggested. In this algorithm, a transformation matrix is determined by the combination of unsupervised classification, regression analysis, and other intuitive methods to find appropriate facet hyperplanes.

Author

Principal Components Analysis; Spectrum Analysis; Transformations (Mathematics); Matrices (Mathematics); Hyperplanes; Image Classification

20000064552 Geological Survey, Denver, CO USA

Spectroscopic Determination of Leaf Biochemistry: Use of Normalized Band-Depths and Laboratory Measurements and Possible Extension to Remote Sensing Measurements

Kokaly, Raymond F., Geological Survey, USA; Clark, Roger N., Geological Survey, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 235-344; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Ecosystems play an important role in the exchange of water, energy and greenhouse gases between soil, vegetation, and the atmosphere. The ability to detect changes in ecosystem processes such as carbon fixation, nutrient cycling, net primary production and litter decomposition is an important part in defining global biogeochemical cycles and identifying changes in climate. These processes have been linked in models of forest ecosystems to canopy biochemical content, specifically to the nitrogen, lignin and cellulose concentrations in vegetation. However, measurements of canopy chemistry by traditional field sampling methods are difficult to perform for large regional and global studies. Therefore, remote sensing measurement of canopy biochemistry is crucial to studying changes in ecosystem functioning. Several studies have suggested that estimates of canopy chemistry based on remote spectroscopic measurements may be possible. These studies used stepwise multiple linear regression to predict canopy chemistry from derivative reflectance spectra. This methodology is based on laboratory techniques developed in the agriculture industry for rapid estimation of forage quality parameters, for example, crude protein content and digestibility. The original applications stressed the importance of controlled laboratory methods for reducing noise levels and the limited application of regression equations to samples of the same type used in calibration. Recently, Grossman et al. (1996) found the use of regression techniques with derivative reflectance spectra to give inconsistent results between dry leaf and needle data sets for forest vegetation. Under the NASA Accelerated Canopy Chemistry Program, analysis using derivatives had also given inconsistent results between test sites (ACCP 1994). Furthermore, although recent studies have correlated plant canopy chemistry to imaging spectrometer measurements, the results at leaf and canopy scales are inconsistent and the derived regression equations are applicable to only the study area and are not reliable predictors for other remotely-sensed data. Because of site-specific results in wavelength selection by derivative analysis and the sensitivity of the technique to noise, we employed a different approach. Before applying the stepwise multiple linear regression, we utilized continuum-removal and band ratios, traditional methods of spectral analysis used in remote sensing by the terrestrial geology and planetary science disciplines. Absorption band-depths were calculated from continuum-removed spectral features in reflectance data. Since all band-depths in an absorption feature were ratioed to the maximum depth at the center of the feature we termed the result ”normalized band-depths.” Subsequently, we used a multiple stepwise linear regression algorithm applied to normalized band-depths to select wavelengths highly correlated to laboratory measurements of chemical concentrations. Wavelength selection was based on only two of the seven data sets used in this paper. Subsequently, the selected wavelengths were tested for correlation with the chemical concentrations of the five other data sets. To test the robustness of this approach, regression equations developed from a subset of the data were used to predict the concentrations in the remaining samples. Finally, since a broadly applicable method for dry leaves serves only as a foundation for a remote sensing algorithm, the method was tested for its extension to remote sensing measurements of plant canopies. The influences of leaf water content, sensitivity to noise in the reflectance spectra, sensor bandwidths, incomplete vegetation coverage, and atmospheric influences were considered.

Derived from text

Spectrum Analysis; Regression Analysis; Continuums; Band Ratioing; Remote Sensing; Spectroscopy; Canopies (Vegetation)

20000064553 Geological Survey, Denver, CO USA

Mapping the Biology and Mineralogy of Yellowstone National Park Using Imaging Spectroscopy

Kokaly, Raymond F., Geological Survey, USA; Clark, Roger N., Geological Survey, USA; Livo, K. Eric, Geological Survey, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 245-254; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Yellowstone National Park preserves and protects unique geologic features and biologic systems. The area contains the world’s largest assemblage of hot springs, geysers, and mud pots. Every year millions of visitors are drawn to see the active geysers, such as Old Faithful, and the colorful eroded remains of ancient hydrothermal systems in the Grand Canyon of the Yellowstone. Within the park, visitors also observe the activities of many large mammals, including bison, elk, moose, grizzly bears, and recently, wolves. The populations and movements of these animals are directly and indirectly influenced by the vegetation covering the park. The large fires of 1988 in Yellowstone demonstrated how dramatically and rapidly the vegetation and the state of the ecosystem can change. Although sometimes overlooked by park visitors, smaller organisms, the biota of the hot springs, are receiving increasing attention. These microorganisms are being researched by the biotechnology field for their potential benefits for the health of humans and the environment (Brock, 1994). The U.S, Geological Survey (USGS), in cooperation with the National Park Service, is using imaging spectroscopy to advance the understanding of the geologic features and biologic systems

in Yellowstone National Park. We are applying recent advances in remote sensing methods to detect and map the mineralogy of active and ancient hydrothermal systems, vegetation cover types, and hot springs microorganisms. These maps will be used to increase the understanding of the hydrothermal systems and to examine the links between the distribution of plant species and large mammal populations (specifically, the use of whitebark pine by grizzly bears). This paper presents the initial results of our efforts in mapping biology and mineralogy in Yellowstone National Park using imaging spectroscopy.
Author
Yellowstone National Park (ID-MT-WY); Thematic Mapping; Mineral Deposits; Remote Sensing; Imaging Spectrometers; Spectroscopy

20000064554 Analytical Imaging and Geophysics, LLC, Boulder, CO USA
Mapping Active Hot Springs Using AVIRIS and TIMS
Kruse, F. A., Analytical Imaging and Geophysics, LLC, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 255; In English; See also 20000064520; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This research is studying the occurrence and characteristics of both active and fossil hot springs systems using Thermal Infrared Multispectral Scanner (TIMS) and Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) data to provide insights into the origins of hydrothermal systems and precious metal ore deposits. At Steamboat Springs, Nevada, TIMS delineates the silica sinter associated with active alkaline-type hot springs, while AVIRIS data map alteration minerals including alunite, kaolinite, and hydrothermal silica associated with inactive acid-sulfate hot springs. Sites studied at Yellowstone National Park, Wyoming, include Mammoth Hot Springs, consisting of several ages of travertine terraces as well as glacially-transported travertine material. Hot springs in the Firehole River basin, include active hydrothermal areas associated with the Upper, Midway, and Lower geyser basins, with mineralogy characteristic of the both the alkaline and acid-sulfate type hot springs, including hydrothermal silica, alunite, and kaolinite. Surface exposures in Hayden Valley and in the Norris and Gibbon Geyser Basins indicate predominantly acid-sulfate alteration, along with smaller occurrences of silica sinter. Study of the nature and spatial distribution of specific hydrothermal-alteration minerals at active hot springs using hyperspectral remote sensing provides insight into the geochemistry of these systems, and to the occurrence and characteristics of hot springs systems in the fossil record. These findings potentially could lead to new and/or improved exploration methods for epithermal ore deposits.
Author
Hydrothermal Systems; Infrared Imagery; Mineral Deposits; Remote Sensing; Thematic Mapping; Springs (Water)

20000064555 Analytical Imaging and Geophysics, LLC, Boulder, CO USA
Spectral Identification of Image Endmembers Determined from AVIRIS Data
Kruse, F. A., Analytical Imaging and Geophysics, LLC, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 257; In English; See also 20000064520; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Experienced scientists can easily identify materials based on their visible/infrared reflectance spectra using field or laboratory instruments. Imaging spectrometry (hyperspectral data) also allow identification of materials using spectroscopy; however, these data typically consist of hundreds-of-thousands of spectra, so which spectra do you identify? Some researchers have taken the approach of matching every spectrum in an image to a spectral library. This works well when pure materials are present on the ground and all of the materials are contained in the library. In real-world situations, however, where materials are spatially or intimately mixed, only the strongest features are matched. In this case, it's also not possible to have all of the possible mixtures in the library, and thus the above approach will only "Identify" the predominant material, if any material at all. The research described here concentrates on identifying only the purest spectra extracted from the hyperspectral data. After applying data reduction and endmember extraction methodologies, the endmember spectra are used in an automated identification procedure based on analysis of spectral features. This approach has an improved likelihood of success because 1) the best endmember spectra have already been extracted for analysis, 2) the extracted endmembers are mean spectra and thus have improved signal-to-noise over single spectra, 3) these spectra are typically one material (no mixing), 4) not every spectrum in the image needs to be analyzed. Once the individual endmembers have been identified, then a variety of mapping methods can be used to map their spatial distributions, associations, and abundances.
Author
Spectroscopy; Spectrum Analysis; Remote Sensing; Spectral Correlation; Imaging Spectrometers; Image Classification

20000064556 Analytical Imaging and Geophysics, LLC, Boulder, CO USA

Characterization and Mapping of Kimberlites and Related Diatremes Using AVIRIS

Kruse, F. A., Analytical Imaging and Geophysics, LLC, USA; Boardman, J. W., Analytical Imaging and Geophysics, LLC, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 259; See also 20000064520; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) data are being used to study the occurrence and mineralogical characteristics of kimberlite diatremes at several sites in Utah and in the State-Line district of Colorado/Wyoming. The Utah kimberlites are well exposed and provide an excellent case history of mineralogical mapping of kimberlite mineralogy and abundant xenoliths of country rock. Two different mineral associations have been observed; 1) dolomite, minor calcite and illite, and an association of kaolinite and goethite at the Mule Ear and Cane Valley diatremes, and 2) serpentine matrix with dolomite xenoliths at the Moses Rock Dike site. The Moses Rock Dike appears to be spatially zoned. The State-Line kimberlites are deeply weathered, poorly exposed, and the AVIRIS data are dominated by green and dry vegetation, presenting a challenge to remote sensing technology. Identification of characteristic kimberlite minerals is difficult except where exposed by current mining; however, sub-pixel analysis methods have been successfully used to map the mineralogy of exposed mine areas, to locate similar areas, and to map the distribution of potential new exploration targets. Minerals identified in the State-Line district using the AVIRIS data include dolomite, calcite, phlogopite, and kaolinite. This work is in progress, with the goal of determining methods for characterizing subtle mineralogic changes associated with kimberlites and developing exploration models valid for a variety of geologic terrains. Author

Mineralogy; Mineral Deposits; Rock Intrusions; Remote Sensing; Thematic Mapping; Biotite; Peridotite; Spectroscopy

20000064558 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Mineral Mapping Using AVIRIS Data at Ray Mine, AZ

McCubbin, Ian, California Univ., USA; Lang, Harold, Jet Propulsion Lab., California Inst. of Tech., USA; Green, Robert O., Jet Propulsion Lab., California Inst. of Tech., USA; Roberts, Dar, California Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 269-272; In English; See also 20000064520; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Imaging Spectroscopy enables the identification and mapping of surface mineralogy over large areas. This study focused on assessing the utility of Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) data for environmental impact analysis over the Environmental Protection Agency's (EPA) high priority Superfund site Ray Mine, AZ. Using the Spectral Angle Mapper (SAM) algorithm to analyze AVIRIS data makes it possible to map surface materials that are indicative of acid generating minerals. The improved performance of the AVIRIS sensor since 1996 provides data with sufficient signal to noise ratio to characterize up to 8 image endmembers. Specifically we employed SAM to map minerals associated with mine generated acid waste, namely jarositc, goethite, and hematite, in the presence of a complex mineralogical background.

Author

Infrared Imagery; Mineral Deposits; Spectroscopy; Thematic Mapping; Remote Sensing; Mines (Excavations)

20000064560 Auckland Univ., Dept. of Geography, New Zealand

Montoring Community Hysteresis Using Spectral Shift Analysis and the Red-Edge Vegetation Stress Index

Merton, Ray, Auckland Univ., New Zealand; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 275-284; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The red-edge, centered at the largest change in reflectance per wavelength change, is located between two of the most widely used wavelength regions used for broad band vegetation studies, the red trough and the NIR plateau. The vegetation red-edge in Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) data comprises eight contiguous spectral bands between 0.6852 - 0.7523 microns. The aim of this study focuses on the development of simple techniques to identify and model multi-temporal red-edge geometry changes in disparate vegetation communities at Jasper Ridge Biological Preserve, Palo Alto, California. This study examines the design and performance of selected measures for monitoring community stress from early spring to late autumn. Defining complex red-edge symmetry through a range of geometric and statistical measures has potential for seasonal and long-term vegetation monitoring. Second-derivative calculations are applied to the measurement of red-edge inflection point shifts. Derivative spectra are also used to identify variations in red-edge geometry associated with apparent stress in communities and changing environmental variables and to determine bands for inclusion in the Red-edge Vegetation Stress Index (RVSI). Pat-

terns of community hysteresis based on multi-temporal changes in spectral shifts, the RVSI, and other important vegetation indices are examined.
Derived from text
Hysteresis; Infrared Imagery; Vegetative Index; Inflection Points; Plant Stress; Spectral Reflectance; Remote Sensing

20000064562 California Inst. of Tech., Div. of Geological and Planetary Sciences, Pasadena, CA USA
Multiple Endmember Spectral Mixture Analysis: Application to an Arid/Semi-Arid Landscape
Okin, Gregory S., California Inst. of Tech., USA; Okin, William J., California Univ., USA; Roberts, Dar A., California Univ., USA; Murray, Bruce, California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 291-299; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

As the Earth's human population increases and once-fertile areas become less so, human activities are bound to spread into areas that once were considered barren and unworkable, namely our planet's arid and semi-arid regions. Worldwide, this process already has begun. As a result, these fragile areas are being put under stresses that are leading to severe landscape damage and hence, a decrease in usefulness to humans. This process of "desertification" is already widespread, and although many people frequently consider desertification to be a problem unique to and and semi-arid Africa, it is in fact occurring on all continents except Antarctica. Desertification is actually a complex suite of phenomena that occur in and and semi-arid environments which can be triggered by human land use, interannual climate variability or long-term climate change. Many interrelated processes on sub-canopy to regional spatial scales are included, but the dominant form of desertification in the southwestern U.S. is the conversion of grasslands to shrublands. The processes involved frequently occur as "runaway" phenomena which are not reversible or remediable on human timescales for reasonable cost (Schlesinger et al., 1990). As a result, monitoring of arid regions is critical in any attempt to short-circuit these land degradation processes. Remote monitoring using current or anticipated satellite remote sensing is the most time- and cost-efficient way to proceed with and region monitoring in the future. Unfortunately, interpretation of remote sensing data from and regions is particularly difficult. Three factors are thought to contribute to this. First, arid and semi-arid regions are often characterized by large soil background, in many cases swamping out the spectral contribution of plants. Second, light rays reaching sensors from desert plants are often polluted by additional interactions with desert soils. Finally, due to evolutionary adaptations to the harsh desert environment, desert plants are spectrally dissimilar to their humid counterparts, lacking in many cases a strong red edge, exhibiting reduced leaf absorption in the visible, and displaying strong wax absorptions around 1720 nm. Many of the early applications of remote sensing to arid and semi-arid regions suggest that present remote sensing techniques, including most brightness and greenness indices, are susceptible to over- or underestimation of vegetation cover simply due to variations in soil color and low vegetation cover, although Musick (1984) found a correlation between total vegetation cover and LANDSAT MSS band 5 brightness. None of theses studies were able to accurately and reliably discern shrubs from grasses in arid and semi-arid environments, which is probably the most important means by which to identify desertification. Later work by Franklin et al. (1993) and Duncan et al. (1993) using SPOT wavebands and greenness and brightness indices found these indices to be sensitive to vegetation type as well as cover. High variance in these studies, however, suggests that even in cases where landscape components were determined to be significantly different, it may not be possible to accurately retrieve the contribution of these components to spatially averaged reflectance measurements. This characteristic is presumably due to the low spectral resolution of the SPOT wavebands and the effect of nonlinear mixing under low cover conditions, as well as the typically high spectral variability found in desert plants. Despite the lackluster performance of remote sensing in arid regions, there are have been a few studies that suggest there is potential for doing accurate and reliable remote sensing in and and semi-arid regions. Smith et al. (1990) applied a mixing model that employed laboratory and field spectra to LANDSAT TM data from the Owens Valley, indicating that mixture modeling can facilitate mapping and monitoring of sparse vegetation cover. Roberts et al. (1993) have used linear mixture analysis of AVIRIS data to map green vegetation, nonphotosynthetic vegetation (NPV), and soils at the Jasper Ridge Biological Preserve, CA. It is a natural next step, therefore, to apply spectral mixture analysis to arid and semi-arid regions in the hope that this will overcome previous difficulties in accurate and reliable landscape assessment by remote sensing in these areas. The purpose of this study is to determine if multiple endmember spectral mixture analysis will accurately and reliably characterize and arid semi-arid region vegetation and soils from AVIRIS data. The ultimate goal of this work is to develop tools for remote sensing of arid regions that make the best use of current and near-future remote sensing technology to monitor these environments.
Derived from text
Arid Lands; Desertification; Remote Sensing; Spectrum Analysis; Spectral Reflectance; Mathematical Models

20000064563 California Univ., Inst. for Computational Earth System Science, Santa Barbara, CA USA

Automated Subpixel Snow Parameter Mapping with AVIRIS Data

Painter, Thomas H., California Univ., USA; Roberts, Dar A., California Univ., USA; Dozier, Jeff, Jet Propulsion Lab., California Inst. of Tech., USA; Green, Robert O., Jet Propulsion Lab., California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 301-307; In English; See also 20000064520
Contract(s)/Grant(s): NAGw-5185; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We describe an automated algorithm (MEMSCAG) for mapping subpixel snow covered area (SCA) and snow grain size with AVIRIS data. The algorithm is based on the multiple endmember approach to spectral mixture analysis in which the spectral endmembers and the number of endmembers can vary on a pixel-by-pixel basis. This approach accounts for surface cover heterogeneity within a scene. The mixture analysis runs on endmembers from a spectral library of snow, vegetation, rock, soil, and lake ice spectra. Snow endmembers of varying grain size were produced with a radiative transfer model. All non-snow endmembers were collected with a portable field spectrometer. Mapping is performed through sequential 2-endmember, 3-endmember, and 4- endmember mixture model runs, each subject to constraints on RMS, residuals, fractions and priority. Grain size is determined by the grain size of the snow endmember used in the optimal mixture model. We apply MEMSCAG to AVIRIS data collected over Mammoth Mountain, CA and the northern site of the BOREAS in Manitoba, Canada. MEMSCAG produces appropriate snow covered area estimates in all regions. A preliminary comparison of grain size estimates from MEMSCAG with field measurements demonstrates high accuracy.
Author

Computer Aided Mapping; Thematic Mapping; Pixels; Snow Cover; Spectral Reflectance; Spectrum Analysis; Remote Sensing

20000064564 California Univ., Dept. of Land, Air, and Water Resources, Davis, CA USA

Remote Sensing of Soils in the Santa Monica Mountains: Hierarchical Foreground and Background Analysis

Palacios-Orueta, Alicia, California Univ., USA; Pinzon, Jorge E., California Univ., USA; Ustin, Susan L., California Univ., USA; Ustin, Susan L., California Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 309-318; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The extreme spatial and temporal variability of surface processes makes soil properties extremely variable and therefore, difficult to measure. Since soil and ecosystem processes occur at different scales, it is necessary to work at sufficiently large spatial resolution and coverage for generalizations to be made. Organic matter is a soil property closely related to soil quality, not only as an indicator of soil erosion and degradation, but also as a regulating factor of processes such as nutrient availability, water holding capacity, and permeability. Because values of organic content are highly variable and react very quickly to external changes, decomposition rates show high spatial variability. The spatial distribution of organic matter content can be an indicator of the rate of decomposition and other processes happening on the soil surface, such as differences in deposition and erosion rates or microclimate factors. Imaging spectrometry offers a potential way to map certain soil properties that are relevant to surficial processes at the landscape scale. In the last few years the analysis of hyperspectral data and image processing techniques have improved to the point that they offer the potential for direct analysis of soil properties. Several multispectral sensors have already been used for discrimination between soils. Specifically, there are several studies where organic matter has been analyzed in terms of its reflectance properties. Hyperspectral data, specifically Advanced Visible Infrared Imaging Spectrometer (AVIRIS) data has been shown to be useful for improved discrimination of minerals. Also, several other studies have dealt with soil identification and discrimination directly or indirectly using AVIRIS data. A significant problem for soil analysis is the presence of vegetation in most pixels. Because the signatures of soils and vegetation are so different, the lesser variability contained within the soil component is not significant enough for soil discrimination when vegetation is also present in the pixel. HFBA (Hierarchical Foreground and Background) is a new steerable analytic technique where the Foreground and Background Analysis (FBA) equation is applied at several levels in a hierarchical way, thus, the variability contained in the data set is confined at each step, making it possible to extract subtle absorption features. For this model FBA was modified to project the spectra into a property-specific axis of continuous variation. to examine the application of this method to extract and improve detection of soil properties using an imaging spectrometer, we applied it to map the spatial distribution of organic matter content from samples in two watersheds in the Santa Monica Mountains Recreation Area. In earlier work, Palacios-Orueta and Ustin (1988a) found that soils from each valley could be discriminated based on organic matter and iron content and that these could be spectrally estimated with reasonable accuracy in soil samples. The purpose of this work was to test the performance of HFBA (Hierarchical Foreground and Background Analysis) applied to AVIRIS data for the discrimination of these soils and soil properties.
Derived from text

Infrared Imagery; Organic Materials; Remote Sensing; Soil Sampling; Spatial Resolution; Surface Properties; Spectrum Analysis; Mountains; Image Processing; Spectroscopic Analysis

20000064565 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Calibration Targets of the Southwest: Albedo and Homogeneity Comparisons Using AVIRIS Data

Pavri, Betina, Jet Propulsion Lab., California Inst. of Tech., USA; Green, Robert, Jet Propulsion Lab., California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 319-323; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Various locations in the southwestern U.S. are used to calibrate remote sensing instruments. This study shows how some of these targets compare in terms of albedo and homogeneity, and records the variation of these factors for a single location (Ivanpah Playa) over a period of one year. Results indicate that there is a great deal of variation among these targets in albedo, spectral flatness, and surface uniformity, and that these factors can change throughout the year.

Author

Calibrating; Flatness; Homogeneity; Remote Sensing; Spectral Reflectance; Earth Albedo; Surface Properties

20000064566 California Univ., Dept. of Applied Mathematics, Davis, CA USA

Robust Feature Extraction for Hyperspectral Imagery Using Both Spatial and Spectral Redundancies

Pinzon, Jorge E., California Univ., USA; Ustin, Susan L., California Univ., USA; Pierce, John F., KT-Tech, Inc., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 325-333; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

As we move into the next century, a wide range of new satellites and airborne sensors will become available with a variety of interesting problems for data analysis and signal processing. In particular, hyperspectral sensors with both, a large set of spatially contiguous spectra and a large set of spectrally contiguous images will require new techniques that ideally would treat the spatial and spectral patterns in the data simultaneously. Resolving the significant spectral and spatial properties associated to ecological processes and interactions is critical to successful interpretation of remote sensing data. In hyperspectral images it is desirable to classify images within the conventional frame of reference of field and laboratory observations with methods that avoid intrinsic singular problems. In this respect, spectral mixture analysis (SMA) has become a well established procedure for analyzing imaging spectrometry data. SMA is a structured and integrated framework that simultaneously addresses the mixed-pixel problem, calibration, and variations in lighting geometry and displays the results in terms of proportions of endmembers that can be related easily to standard ecological observational units (e.g., cover).

Derived from text

Pattern Recognition; Remote Sensing; Redundancy; Spatial Distribution; Spectral Signatures; Spectroscopic Analysis; Image Analysis

20000064568 California Univ., Dept. of Geography, Santa Barbara, CA USA

Mapping the Distribution of Wildfire Fuels Using AVIRIS in the Santa Monica Mountains

Roberts, Dar, California Univ., USA; Gardner, M., California Univ., USA; Regelbrugge, J., Forest Service, USA; Pedreros, D., California Univ., USA; Ustin, S., California Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 345-352; In English; See also 20000064520

Contract(s)/Grant(s): NAGW-4626-I; NAG2-1140; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Catastrophic wildfires, such as the 1990 Painted Cave Fire in Santa Barbara or Oakland fire of 1991, attest to the destructive potential of fire in the wildland/urban interface. For example, during the Painted Cave Fire, 673 structures were consumed over a period of only six hours at an estimated cost of 250 million dollars (Gomes et al., 1993). One of the primary sources of fuels is chaparral, which consists of plant species that are adapted to frequent fires and may actually promote its ignition and spread of through volatile organic compounds in foliage. As one of the most widely distributed plant communities in Southern California, and one of the most common vegetation types along the wildland urban interface, chaparral represents one of the greatest sources of wildfire hazard in the region. An ongoing NASA funded research project was initiated in 1994 to study the potential of AVIRIS for mapping wildfire fuel properties in Southern California chaparral. The project was initiated in the Santa Monica Mountains, an east-west trending range in western Los Angeles County that has experienced extremely high fire frequencies over the past 70 years. The Santa Monica Mountains were selected because they exemplify many of the problems facing the southwest, forming a complex mosaic of land ownership intermixed with a diversity of chaparral age classes and fuel loads. Furthermore, the area has a wide diversity of chaparral community types and a rich background in supporting geographic information including fire history, soils and topography. Recent fires in the Santa Monica Mountains, including several in 1993 and the Calabasas fire of 1996 attest to the active fire regime present in the area. The long term objectives of this project are to improve existing maps of wildland fuel properties in the area, link AVIRIS derived products to fuel models under development for the region, then predict

fire hazard through models that simulate fire spread. In this paper, we describe the AVIRIS derived products we are developing to map wildland fuels.
Derived from text
Thematic Mapping; Remote Sensing; Mountains; California; Forest Fires; Fire Prevention; Chaparral

20000064569 California Univ., Dept. of Land, Air, and Water Resources, Davis, CA USA
Evaluation of Landscape Structure Using AVIRIS Quicklooks and Ancillary Data
Sanderson, Eric W., California Univ., USA; Ustin, Susan L., California Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 355-364; In English; See also 20000064520
Contract(s)/Grant(s): 1995-GlobalCh00404; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Currently the best tool for examining landscape structure is remote sensing, because remotely sensed data provide complete and repeatable coverage over landscapes in many climatic regimes. Many sensors, with a variety of spatial scales and temporal repeat cycles, are available. The Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) has imaged over 4000 scenes from over 100 different sites throughout North America. For each of these scenes, one-band ”quicklook” images have been produced for review by AVIRIS investigators. These quicklooks are free, publicly available over the Internet, and provide the most complete set of landscape structure data yet produced. This paper describes the methodologies used to evaluate the landscape structure of quicklooks and generate corresponding datasets for climate, topography and land use. A brief discussion of preliminary results is included at the end. Since quicklooks correspond exactly to their parent AVIRIS scenes, the methods used to derive climate, topography and land use data should be applicable to any AVIRIS analysis.
Derived from text
Infrared Imagery; Land Use; Remote Sensing; Topography; Climatology

20000064570 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The AVIRIS Low Altitude Option-An Approach to Increase Geometric Resolution and Improve Operational Flexibility Simultaneously
Sarture, Charles M., Jet Propulsion Lab., California Inst. of Tech., USA; Chovit, Christopher J., Jet Propulsion Lab., California Inst. of Tech., USA; Chrien, Thomas G., Jet Propulsion Lab., California Inst. of Tech., USA; Eastwood, Michael L., Jet Propulsion Lab., California Inst. of Tech., USA; Green, Robert O., Jet Propulsion Lab., California Inst. of Tech., USA; Kurzwell, Charles G., Jet Propulsion Lab., California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 365; In English; See also 20000064520; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

From 1987 through 1997 the Airborne Visible-InfraRed Imaging Spectrometer has matured into a remote sensing instrument capable of producing prodigious amounts of high quality data. Using the NASA/Ames ER-2 high altitude aircraft platform, flight operations have become very reliable as well. Being exclusively dependent on the ER-2, however, has limitations: the ER-2 has a narrow cruise envelope which fixes the AVIRIS ground pixel at 20 meters; it requires a significant support infrastructure; and it has a very limited number of bases it can operate from. In the coming years, the ER-2 will also become less available for AVIRIS flights as NASA Earth Observing System satellite underflights increase. Adapting AVIRIS to lower altitude, less specialized aircraft will create a much broader envelope for data acquisition, i.e., higher ground geometric resolution while maintaining nearly the ideal spatial sampling. This approach will also greatly enhance flexibility while decreasing the overall cost of flight operations and field support. Successful adaptation is expected to culminate with a one-month period of demonstration flights.
Author
Airborne Equipment; Flight Altitude; Flight Operations; Low Altitude; Remote Sensing; U-2 Aircraft

20000064571 Zurich Univ., Remote Sensing Labs., Switzerland
Parametric Geocoding of AVIRIS Data Using a Ground Control Point Derived Flightpath
Schlaepfer, Daniel, Zurich Univ., Switzerland; Meyer, Peter, Zurich Univ., Switzerland; Itten, Klaus, Zurich Univ., Switzerland; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 367-372; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The position of scanning airborne systems (e.g. of the AVIRIS instrument) never is as stable as the behaviour of sensors on spaceborne platforms. Thus, geometric distortions occur due to variations of the flight-path as well as of the attitude (given by roll, pitch and heading angles) of the plane. These distortions can not be corrected by ground control point based traditional georeferencing procedures easily, since the movements can not be approximated satisfyingly by polynomial transformations of the image. A linewise calculation has to be performed instead, to consider the behaviour of the plane. Various projects have been carried out at the RSL, which require an exact localization of ground truth measurement or need the information from a digital eleva-

tion model (DEM) fitting to the scanner data (e.g. in-flight calibration of the DAIS sensor), limnological investigations on Swiss lakes (in progress), or water vapor retrieval over complex terrain, using the digital elevation model. The geocoding issue therefore had to be addressed, resulting in the presented algorithm and application. The described georeferencing procedure is based on a parametric approach and theoretically allows sub-pixel accopcy even in steep terrain. A predecessor of the algorithm was developed by Meyer. to achieve accurate results, all auxiliary data have to be provided at highest accuracy possible. Since these requirements seem to be very hard to fulfill, a ground control point based procedure has been developed to recalibrate the offsets of the attitude angles as well as to reconstruct the flightpath. It was possible to geolocate AVIRIS data in mountainous terrain at accuracies of 1-2 pixels, using this GCP based PARGE algorithm (PARametric GEocoding).
Derived from text
Algorithms; Flight Paths; Ground Truth; Correction; Remote Sensing

20000064572 California Univ., Computer Vision Laboratory, Irvine, CA USA
A Method for Material Classification in AVIRIS Data with Unknown Atmospheric and Geometric Parameters
Slater, David, California Univ., USA; Healey, Glenn, California Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 373-382; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The measured spectral radiance signature for a material can vary significantly due to atmospheric conditions and scene geometry. We show using a statistical analysis of a comprehensive physical model that the variation in a material's spectral signature lies in a low-dimensional space. The spectral radiance model includes reflected solar and scattered radiation as well as the effects of atmospheric gases and aerosols. The MODTRAN 3.5 code was employed for computing radiative transfer aspects of the model. Using the new model, we develop a maximum likelihood algorithm for material classification which is invariant to atmospheric conditions and scene geometry. The algorithm is demonstrated for material classification in AVIRIS data.
Author
Image Classification; Maximum Likelihood Estimates; Spectral Signatures; Statistical Analysis; Geometric Accuracy; Remote Sensing; Radiance

20000064575 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Evaluation of the Use of Dark and Bright Targets for the In-Flight Calibration of AVIRIS
Thome, K., Arizona Univ., USA; Parada, R., Arizona Univ., USA; Schiller, S., South Dakota State Univ., USA; Conel, J., Jet Propulsion Lab., California Inst. of Tech., USA; LaMarr, J., Arizona Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 391-397; In English; See also 20000064520
Contract(s)/Grant(s): NAS3-5171; NGT-30239; NAGW-3543; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

During a field campaign at Lake Tahoe on June 22, 1995, calibrations of AVIRIS were attempted using both the reflectance-based and radiance-based methods. This experiment shows that the use of dark water targets to calibrate radiometric sensors can result in meaningful sensor characterization. In particular, the reflectance-based method shows promise towards meeting the desired 2-3% uncertainty levels for ocean color sensors since experimental agreement of better than 1.5% is found for the Lake Tahoe AVIRIS experiment. Similarly promising results were found from reflectance-based calibrations at Lunar Lake with large portions of the spectrum having less than a 5% difference between the reflectance-based predictions and the measured AVIRIS radiances. These results are still in the preliminary stage and it is likely that further study of this data set will lead to even better agreement. The results of the radiance-based calibration at Lake Tahoe are quite good at the shorter wavelengths where atmospheric scattering leads to larger signals and smaller effects of specularly reflected solar energy. The results also showed the sensitivity to radiometer pointing when using water targets for vicarious calibration.
Derived from text
Airborne Equipment; Calibrating; Infrared Spectrometers; Radiance; Spectral Reflectance; Targets

20000064576 NASA Ames Research Center, Moffett Field, CA USA
Diurnal Reflectance Changes in Vegetation Observed with AVIRIS
Vanderbilt, V. C., NASA Ames Research Center, USA; Ambrosia, V. G., NASA Ames Research Center, USA; Ustin, S. L., California Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 399-408; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Among the most important short-term dynamic biological processes are diurnal changes in canopy water relations. Plant regulation of water transport through stomatal openings affects other gaseous transport processes, often dramatically decreasing photosynthetic fixation of carbon dioxide during periods of water stress. Water stress reduces stomatal conductance of water vapor through the leaf surface and alters the diurnal timing of stomatal opening. Under non-water stressed conditions, stomates typically

open soon after dawn and transpire water vapor throughout the daylight period. During stress periods, stomates may close for part of the day, generally near mid-day. Under prolonged stress conditions, stomatal closure shifts to earlier times during the day; stomates may close by mid-morning and remain closed until the following morning - or remain closed entirely. Under these conditions the relationship between canopy greenness (e.g., measured with a vegetation index or by spectral mixture analysis) and photosynthetic fixation of carbon is lost and the remotely sensed vegetation metric is a poor predictor of gas exchange. Prediction of stomatal regulation and exchange of water and trace gases is critical for ecosystem and climate models to correctly estimate budgets of these gases and understand or predict other processes like gross and net ecosystem primary production. Plant gas exchange has been extensively studied by physiologists at the leaf and whole plant level and by biometeorologists at somewhat larger scales. While these energy driven processes follow a predictable if somewhat asymmetric diurnal cycle dependent on soil water availability and the constraints imposed by the solar energy budget, they are nonetheless difficult to measure at the tree and stand levels using conventional methods. Ecologists have long been interested in the potential of remote sensing for monitoring physiological changes using multi-temporal images. Much of this research has focused on day-to-day changes in water use, especially for agricultural applications. Ustin et al. showed seasonal changes in canopy water content in chaparral shrub could be estimated using optical methods. Vanderbilt et al. followed asymmetric diurnal changes in the reflectance of a walnut orchard, but could not attribute specific reflectance changes to specific changes in canopy architecture or physiology. Forests and shrub lands in California experience prolonged periods of drought, sometimes extending six months without precipitation. The conifer and evergreen chaparral communities common to the foothill region around the central valley of California retain their foliage throughout the summer and have low transpiration rates despite high net radiation and temperature conditions. In contrast, grasslands and drought resistant deciduous species in the same habitat are seasonally dormant in summer. Because of differences in the mechanisms of drought tolerance, rooting depth and physiology between different plant communities in the region, it is likely that they display differences in diurnal water relations. The presence of diverse plant communities provides an opportunity to investigate possible diurnal landscape patterns in water relations that could be observed by an airborne hyperspectral scanner. This investigation of AVIRIS data collected over forest and shrub land represents the continuation of a prior investigation involving spectral mixture analysis of diurnal effects in the same AVIRIS data set.
Derived from text
Diurnal Variations; Vegetation; Moisture Content; Gas Exchange; Remote Sensing; Spectral Reflectance

20000064577 Colorado Univ., Cooperative Inst. for Research in Environmental Sciences, Boulder, CO USA
A Method to Access Absolute fIPAR fo Vegetation in Spatially Complex Ecosystems
Wessman, Carol A., Colorado Univ., USA; Nel, Elizabeth M., Colorado Univ., USA; Bateson, C. Ann, Colorado Univ., USA; Asner, Gregory P., Colorado Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 409-416; See also 20000064520
Contract(s)/Grant(s): NAGW-2662; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Arid and semi-arid lands compose a large fraction of the earth's terrestrial vegetation, and thereby contribute significantly to global atmospheric-biospheric interactions. The thorny shrubs and small trees in these semi-arid shrub lands have counterparts throughout much of the world's tropical and subtropical zones and have captured substantial areas of the world's former grasslands. The objective of our field and remotely sensed measurements in the semi-arid shrublands of Texas is to monitor interannual variability and directional change in landscape structure, ecosystem processes and atmosphere-biosphere exchanges. to understand the role ecosystems play in controlling the composition of the atmosphere, it is necessary to quantify processes such as photosynthesis and primary production, decomposition and soil carbon storage, and trace gas exchanges. Photosynthesis is the link whereby surface-atmosphere exchanges such as the radiation balance and exchange of heat, moisture, and gas can be inferred. It also describes the efficiency of carbon dioxide exchange and is directly related to the primary production of vegetation. Our efforts in this paper focus on the indirect, quantification of photosynthesis, and thereby carbon flux and net primary production, via remote sensing and direct measurements of intercepted photosynthetically active radiation (IPAR).
Derived from text
Vegetation; Ecosystems; Arid Lands; Remote Sensing; Photosynthesis; Canopies (Vegetation)

20000064578 Geological Survey, Reston, VA USA
Mapping Chestnut Oak Forest Associated with Silicified Hydrothermally Altered Rocks in teh Carolina Slate Belt Using Airborne Visible/Infrared Imaging Spectrometer (AViris) Data
Rowan, Lawrence C., Geological Survey, USA; Crowley, James K., Geological Survey, USA; Schmidt, Robert G., Geological Survey, USA; Mars, John C., Geological Survey, USA; Ager, Cathy M., Geological Survey, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 353-354; In English; See also 20000064520; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Carolina slate belt is a 10- to 50- kilometer-wide zone of 350- to 600- million-year-old volcanic and sedimentary rocks extending from Georgia to Virginia. An older group of heterogeneous volcanic rocks is unconformably overlain by an extensive unit of rhyodacitic to dacitic rocks. These units were intruded by granitic to dioritic complexes which resulted in hornfels and hydrothermally altered rocks ranging from quartz-sericite to nearly pure quartz. Gold and silver deposits and pyrophyllite deposits are associated with the hydrothermally altered rocks, particularly along northeast-trending shear zones. Mineral resource studies in the slate belt are complicated by the complex geology, deep weathering of bedrock, and dense vegetation cover over much of the area. to augment conventional geologic mapping and mineral resource studies in the area the U. S. Geological Survey has been evaluating the use of LANDSAT images and, more recently, Airborne Visible-Infrared Imaging Spectrometer (AVIRIS) data for mapping spectral reflectance variations in the forest canopy that might be related to altered, potentially mineralized rocks. Previous analysis of a December 1, 1981, LANDSAT Multispectral Scanner (MSS) image showed good spatial correspondence between known areas of hydrothermally altered, commonly mineralized rocks and pixels derived by thresholding a principal component image. Field studies showed that most of these areas are topographically high and have a forest community of principally Quercus prinus (chestnut oak) and subordinate Pinus virginiana (Virginia pine) and Acer rubrum (red maple). The understory is typically open with patches of Vaccinium sp. (blueberry). Analyses of LANDSAT Thematic Mapper images recorded on November 9, 1982, and also 1988, which is near the peak of autumn colors, essentially duplicated the earlier MSS results. However, in both of these studies, numerous areas underlain by unaltered silicic volcanics also showed as anomalies, reducing the effectiveness of the LANDSAT-image maps for mineral resource studies. Initial analysis of AVIRIS images recorded on June 26, 1996, indicates that chestnut oak growing on highly siliceous altered rocks can be distinguished from the chestnut-oak canopy on unaltered silicic volcanic rocks, as well as from the background canopy on other unaltered lithologic units. Calibration of 10 scenes of AVIRIS data was accomplished by using a modified version of the Atmosphere Removal Program (ATREM), and a laboratory spectrum representing a spectrally uniform plowed field. A matched-filter algorithm was used to map anomalous and background canopies in the 0.49 to 1.3 micrometer region. The resulting anomalous-class image was thresholded to retain only the highest digital numbers and, hence, the best matches to the AVIRIS canopy reference spectrum. The main difference between anomalous and background canopy spectra is weaker intensity of the 0.96 and 1.19 micrometer water absorption features in the anomalous canopy spectra. AVIRIS spectra of chestnut-oak canopy growing on unaltered silicic volcanic rocks are similar to those that characterize other background forest types. Soil analyses indicate that nutrients are anomalously low in residual samples representing the silicified altered areas. The spatial agreement with known hydrothermally silicified bedrock situated along the 10-scene strip of AVIRIS data is very high with no known omissions, except where forests have been cut or replanted. Two areas of silicified rocks were identified in this study that had not been previously documented. A few areas that were initially erroneously identified as being underlain by silicified rocks were eliminated subsequently by reprocessing these scenes using additional AVIRIS reference spectra.

Author

Infrared Imagery; Canopies (Vegetation); Deciduous Trees; Foliage; Timber Identification; Spectral Reflectance; Forests

20000064905 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Analysis of Interferometric Radar Data in a Queensland, Australia Tropical Rain Forest

Hensley, Scott, Jet Propulsion Lab., California Inst. of Tech., USA; Rodriquez, Ernesto, Jet Propulsion Lab., California Inst. of Tech., USA; Chapin, Elaine, Jet Propulsion Lab., California Inst. of Tech., USA; Accad, Arnon, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 14p; In English; PIERS 99, 23 Mar. 1999, Pasadena, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The radar flies at 8000 m (24000 ft) above the ground and collects data in swath about 10 km wide. The radar simultaneously collects data from multiple frequencies and is capable of making interferometric radar measurements.

Derived from text

Radar Data; Rain Forests; Data Acquisition; Radar Measurement

20000067675 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Potential Applications of Satellite Based Low Frequency Microwave Measurements of Snow and Ice

West, Richard D., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

In this presentation we will examine some potential applications of low frequency microwave radar and radiometer data to remote sensing of snow and ice conditions over land. We focus on the following low frequency bands; L-band (1.28 GHz), S-band (2.69 GHz), and C-band (5.0 GHz). to predict the effect of snow cover on microwave emission, we need to characterize the dielectric properties of the snow in terms of important physical parameters such as snow density, temperature, and wetness. For the case of dry snow, we use an empirical mixing formula which gives the effective complex permittivity of snow as a function of density,

temperature, and frequency. For wet snow, we use another mixing formula which gives the effective complex permittivity as a function of snow wetness. With dry snow, the loss at low microwave frequencies is very small so the corresponding penetration depths are very large (eg., 100 m). Clearly seasonal snow covers are far too thin to have a direct scattering or emission effect on these low frequency bands. There are, however, indirect effects introduced because of altered reflection at the snow/soil boundary, and an extra reflecting interface at the snow/air boundary. For C-band, layers of snow with different densities can have an impact if the number of layers grows sufficiently large. (eg., many meters of snow pack with cm-scale density layering.) Wet snow poses a more difficult problem. Liquid water is much more effective than ice at scattering and absorbing L-band radiation, so even a small amount of wetness will greatly reduce penetration. For example, with a snow wetness of 1 percent (volume fraction), and a density of 300 kg/cu. m, the penetration depths for L-band, S-band, and C-band are about 1.6 m, 0.3 m, and 0.15 m respectively. Very wet snow has more than 10 percent liquid water, and the corresponding L-band penetration is less than 0.2 m. Because the penetration distance is a strong function of frequency, it may be possible to identify a particular class of snow where the wetness is a few percent, and the depth is around one meter by looking at the frequency gradient.
Author
Snow; Microwave Emission; Remote Sensing; Low Frequencies; Microwaves; Dielectric Properties; Ice

20000067687 NASA Glenn Research Center, Cleveland, OH USA
Using Airborne Laser Altimetry to Detect Topographic Change at Long Valley Caldera California
Hofton, M. A., Scripps Institution of Oceanography, USA; Minster, J.-B., Scripps Institution of Oceanography, USA; Ridgway, J. R., Scripps Institution of Oceanography, USA; Williams, N. P., Scripps Institution of Oceanography, USA; Blair, J. B., NASA Glenn Research Center, USA; Rabine, D. L., NASA Glenn Research Center, USA; Bufton, J. L., NASA Glenn Research Center, USA; Remote Sensing of Active Volcanism; [2000], pp. 249-263; In English
Contract(s)/Grant(s): NAG5-3001; NAS5-33019; Copyright; Avail: Issuing Activity

The topography of the Long Valley caldera, California, was sampled using airborne laser altimetry in 1993, 1995, and 1997 to test the feasibility of using airborne laser altimetry for monitoring deformation of volcanic origin. Results show the laser altimeters are able to resolve subtle topographic features such as a gradual slope and to detect small transient changes in lake elevation. Crossover and repeat pass analyses of laser tracks indicate decimeter-level vertical precision is obtained over flat and low-sloped terrain for altimeter systems performing waveform digitization. Comparisons with complementary, ground-based CPS data at a site close to Bishop airport indicate that the laser and GPS-derived elevations agree to within the error inherent in the measurement and that horizontal locations agree to within the radius of the laser footprint. A comparison of the data at two sites, one where no change and the other where the maximum amount of vertical uplift is expected, indicates approximately 10 cm of relative uplift occurred 1993-1997, in line with predictions from continuous CPS measurements in the region. Extensive terrain mapping flights during the 1995 and 1997 missions demonstrate some of the unique abilities of laser altimetry; the straightforward creation of high resolution, high accuracy digital elevation models of overflown terrain, and the ability to determine ground topography in the presence of significant ground cover such as dense tree canopies. These capabilities make laser altimetry an attractive technique for quantifying topographic change of volcanic origin, especially in forested regions of the world where other remote sensing instruments have difficulty detecting the underlying topography.
Author
Airborne Lasers; Spaceborne Lasers; Altimetry; Laser Altimeters; Remote Sensing

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ENERGY PRODUCTION AND CONVERSION

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

20000063364 Maryland Power Plant Research Program, Annapolis, MD USA
Bibliography of the Maryland Power Plant Research Program. 20th Edition ***Final Report***
McLean, R. I.; Feb. 2000; 126p; In English
Report No.(s): PB2000-105792; PPRP-B-20; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This bibliography is a compilation of over 700 reports of electric power related studies conducted by the Power Plant Research Program since 1971.
NTIS
Bibliographies; Electric Power Plants; Hydroelectric Power Stations; Maryland

20000063373 Los Alamos National Lab., NM USA

Light-Weight Radioisotope Heater Unit (LWRHU) sequential impact tests

Reimus, M. A. H.; Rinehart, G. H.; Aug. 31, 1997; 38p; In English

Report No.(s): DE97-009285; LA-13339-MS; No Copyright; Avail: Department of Energy Information Bridge

The light-weight radioisotope heater unit (LWRHU) is a (sup 238)PuO2- fueled heat source designed to provide one thermal watt in each of various locations on a spacecraft. Los Alamos National Laboratory designed, fabricated, and safety tested the LWRHU. The heat source consists of a hot-pressed (sup 238)PuO2 fuel pellet, a Pt-30Rh vented capsule, a pyrolytic graphite insulator, and a fine weave-pierced fabric graphite aeroshell assembly. A series of sequential impacts tests using simulant-fueled LWRHU capsules was recently conducted to determine a failure threshold. Sequential impacting, in both end- on and side-on orientations, resulted in increased damage with each subsequent impact. Although the tests were conducted until the aeroshells were sufficiently distorted to be out of dimensional specification, the simulant- fueled capsules used in these tests were not severely deformed. Sequential impacting of the LWRHU appears to result in slightly greater damage than a single impact at the final impact velocity of 50 m/s. Post impact examination revealed that the sequentially impacted capsules were slightly more deformed and were outside of dimensional specifications.

NTIS

Radioisotope Batteries; Heat Sources; Heating Equipment

20000064663 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Research report of FY 1996 on development of new hydrogen energy demonstration technology, 1, FY 1996 results

Nov. 30, 1997; 162p; In Japanese; In English

Report No.(s): DE99-714207; NEDO-9601-I; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this project is to clarify the possibility of new hydrogen energy as a future energy source. The new hydrogen energy is obtained from the excess heat generation phenomenon through the electrolysis of heavy water using palladium metal as an electrode. The excess heat regeneration tests have been successively conducted using two kinds of electrolytic cells. As a result, the excess heat generation measured by one electrolytic cell in FY 1996 has been confirmed in about 35% of repeatability under the same condition. On the other hand, the excess heat over the measuring accuracy was not measured using two kinds of absolute heating value measuring systems. The electrolytic cell, by which the excess heat was measured, was used for confirming the absolute heating value as keeping its condition. When tests were conducted using the developed system, it was found that the absolute heating value can not be detected. Then, verification tests are currently conducted for determining the cause. Moreover, in order to clarify the basic characteristics of materials required for the regeneration of the excess heat generation phenomenon, observation and analysis of the materials were performed before and after the excess heat measurement. Thus, the cause of difference was revealed.

NTIS

Energy Technology; Hydrogen

20000064664 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Research report of FY 1996 on development of new hydrogen energy demonstration technology, 2, Results in the extension period of FY 1996

Nov. 30, 1997; 142p; In Japanese; In English

Report No.(s): DE99-714208; NEDO-9601-II; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this project is to clarify the possibility of new hydrogen energy as a future energy source. The new hydrogen energy is obtained from the excess heat generation phenomenon through the electrolysis of heavy water using palladium metal as an electrode. The excess heat measurements were conducted through the excess heat confirmation tests using a fuel cell-type electrolytic cell up to November 1997. As a result, it was found that the excess heat measured by the calibration method can not be measured by the flow calorimetric method. In order to investigate the possibility of systematic errors of the both methods, the sensitivity, accuracy and responsibility, and the conditions of the excess heat generation, research activities based on new facts from scientific information and fundamental research supporting projects have been mainly performed. Among these, were performed the excess heat measurement tests by the cataphoresis method, absorption tests by the high-pressure and high-temperature charging method, gas plasma loading, in-situ X-ray detection, and reactant detection tests using Au/Pd/PdO heterogeneous structural body.

NTIS

Energy Technology; Hydrogen

20000064909 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 report on the survey for a data book on new energy technology development. Waste power generation, solar energy utilization, geothermal power generation, clean energy vehicles, coal liquefaction/gasification, and traverse themes
Mar. 31, 1998; 353p; In Japanese; In English
Report No.(s): DE99-714241; NEDO-P-9715; No Copyright; Avail: Department of Energy Information Bridge

The paper collected and arranged data on new energy technology. As to the waste power generation, in terms of general waste, 161 places have power generation facilities, 657,000 kW in output, as of the end of FY 1996. Out of them, 100 facilities (scale of output: 555,000 kW) are selling power. In terms of industrial waste, 53 places (209,000 kW) have power generation facilities. The output will be 2 million kW in FY 2000. In relation to the solar energy utilization, the number of solar systems introduced in FY 1996 is 25,000, that of water heating appliances produced in FY 1996 is 170,000. Geothermal power of 494,000 kW and 37,000 kW was introduced for electric power industry use and private use, respectively. Clean energy vehicles have not been so much spread, but the hybrid car was put on sale in 1997. Concerning the coal liquefaction, the R and D were made at a pilot plant of NEDOL process, and operation started in 1997. As to the coal gasification, investigational study and element study on the demonstration plant are being conducted in FY 1997 and 1998, making use of the research results obtained from the existing pilot plant of coal gasification combined power generation.
NTIS
Energy Technology; Solar Energy Conversion; Waste Energy Utilization; Geothermal Energy Utilization; Clean Energy; Coal Liquefaction; Coal Gasification

20000064910 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Research report of fiscal 1997. Basic research on the commercialization of innovative energy technologies
Mar. 31, 1998; 278p; In Japanese; In English
Report No.(s): DE99-714245; NEDO-P-9737; No Copyright; Avail: Department of Energy Information Bridge

This paper summarizes the research result in fiscal 1997 from the basic research results on the commercialization of innovative energy technologies. The target of a photovoltaic power generation market includes isolated power sources (several kWp) for distant places or developing countries, and those (several tens kWp) for personal residences or public facilities. Although the former is mainly promoted in the West, while the latter over the world, their profitability is unsolved. Power plants over several hundreds kWp are in demonstration test. Solar heat power generation of several tens to hundreds MWp is most profitable, however, small-scale one is poor in feasibility. Australia takes an interest in distributed photovoltaic power generation directly connected with actual lives of residents, and has a dominant opinion that desert is useless as large-scale site. This country lays emphasis on protection and maintenance rather than positive use of desert based on a basic cognition that desert is easily changed and broken. The Australian government announced power company's obligation to use renewable energy by 2%, and a strong organization is scheduled to be newly established.
NTIS
Technology Utilization; Commercialization

20000064911 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Research report of fiscal 1997. Research on formation of energy and environment technology development projects
Mar. 31, 1998; 142p; In Japanese; In English
Report No.(s): DE99-714246; NEDO-P-9740; No Copyright; Avail: Department of Energy Information Bridge

Research was made on a systematic objective decision making technique for formation of New Sunshine (NSS) projects, based on a supercritical fluid applied technology project. Various issues were raised on the basis of meeting discussions and questionnaire results. Evaluation/screening of R and D themes was picked up among them as a matter of special concerns by decision hierarchy technique. Themes were selected by a grading method and a portfolio method. The former integrates the grades objectively marked by some researchers on each evaluation items of a given R and D theme, while the latter clarifies the position of a R and D theme by plotting the grades of 2 evaluation items on a 2-D chart. Issues and problems were thus extracted through extraction of themes with questionnaire results, and evaluation of the extracted themes by the above evaluation method. Themes were thus integrally evaluated, and their priority was decided. The evaluation technique including 8 generalized steps was proposed. As a result, certain results were obtained on theme selection for new R & D projects.
NTIS
Energy Technology; Environmental Engineering; Technology Assessment

20000064912 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1996 report on the results of the subsidy operation under the Sunshine Project on the development of a geothermal water use power plant, etc. Development of the binary
Mar. 31, 1997; 430p; In Japanese; In English
Report No.(s): DE99-714258; ETDE/JP-99714258; No Copyright; Avail: Department of Energy Information Bridge

The R and D were carried out of a detecting system for measurement of data on the bottom of geothermal well, data transmission and signal processing, and an analysis system for well drilling trajectory control and well assessment while geothermal well drilling based on the data obtained by the detecting system. The paper reported the results of the technology development in fiscal 1996. In the development of the detecting system, improvement/design were conducted on a mud pulse generator constituting sonde, well bottom signal processing equipment, mode switch and inclined information sensor, and the system equivalent to the actual one was manufactured to conduct a running test at high temperature/pressure. Moreover, a test to confirm heat resistance of electronic parts was made for further improvement in heat resistance of the sonde, in order to obtain the data. In the development of an analysis system, conducted were enhancement of operability of the planning/indication portions of the well drilling trajectory supporting system, improvement of the data intake system, etc. In relation to the well assessment supporting system, carried out were heightening of operability of the temperature analysis portion and confirmation of accuracy increase.
NTIS
Systems Engineering; Water; Project Management

20000066588 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
HSTSS Battery Development for Missile and Ballistic Telemetry Applications ***Final Report, Jul. 1998-Aug. 1999***
Burke, Lawrence W.; Bukowski, Edward; Newnham, Colin; Scholey, Neil; Hoge, William; May 2000; 37p; In English; Prepared in collaboration with Dynamic Science Inc., Aberdeen Proving Ground, MD, Ultralife Batteries Ltd, Abingdon, England and Ultralife Batteries, Inc., Newark, NY.
Contract(s)/Grant(s): Proj-1L162618AH80
Report No.(s): AD-A377288; ARL-MR-477; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The rapid growth in portable and wireless communication products has brought valuable advancements in battery technology. No longer is a battery restricted to a metal container in cylindrical or prismatic format. Today's batteries (both primary and secondary) can be constructed in thin sheets and sealed in foil/plastic laminate packages. Along with improvements in energy density, temperature performance, and environmentally friendly materials, these batteries offer greater packaging options at a significantly lower development cost. Under the Hardened Subminiature Telemetry and Sensor System (HSTSS) Program, these battery technologies have been further developed for high-g telemetry applications. Both rechargeable solid-state lithium-ion polymer and primary lithium manganese dioxide (Li/MnO2) batteries are being developed in conjunction with Ultralife Batteries, Inc. Prototypes of both chemistries have been successfully tested in a ballistic environment, while providing high constant rates of discharge, which is essential to these types of applications. Electrical performance and environmental data are reported.
DTIC
Lithium Batteries; Ballistics; Portable Equipment; Telemetry; Metal Ions; Cylindrical Bodies; Dioxides

45
ENVIRONMENT POLLUTION

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

20000062470 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
In Situ Measurements of the NO2/NO Ratio for Testing Atmospheric Photochemical Models
Jaegle, L., California Inst. of Tech., USA; Webster, C. R., Jet Propulsion Lab., California Inst. of Tech., USA; May, R. D., Jet Propulsion Lab., California Inst. of Tech., USA; Fahey, D. W., National Oceanic and Atmospheric Administration, USA; Woodbridge, E. L., National Oceanic and Atmospheric Administration, USA; Keim, E. R., National Oceanic and Atmospheric Administration, USA; Gao, R. S., National Oceanic and Atmospheric Administration, USA; Proffitt, M. H., National Oceanic and Atmospheric Administration, USA; Stimpfle, R. M., Harvard Univ., USA; Salawitch, R. J., Harvard Univ., USA; Geophysical Research Letters; Nov. 15, 1994; ISSN 0094-8534; Volume 21, No. 23, pp. 2555-2558; In English
Report No.(s): Paper 94GL02717; Copyright; Avail: Issuing Activity

Simultaneous in situ measurements of NO2, NO, O3, ClO, pressure and temperature have been made for the first time, presenting a unique opportunity to test our current understanding of the photochemistry of the lower stratosphere. Data were collected from several flights of the ER-2 aircraft at mid-latitudes in May 1993 during NASA's Stratospheric Photochemistry, Aerosols and

Dynamics Expedition (SPADE). The daytime ratio of NO2/NO remains fairly constant at 19 km with a typical value of 0.68 and standard deviation of +/- 0.17. The ratio observations are compared with simple steady-state calculations based on laboratory-measured reaction rates and modeled NO2 photolysis rates. At each measurement point the daytime NO2/NO with its measurement uncertainty overlap the results of steady-state calculations and associated uncertainty. However, over all the ER-2 flights examined, the model systematically overestimates the ratio by 40% on average. Possible sources of error are examined in both model and measurements. It is shown that more accurate laboratory determinations of the NO + O3 reaction rate and of the NO2 cross-sections in the 200-220 K temperature range characteristic of the lower stratosphere would allow for a more robust test of our knowledge of NO(x) photochemistry by reducing significant sources of uncertainties in the interpretation of stratospheric measurements. The present measurements are compared with earlier observations of the ratio at higher altitudes.
Author
Nitrogen; Oxygen; Photochemical Reactions; Atmospheric Models; Aerosols; Photolysis

20000062714 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 international cooperation project. Report on the results of the research on environmental harmony type combustion technology
Mar. 31, 1998; 282p; In Japanese; In English
Report No.(s): DE99-714266; ETDE/JP-99714266; No Copyright; Avail: Department of Energy Information Bridge

Out of the R and D on the environmental harmony type combustion technology, the results of the project carried out in fiscal 1997 were summed up. In the site survey, etc., visits were paid to France, Spain, Greek, Germany, the UK and the US to have discussions and examine the trend of research on the NOx removal catalyst and catalyst combustion. In the actual R and D, the R and D were conducted on zeolite base NOx removal catalyst, oxide composite base NOx removal catalyst, alumina base NOx removal catalyst, direct decomposition type NOx removal catalyst, catalyst combustion, etc. In the R and D of the catalyst combustion, durability under high gas flow flux was examined of PdO-Pt/Ba-Al203 catalyst developed for low temperature use, which indicated that durability and low temperature activity were heightened. As high temperature use catalyst, high temperature durability was examined of the developed Pd0-La/Gd-ZrO2 catalyst, which showed that the durability was favorable.
NTIS
International Cooperation; Combustion Control; Environment Protection

20000063374 Los Alamos National Lab., NM USA
US Department of Energy report 1996 LANL radionuclide air emissions
Jacobson, K. W.; Aug. 31, 1997; 48p; In English
Report No.(s): DE97-009280; LA-13353-ENV; No Copyright; Avail: Department of Energy Information Bridge

Presented is the Laboratory-wide certified report regarding radioactive effluents released into the air by the Los Alamos National Laboratory (LANL) in 1996. This information is required under the Clean Air Act and is being reported to the U.S. Environmental Protection Agency (EPA). The effective dose equivalent (EDE) to a hypothetical maximum exposed individual (MEI) of the public was calculated, using procedures specified by the EPA and described in this report. That dose was 1.93 mrem for 1996. Emissions of (sup 11)C, (sup 13) N, and (sup 15)O from a 1-mA, 800 MeV proton accelerator contributed over 92% of the EDE to LANL's MEI. Using CAP88, the EPA's dose assessment model, more than 86% of the total dose received by the MEI was via the air immersion pathway.
NTIS
Environment Protection; Radioactivity; Air Pollution; Emission; Pollution Monitoring; Radioactive Isotopes

20000063510 Environmental Protection Agency, National Exposure Research Lab., Research Triangle Park, NC USA
Modeling and Measurement of Real-Time CO Concentrations in Roadway Microenvironments
Singh, R. B.; Huber, A. H.; Braddock, J. N.; 2000; 22p; In English
Report No.(s): PB2000-105754; EPA/600/A-00/013; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The USA Environmental Protection Agency's National Exposure Research Laboratory has initiated a project to improve the methodology for modeling motor vehicle emissions from source through the pathway to human exposure. A real-time microscale automobile emission factor model for CO (MicroFacCO) virtually capturing all the information in the real world had been developed for USA vehicles. The goal is to use this CO model as a surrogate for other tailpipe air toxic emissions. The emission model is being used in conjunction with roadway dispersion models (e.g., CALINE4), and being evaluated in the roadways around Research Triangle Park, North Carolina in a range of traffic fleet and meteorological conditions. Modeled concentrations are being compared with measured concentrations inside a moving vehicle and parked vehicle along the roadside. This paper discusses the new emission model, demonstrates the use of the emission model in modeling roadway air concentrations through an example,

and discusses the issues and research needs for improving the methodology of modeling human exposures to mobile source emissions.
NTIS
Carbon Monoxide; Concentration (Composition); Atmospheric Composition; Air Pollution; Pollution Monitoring; Air Quality

20000063514 Environmental Protection Agency, National Exposure Research Lab., Research Triangle Park, NC USA
Characterization of Emissions from Handheld Two-Stroke Engines
Gabele, P. A.; 2000; 16p; In English
Report No.(s): PB2000-105753; EPA/600/A-00/012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Results reported in this paper were obtained using a facility that shares exhaust emission sampling and analytical systems with an adjacent automotive emissions test laboratory with an adjacent automotive emissions test laboratory. This enabled a comprehensive examination of emissions from three hand-held, two stroke, engines. In addition to the determination of routine regulated pollutant emission rates, organic emissions are speciated and particulate matter emission rates are measured. Each engine was tested using two fuels: 1990 Baseline Gasoline and a reformulated gasoline. One engine was run for an extended period to assess durability effects on exhaust emissions, and another was operated at a leaner air-fuel ratio setting to examine enleanment effects.
NTIS
Exhaust Emission; Variable Cycle Engines

20000063519 Georgia Inst. of Tech., School of Earth and Atmospheric Sciences, Atlanta, GA USA
Modeling and Data Analysis of SONEX Observations
Liu, Shaw C., Georgia Inst. of Tech., USA; [1997]; 3p; In English
Contract(s)/Grant(s): NAG2-1103; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Primary focus of the study is on the sources, photochemistry and transport of reactive nitrogen species, O3, as well as other O3 precursors such as NMHC and CO. Major objectives are: (1) Identify the major sources of NO(x) and quantify the contribution of each source to the NO(x) distribution in the free troposphere, particularly in the upper troposphere. (2) Understand the odd hydrogen photochemistry and the recycling of NO(x) in the free troposphere. (3) Evaluate the photochemical production and destruction of O3. A combination of modeling and data analysis/interpretation approach is used. We use a three-dimensional model and a box model to simulate, analyze, and interpret the observations. Both models are needed because they are complementary and each has its advantages and limitations. Proven analytical techniques, including correlation of NOx with various tracers and with different air masses, are applied to both observations and model results to deduce useful information toward accomplishing the objectives. In addition, the SONEX observations are compared and analyzed in a systematic way against other airborne experiments conducted over remote atmosphere, especially those from NASA GTE experiments, AASE 1 and 2, and SUCCESS. Author
Data Processing; Models; Nitrogen Oxides; Troposphere; Hydrogen; Photochemical Reactions

20000064548 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Monitoring of Volcanogenic CO2-Induced Tree Kills with AVIRIS Image Data at Mammoth Mountain, California
Hausback, Brian P., California State Univ., USA; Strong, Mel, California State Univ., USA; Farrar, Chris, Geological Survey, USA; Pieri, David, Jet Propulsion Lab., California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 221-222; In English; See also 20000064520; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Elevated cold CO2 emissions from the flank of Mammoth Mountain volcano on the southwest rim of the Long Valley Caldera, eastern California, have been the cause of over 100 acres of dead trees in that area since 1990. The source of the CO2 gas is thought to be from one or more magmatic intrusion(s) beneath Mammoth Mountain and is probably related to a period of seismic unrest that began in 1989. The gas rises to the surface probably from depths of a few kilometers, along faults and fracture zones. The gas is at ambient temperature and diffuses from the soil rather than discharging from distinct vents. Typically, soil gas concentrations in tree-kill areas range from 10% to over 90% CO2 by volume, as compared to normal background of is less than 1% in healthy forest. The gas composition is predominantly CO2 mixed with air (sulfur gases are not elevated), and C and He isotopic ratios are consistent with a magmatic origin for the gas. The total CO2 emission has been estimated at 1200 tons/day, comparable to the emissions at Kilauea. Some of the dead trees are as old as 250 years, suggesting that similar anomalous gas discharge has not occurred over the previous few hundred years. The delta C-13/12 ratio in the Mammoth Mountain CO2 emission averages about -4.5 (PDB standard). This is consistent with a mantle source for the carbon. However, the large volume of the emission suggests that not all of the CO2 is necessarily being generated from the 1989 intrusion. The voluminous gas could be leaking from

a vapor-rich zone, capped by an impermeable layer, that was supplied CO2 from degassing of many small magma bodies that intruded beneath the mountain over a period of decades or centuries. Earthquakes in 1989 could have fractured the capping layer and provided pathways for the escape of CO2 to the surface. Alternatively, some of the CO2 could be derived from contact metamorphism of carbonate rocks intruded by magma. Carbonate-bearing Paleozoic roof pendents crop out in close proximity to Mammoth Mountain. It is possible that similar rocks could occur at depth beneath Mammoth Mountain, and could have contributed CO2 from thermal decomposition caused from recent intrusions. We hope to determine the C-13/12 ratio of a suite of samples to demonstrate if the carbonate rocks could be the source of at least part of the 1990-97 CO2 emission. to better understand the behavior of the CO2 gas, we have used hyperspectral imagery data of Mammoth Mountain acquired from the Airborne Visual/Infrared Imaging Spectrometer (AVIRIS) to map out areas of dead trees. The areas of tree kill have increased in size from about 50 acres in 1994 to about 100 acres in 1997. Tree kill is the major surface manifestation of the carbon dioxide flux at Mammoth Mountain, is widely dispersed, and has been cursorily mapped by regular field mapping techniques in the area. Initial investigations using airborne digital imagery from the Thematic Mapper Simulator (NS001) and AVIRIS instruments have shown extremely encouraging results for complete delineation of the vegetation anomalies. The most successful maps (when compared with ground truth) were developed using AVIRIS data with spectral angle mapper and matched filter algorithms with a data set that was reduced to maximum variance via the minimum noise fraction transformation. The result of this work is a series of maps that show the tree kill areas occurring in an halo-pattern surrounding the base of Mammoth Mountain. We are applying these same techniques to earlier AVIRIS images of Mammoth Mountain to examine the progression of the tree kill areas over time. Temporal maps of the tree kill areas may assist in constructing a picture of the structure beneath Mammoth Mountain.
Author
Carbon Dioxide Concentration; Deforestation; Volcanology; Remote Sensing; Trees (Plants); Remote Sensors; Infrared Imagery; Thematic Mapping

20000064549 NASA Ames Research Center, Moffett Field, CA USA
Joint NASA/EPA AVIRIS Analysis in the Chesapeake Bay Region: Plans and Initial Results
Johnson, Lee, NASA Ames Research Center, USA; Stokely, Peter, Environmental Protection Agency, USA; Lobitz, Brad, JCWS, Inc., USA; Shelton, Gary, NASA Ames Research Center, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 223; In English; See also 20000064520; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

NASA's Ames Research Center is performing an AVIRIS demonstration project in conjunction with the U. S. Environmental Protection Agency (Region 3). NASA and EPA scientists have jointly defined a Study Area in eastern Virginia to include portions of the Chesapeake Bay, southern Delmarva Peninsula, and the mouths of the York and James Rivers. Several environmental issues have been identified for study. These include, by priority: 1) water constituent analysis in the Chesapeake Bay, 2) mapping of submerged aquatic vegetation in the Bay, 3) detection of vegetation stress related to Superfund sites at the Yorktown Naval Weapons Station, and 4) wetland species analysis in the York River vicinity. In support of this project, three lines of AVIRIS data were collected during the Wallops Island deployment on 17 August 1997. The remote sensing payload included AVIRIS, MODIS Airborne Simulator and an RC-10 color infrared film camera. The AVIRIS data were delivered to Ames from the JPL AVIRIS Data Facility, on 29 September 1997. Quicklook images indicate nominal data acquisition, and at the current time an atmospheric correction is being applied. Water constituent analysis of the Bay is our highest priority based on EPA interest and available collateral data, both from the surface and from other remote sensing instruments. Constituents of interest include suspended sediments, chlorophyll-a and accessory pigments, Analysis steps will include: verification of data quality, location of study sites in imagery, incorporation of relevant field data from EPA and other Chesapeake Bay cooperators, processing of imagery to show phenomenon of interest, verification of results with cooperators. by 1st quarter CY98 we plan to circulate initial results to NASA and EPA management for review. In the longer term we will finalize documentation, prepare results for publication, and complete any needed technology transfer to EPA remote sensing personnel.
Author
Chesapeake Bay (US); Data Acquisition; Remote Sensing; Wallops Island; Pigments; Water Sampling; Aquatic Plants; Plant Stress; Wetlands

20000064557 Geological Survey, Denver, CO USA
Environmental Study of the Bonanza Mining District, Colorado Using AVIRIS, Aircraft, Satellite, and Terrain Data
Livo, K. Eric, Geological Survey, USA; Watson, Ken, Geological Survey, USA; Knepper, Dan H., Jr., Geological Survey, USA; Hummer-Miller, Susanne, Geological Survey, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 261-267; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The objective of this study was to describe the mineralization, altered rock, and mining impacts on the environment of the Kerber Creek drainage within the Bonanza Mining District, Colorado, using several types of remotely sensed data. Several types of data sets were analyzed, including imagery, map data, and point data. These data were assembled into a coregistered database where features were correlated between layers visually and/or combined through masking.
Author
Remote Sensing; Mineral Deposits; Mines (Excavations); Drainage Patterns; Thematic Mapping

20000064665 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 report on the survey of biological CO2 fixation using arid land and oligotrophic waters
Mar. 31, 1998; 312p; In Japanese; In English
Report No.(s): DE99-714222; NEDO-GET-9701; No Copyright; Avail: Department of Energy Information Bridge
This survey is aimed to investigate various measures to be taken for biological CO2 fixation, to synthetically study feasibilities of the measures from various aspects of CO2 fixation mechanism, scale, speed, and environmental effects and technical problems in case of introducing those, and to assess the measures quantitatively. In this fiscal year, a study was proceeded with of possibilities of carbon fixation by afforestation and that by fertilization into ocean. The paper defined significance of afforestation in arid land, and especially advantages in conducting researches in West Australia. Relationships were examined among afforestation, precipitation and topography. The result of the survey was described of water- and salt-transfer simulation methods. Studies of arid land were made in terms of photosynthetic speed, transpiration speed, soil characteristics, measuring methods for precipitation and vaporization amount, and the examples. Seven places of Leonora where water source and water quality were examined were selected, and the measuring results were described. The paper summed up the state of utilization of biomass energy obtained from forest and commented on a scenario on tree-planting. Finally, a possibility was stated of the carbon fixation by fermentation into ocean.
NTIS
Carbon Dioxide; Photosynthesis; Environment Pollution

20000064666 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Survey report of FY 1997 on the trends of novel CO2 fixation technology using bacteria and microalgae
Mar. 31, 1998; 169p; In Japanese; In English
Report No.(s): DE99-714223; NEDO-GET-9702; No Copyright; Avail: Department of Energy Information Bridge
For this survey, the latest technology trends relating to microbial functions are summarized to recover and effectively utilize CO2, typical greenhouse effect gas, using microbial functions. Systematic survey and analysis are conducted concerning the microorganisms useful for fixing CO2, CO2 uptake mechanism during the microbial reactions, utilization methods of solar light and useful energy sources except solar light, highly efficient production of useful materials, and usage of produced useful materials. Research has concentrated on use of biological activities for this purpose through design of bioreactors using microorganisms (bacteria and microalgae) for efficient CO2 fixation. For the process to have net CO2 fixation as assessed by its life cycle and to make the process economically feasible, it is essential not only to fix CO2 merely in the form of biomass but in addition to convert it to useful materials by the catalytic activities of the organisms. Three categories were set for the survey, i.e., microorganisms with CO2 fixation ability, available energy for CO2 fixation, and target CO2 fixation products.
NTIS
Technology Assessment; Surveys; Trends; Carbon Dioxide

20000064719 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Response of ClO Radical Concentrations to Variations in NO2 Radical Concentrations in the Lower Stratosphere
Stimpfle, R. M., Harvard Univ., USA; Koplow, J. P., Harvard Univ., USA; Cohen, R. C., Harvard Univ., USA; Kohn, D. W., Harvard Univ., USA; Wennberg, P. O., Harvard Univ., USA; Judah, D. M., Harvard Univ., USA; Toohey, D. W., California Univ., USA; Avallone, L. M., California Univ., USA; Anderson, J. G., Harvard Univ., USA; Salawitch, R. J., Harvard Univ., USA; Geophysical Research Letters; Nov. 15, 1994; ISSN 0094-8534; Volume 21, No. 23, pp. 2543-2546; In English
Contract(s)/Grant(s): NAG1-1305; HSRP-92-659
Report No.(s): Paper-94GL02373; Copyright; Avail: Issuing Activity
The response of ClO concentrations to changes in NO2 concentrations has been inferred from simultaneous observations of [ClO], [NO], [NO2] and [O3] in the mid-latitude lower stratosphere. This analysis demonstrates that [ClO] is inversely correlated with [NO2], consistent with formation and photolysis of [ClONO2]. A factor of ten range in the concentration of NO2 was sampled (0.1 to 1 x 10(exp 9) mol/cc), with a comparable range in the ratio of [ClO] to total available inorganic chlorine (1% is less than

or equal to [ClO]/[Cl(sub y)] is less than or equal to 5%). This analysis leads to an estimate of [ClONO2]/[Cl(sub y)] = 0.12 (x/divided by 2), in the mid-latitude, lower-stratospheric air masses sampled.
Author
Chlorine Oxides; Nitrogen Dioxide; Radicals; Concentration (Composition)

20000064907 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Research and survey report of FY 1997 on the CO2 balance for high-temperature CO2 fixation and utilization technology
Mar. 31, 1998; 186p; In Japanese; In English
Report No.(s): DE99-714226; NEDO-GET-9706; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this research is to clarify the application condition and effectiveness of high-temperature CO2 fixation and utilization technology. To evaluate the present process, it was compared with others, such as separation using a polymer membrane, physico-chemical absorption process, adsorption process, hydrogen contact reduction process, and biological fixation. The development trends of absorption, membrane, adsorption, and cryogenic separation were investigated. The questionnaire was carried out about the separation technologies which are in the stage of performance test using actual gas, to arrange and compare the data and information. The current trends of chemical and biological CO2 fixation and utilization technology were also investigated for arranging the subjects. High-temperature CO2 disposal by the carbonation in concrete waste has been studied, to clarify its application conditions and effectiveness. In order to compare the separation technologies, treatment processes of CO2 in the exhaust gas from boilers of LNG power generation and coal fired power generation were simulated. These processes were simulated by ASPEN PLUS for the modeling. Trends of application of ASPEN PLUS and collection of information were surveyed by participating in the ASPEN WORLD.
NTIS
Surveys; Carbon Dioxide; Material Balance

20000064908 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Research report of fiscal 1997. Basic research on joint implementation for preventing global climate changes
Mar. 31, 1998; 148p; In Japanese; In English
Report No.(s): DE99-714235; NEDO-GET-9727; No Copyright; Avail: Department of Energy Information Bridge

Research was made to promote Activities Implemented Jointly Japan Program. Joint Implementation (JI) is the methodology for preventing global climate changes by collaboration of countries. The countries take cooperative actions for reduction, absorption and fixation of greenhouse gases, and effectively distribute the reduction credits among relevant parties. This was decided in the first session of the Conference of Parties (COP) held in March, 1995. In COP3, Japan's assigned reduction amount in 2008-2012 was determined as 6% of the emission level in 1990. The protocol defines JI between parties as dealings of emission reduction units, and JI between developing countries as clean development mechanism. The rules for a base line and credit distribution are necessary before full-scale implementation. Although JI is regarded as an important cost-effective project, it is important to decide where and how the JI projects should been promoted. The present state and issues of the primary approved project of Japan Program are arranged. In particular, various terms related to developing countries remain to be solved.
NTIS
Climatology; Climate Change

20000065667 National Renewable Energy Lab., Golden, CO USA
Origin of organic pollutants from the combustion of alternative fuels: Phase IV report
Taylor, P. H.; Dellinger, B.; Sidhu, S. K.; Jun. 30, 1997; 63p; In English
Report No.(s): DE97-007741; NREL/SR-540-23145; No Copyright; Avail: Department of Energy Information Bridge

As part of the US-DOE's on-going interest in the use of alternative automotive fuels, the University of Dayton Research Institute has been conducting research on pollutant emissions resulting from the combustion of candidate fuels. This research, under the direction and sponsorship of the NREL, has been concerned primarily with the combustion of compressed natural gas, liquefied petroleum gas (LPG), methanol, and ethanol. In the first 24 months of this program, studies of the oxygen rich, stoichiometric, and fuel-rich thermal degradation of these fuels in the temperature range of 300 to 1100 C at atmospheric pressure and for reaction times of 1.0 and 2.0 s were completed. Trace organic products were identified and quantified for each fuel as a function of temperature. The results of these studies agreed well with the results of tail-pipe emission studies in that the types and quantity of emissions measured in both the laboratory and engine tests were shown to be very similar under certain operating conditions. However, some chemicals were observed in the laboratory studies that were not observed in the engine studies and vice versa. This result is important in that it has implications concerning the origin of these emissions. Experiments concerning the NO perturbed oxidation of methanol, M85, ethanol, and E85 indicated the presence of complex oxidation chemistry. Comparison of flow reactor product

distributions with engine test results generally indicated improved comparisons when NO was added to the fuel. Analysis of secondary components of alcohol fuels resulted in some unexpected observations. Several previously unidentified species were observed in these experiments which may impact atmospheric reactivity assessments of these fuels.
NTIS
Combustion; Fuels; Exhaust Emission; Organic Compounds; Contaminants

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GEOPHYSICS

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

20000062462 California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA
Bridging Two Worlds: From the Archean to the Proterozoic ***Final Report, 1 Apr. 1999 - 31 Mar. 2000***
Schopf, J. William, California Univ., USA; [2000]; 9p; In English, 18-20 Feb. 1999, Los Angeles, CA, USA
Contract(s)/Grant(s): NAG5-8439; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

As now known, the Archean and Proterozoic appear to have been different worlds: the geology (tectonic style, basinal distribution, dominant rock types), atmospheric composition (O2, CO21, CH4), and surface environment (day-length, solar luminosity, ambient temperature) all appear to have changed over time. And virtually all paleobiologic indicators can be interpreted as suggesting there were significant biotic differences as well: (1) Stromatolites older than 2.5 Ga are rare relative to those of the Proterozoic; their biotic components are largely unknown; and the biogenicity of those older than approx. 3.2 Ga has been questioned. (2) Bona fide microfossils older than approx. 2.4 Ga are rare, poorly preserved, and of uncertain biological relations. Gaps of hundreds of millions of years in the known record make it impossible to show that Archean microorganisms are definitely part of the 2.4 Ga-to-present evolutionary continuum. and (3) In rocks older than approx. 2.2 Ga, the sulfur isotopic record is subject to controversy; phylogenetically distinctive bio-markers are unknown; and nearly a score of geologic units contain organic carbon anomalously light isotopically (relative to that of the Proterozoic and Phanerozoic) that may reflect the presence of Archaeans (”Archaebacteria of earlier classifications) but may not (since cellularly preserved Archean-age Archaeans have never been identified).
Derived from text
Atmospheric Composition; Classifications; Fossils; Geology; Microorganisms; Precambrian Period; Tectonics

20000062725 California Univ., San Diego, La Jolla, CA USA
Coseismic and Postseismic Deformations Associated with the 1992 Landers, California, Earthquake Measured by Synthetic Aperture Radar Interferometry
Price, Evelyn J., California Univ., San Diego, USA; 1999; 214p; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity

This dissertation focuses on using a relatively new technology called Synthetic Aperture Radar Interferometry (InSAR) to measure the displacements of the Earth’s surface during the coseismic and postseismic deformation phases of the 1992 Landers, California, earthquake. An introduction to InSAR and its application to movements of the Earth’s surface are given in Chapter 1. In Chapter 2, microwave remote sensing and the range-Doppler Synthetic Aperture Radar (SAR) processing algorithm are discussed. In Chapter 3, the ”phase gradient” method is used to map fractures and triggered slip on faults induced by the Landers earthquake. In Chapter 4, we investigate the vertical component of displacement on the Landers earthquake rupture and generate a coseismic vertical displacement map using a combination of InSAR displacement maps and elastic half-space modeling. In Chapter 5, we map displacements of the Earth’s surface during the postseismic phase of deformation using InSAR measurements and predict these displacements assuming that the deformation mechanism is after-slip in an elastic half-space. Chapter 6 lists the main conclusions of Chapters 3,4, and 5.
Author
Synthetic Aperture Radar; Seismology; Interferometry; Geological Faults; Fractures (Materials); Earthquakes; Displacement

20000062896 NASA Goddard Inst. for Space Studies, New York, NY USA
Influence of the Latitudinal Temperature Gradient on Soil Dust Concentration and Deposition in Greenland
Tegen, Ina, Columbia Univ., USA; Rind, David, NASA Goddard Inst. for Space Studies, USA; [2000]; 28p; In English
Contract(s)/Grant(s): NOAA-NA-56GP0450
Report No.(s): GCN-00-10; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To investigate the effects of changes in the latitudinal temperature gradient and the global mean temperature on dust concentration in the Northern Hemisphere, experiments with the Goddard Institute for Space Studies General Circulation Model (GISS GCM) are performed. The dust concentration over Greenland is calculated from sources in central and eastern Asia, which are integrated on-line in the model. The results show that an increase in the latitudinal temperature gradient increases both the Asian dust source strength and the concentration over Greenland. The source increase is the result of increased surface winds, and to a minor extent, the increase in Greenland dust is also associated with increased northward transport. Cooling the climate in addition to this increased gradient leads to a decrease in precipitation scavenging, which helps produce a further (slight) increase in Greenland dust in this experiment. Reducing the latitudinal gradient reduces the surface wind and hence the dust source, with a subsequent reduction in Greenland dust concentrations. Warming the climate in addition to this reduced gradient leads to a further reduction in Greenland dust due to enhanced precipitation scavenging. These results can be used to evaluate the relationship of Greenland ice core temperature changes to changes in the latitudinal and global temperatures.
Author
Deposition; Greenland; Soils; Temperature Gradients; Dust; Atmospheric General Circulation Models; Asia; Latitude

20000064052 Indiana Univ., Dept. of Geological Sciences, Bloomington, IN USA
Innovative Seismic Array Analysis for Studies of Wave Propagation in the Earth ***Final Report, 1 May 1995 - 30 Apr. 1999***
Pavlis, Gary L.; Apr. 30, 1999; 44p; In English
Contract(s)/Grant(s): F49620-95-1-0366
Report No.(s): AD-A376283; AFRL-SR-BL-TR-00-0144; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
We have developed a new seismic array data processing method to produce slowness vector estimates and an objective measure of their uncertainties in tile form of statistical confidence intervals. The slowness vector, which is typically transformed into bearing and velocity, is a key parameter used for identifying seismic phases and for event source location. Our method, multi-wavelet beamforming, is closely related to both time-domain and frequency-domain beamforming. The major advantage of multi-wavelet beamforming is that it produces multiple estimates of the slowness vector that are approximately statistically independent. First, a set of wavelet transforms is applied to the data in a manner analogous to the use of the windowed Fourier transform. Next, for each wavelet transform, we calculate semblance, a measure of signal coherence, for a range of possible slowness vectors. Then, the slowness vector estimate associated with that transform is the vector that produces the largest semblance value. The multiple slowness vector estimates can be treated as samples from a probability distribution, whose ”center” we estimate using the mean, the median, and an M-estimator. Uncertainty intervals are calculated for these estimators by applying the jackknife statistical method. The intervals for the mean estimator appear to be true statistical confidence intervals, but the estimates can be biased by a directional noise field in low signal-to-noise circumstances. The median estimates are less biased by a directional noise field, but sometimes underestimate the uncertainty. The M-estimator produces less-biased estimates while appearing to estimate correctly their uncertainty.
DTIC
Seismology; Data Processing; Antenna Arrays; Beamforming

20000064068 Scripps Institution of Oceanography, Cecil H. and Ida M. Green Inst. of Geophysics and Planetary Physics, La Jolla, CA USA
One Century of Tectonic Deformation Along the Sumatran Fault from Triangulation and GPS Surveys
Prawirodirdjo, L., Scripps Institution of Oceanography, USA; Bock, Y., Scripps Institution of Oceanography, USA; Genrich, J. F., Scripps Institution of Oceanography, USA; Puntodewo, S. S. O., Badan Koordinasi Survey dan Permetaan Nasional, Indonesia; Rais, J., Badan Koordinasi Survey dan Permetaan Nasional, Indonesia; Subarya, C., Badan Koordinasi Survey dan Permetaan Nasional, Indonesia; Sutisna, S., Badan Koordinasi Survey dan Permetaan Nasional, Indonesia; May 04, 2000; 52p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAGW-2641; NSF EAR-88-17067; NSF EAR-90-04376; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
An analysis combining historical triangulation and recent Global Positioning System (GPS) survey measurements in West and North Sumatra, Indonesia, reveals a detailed slip history along the central part of the Sumatran Fault. The arc-parallel components of the combined velocity field are consistent with slip rates inferred from GPS data, ranging from 23 to 24 mm/yr. Between 1.0 S and 1.3 N the Sumatran Fault appears to be characterized by deep locking depths, on the order of 20 km, and the occurrence of large (M (sub w) approximately 7) earthquakes. The long-term (1883-1993) strains show simple right-lateral shear, with rates similar to GPS-measured, 1989-1993 strain rates. Coseismic deformation due to the 1892 Tapanuli and 1926 Padang Panjang earthquakes, estimated from triangulation measurements taken before and after the events, indicate that the main shocks were significantly larger than previously reported. The 1892 earthquake had a likely magnitude of M (sub w) approximately equal to

7.6, while the 1926 events appear to be comparable in size to the subsequent (M approximately 7) 1943 events, and an order of magnitude higher than previously reported.
Author
Deformation; Global Positioning System; Tectonics; Triangulation; Geodetic Surveys; Indonesia

20000064087 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Capabilities and Limitations of Radio Occultation Measurements for Ionosphere Monitoring
Hajj, G. A., Jet Propulsion Lab., California Inst. of Tech., USA; Romans, L. J., Jet Propulsion Lab., California Inst. of Tech., USA; Pi, X., Jet Propulsion Lab., California Inst. of Tech., USA; Wang, Chunming, University of Southern California, USA; [1999]; 20p; In English; LEO Missions, 9-11 Mar. 1999, Potsdam, Germany; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper: (1) describes the range of capabilities of GPS radio occultation missions in ionospheric research: (a) ionospheric profiling; (b) ionospheric imaging; (c) ionospheric data assimilation; and (d) measurement of scintillation. (2) Identify strengths and weaknesses of measurements: (a) coverage; (b) resolution; and (c) uniqueness of solution.
Derived from text
Global Positioning System; Imaging Techniques; Ionospheric Propagation

20000064521 Arizona Univ., Soil, Water, and Environmental Science Dept., Tucson, AZ USA
Using Mixture Analysis for Soil Information Extraction from an AVIRIS Scene at the Walnut Gulch Experimental Watershed-Arizona
Accioly, L., Arizona Univ., USA; Huete, A. R., Arizona Univ., USA; Batchily, K., Arizona Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 1-7; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Due to its ubiquitous presence, soil is present in almost all applications of image-based spectral mixture analysis (SMA). In many studies, however, most of the interest is given to the fraction of the vegetation endmember and its relationship to plant biophysical parameters. One of the few examples of the application of mixture analysis directly to soil is given by Huete and Escadafal (1991). These authors used SMA for soil biophysical information extraction in the region from 400 to 900 nm. They found that the variability of 46 soils from different types of environments could be explained by four independent basis curves, which in linear combination were able to reconstitute the experimental data set. These authors, however, did not use spectral mixture analysis to produce soil spectral maps. Mixture analysis can be applied on the basis of spectra extracted from the image (image endmembers) and/or on the basis of pure spectra from lab of field (reference endmembers). When the spatial variability within a pixel is high, as in a semiarid scrubland, mixture analysis on the basis of image endmembers has been shown more accurate than maximum likelihood supervised classification. The general objective of this study was to derive soil spectral maps of an AVIRIS scene at the Walnut Gulch Experimental Watershed using mixture analysis. The specific objectives are to: (a) evaluate the dimensionality of AVIRIS data (i.e., how many endmembers); (b) find the physical meaning of the dimensions (i.e., what feature in the ground each endmember represents); and (c) determine the spatial abundances of the endmembers throughout the AVIRIS scene of the Walnut Gulch Experimental Watershed.
Derived from text
Image Analysis; Soil Mapping; Spectrum Analysis; Remote Sensing; Infrared Spectrometers

20000064522 Spectral Sciences, Inc., Burlington, MA USA
FLAASH, A MODTRAN4 Atmospheric Correction Package for Hyperspectral Data Retrievals and Simulations
Adler-Golden, S., Spectral Sciences, Inc., USA; Berk, A., Spectral Sciences, Inc., USA; Bernstein, L. S., Spectral Sciences, Inc., USA; Richtsmeier, S., Spectral Sciences, Inc., USA; Acharya, P. K., Spectral Sciences, Inc., USA; Matthew, M. W., Spectral Sciences, Inc., USA; Anderson, G. P., Phillips Lab., USA; Allred, C. L., Phillips Lab., USA; Jeong, L. S., Phillips Lab., USA; Chetwynd, J. H., Phillips Lab., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 9-14; In English; See also 20000064520
Contract(s)/Grant(s): F19628-91-C-0145; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

FLAASH (Fast Line-of-sight Atmospheric Analysis of Spectral Hypercubes) is a MODTRAN-based ”atmospheric correction” software package which is being developed by the Air Force Phillips Laboratory, Hanscom AFB and Spectral Sciences, Inc. to support current and planned IR-visible-UV hyperspectral and multispectral sensors. The main objectives are to provide (1) accurate, physics-based derivation of surface and atmospheric properties (such as surface albedo, surface altitude, water vapor column, aerosol and cloud optical depths, surface and atmospheric temperatures), (2) minimal computation time requirements, and (3) an interactive, user-friendly interface for running arbitrary MODTRAN calculations. FLAASH is written in the Interactive

Data Language (IDL) for compatibility with a wide variety of computer platforms and to facilitate its use with IDL-based display/analysis software such as ENVI. FLAASH draws heavily on existing spectral analysis methods and codes that have been developed for both research and general use. It is designed as a general-purpose code and is being developed in parallel with upgrades to MODTRAN in order to take advantage of the latest improvements in accuracy and speed. FLAASH is currently interfaced with a pre-release version of MODTRAN4. This paper briefly describes the progress achieved to date in the code development and presents some preliminary results.
Derived from text
Atmospheric Correction; Applications Programs (Computers); Data Simulation; Spectrum Analysis; Data Retrieval

20000064531 Geological Survey, Reston, VA USA
Hazard Characteristics of Hydrothermally Altered Rocks on Stratovolcanoes: A Remote Sensing Framework for Debris Flow Hazard Assessments
Crowley, J. K., Geological Survey, USA; Mars, J. C., Geological Survey, USA; Zimbelman, D. R., Colorado Univ., USA; Finn, C. A., Geological Survey, USA; Rye, R. O., Geological Survey, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 77-78; In English; See also 20000064520; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Among the most devastating volcanic phenomena are large rock avalanches and debris flows that begin high on a volcano and surge for many tens of kilometers down the surrounding river valleys. Such events are closely linked to the presence and distribution of hydrothermally altered rocks, which serve both to weaken a volcanic edifice, and to produce clay-rich mudflows that travel especially long distances. For example, the Osceola Mudflow, which occurred approximately 5000 years ago, removed some 3 cu km of rock from the summit of Mount Rainier, and traveled over 100 km downstream to Puget Sound. Catastrophic collapse events are not always triggered by eruptive activity, and many events appear to have taken place essentially without warning. Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) data acquired over nine Cascade stratovolcanoes have proven useful for mapping altered rocks based on associated clay and hydrous sulfate mineral spectral properties. These data, coupled with digital elevation models and ground-based mapping information, indicate that particular geomorphic features, including volcanic summits, ridges, amphitheaters, and breached craters, have distinctive hazard characteristics. For example, intensely altered summit rocks, present on Mount Rainier, Mount Adams, and Mount Shasta, have the potential to generate extremely large debris flows affecting any volcanic sector, i.e., the direction of flow is not constrained by the topography. In contrast, where altered rocks occur within breached craters, (e.g., Mount Baker, Mount Saint Helens, and Mount Hood), avalanches and debris flows are more likely to be constrained to the breach direction. Isolated ridges of altered rock would ordinarily be capable of generating flows of limited volume. However, where a ridge is contiguous to an altered summit, relatively small ridge failures might trigger a much larger summit collapse. Amphitheaters (arcuate cliffs) composed of altered rock are important debris flow source areas, and can be distinguished from glacial cirques, which have a similar morphology, but different spectral characteristics. Amphitheaters seen on AVIRIS imagery of Mount Rainier and Mount Adams may signify preferred azimuths for major edifice failures. Amphitheaters also are a source of frequent smaller avalanches and debris flows, including an event at Mount Adams during 1997. At least three distinct types of altered rock have been recognized with the Cascades AVIRIS imagery, including advanced argillic (sulfate-clay) and argillic (clay-silica) mineral assemblages in the Quaternary volcanics, and chlorite-quartz-sericite assemblages in surrounding Tertiary rocks. Although the lower rank argillic and Tertiary chlorite-quartz-sericite alteration forms may not be associated with large collapse events, their role as source areas merits further study. by examining the mineralogy of debris flow deposits and possible source rocks in a given watershed, it may be possible to link source areas with individual debris flows. This would aid in establishing how local structures and source mineralogy influence debris flow generation, and shape the size and sedimentological character of flows. The combination of spatial and spectral information afforded by AVIRIS imagery provides a basic framework for making debris flow hazard assessments. Studies of the Cascade volcanoes will aid in extending this type of analysis globally as advanced satellite remote sensing data become available in the next decade.
Derived from text
Volcanology; Mineral Deposits; Imaging Spectrometers; Remote Sensing; Infrared Spectroscopy; Hydrothermal Systems

20000064559 Arizona Univ., Lunar and Planetary Lab., Phoenix, AZ USA
Analysis of Volcanic Fields Near Popocatepetl, Mexico, from AVIRIS Data
Mere'nyi, Erzse'bet, Arizona Univ., USA; Penn, Brian S., Texas Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 273-274; In English; See also 20000064520; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We investigate the compositional distribution of tephras over a volcanic field approximately 50 km south of Popocate'petl. The surface mineralogy is expected to reveal some of the eruptive history of the field. AVIRIS was flown over this area on November 23, 1994. The resulting 224-band image has been provided for us by Dr. Harold Lang of JPL. Popocate'petl (5452 m) is a stratovolcano located 60 km SE of Mexico City in the eastern portion of the WNW trending 1,000 km long Trans-Mexican Volcanic Belt (TMVB). The presence of three successive debris-avalanche deposits fanning southward documents the previous existence of other large volcanic edifices destroyed by gravitational collapse. The present cone consists of inter-layered lavas and pyroclastic deposits of intermediate to silicic composition. Such volcanoes usally result in violent phreato-magmatic eruptions (e.g., Mt. Saint Helens), due to the viscous nature of the magmas, which also tends to restrict lava flows to within a few kilometers of the vent. Ash-flow and/or air-fall deposits, on the other hand, can spread very far. Small cinder cones of more basic composition were also found east and west of Popocate'petl. During the last 20,000 years, at least seven Plinian eruptions occurred near Popocate'petl, producing pumice-fall and ash-flow deposits as far away as Mexico City. The volcanic field in our AVIRIS image has presumably preserved a lot of the dynamic geologic history related to Popocate'petl and other volcanoes active in the past in the TMVB. VIS-NIR reflectance spectrometry is very sensitive to different extents of alteration in basaltic tephras. AVIRIS images can potentially differentiate between many stages of alteration between highly palagonitized tephras and unaltered ones because of the high spectral resolution. This is partly due to the fact that many volcanic products (e.g., basaltic tuffs) have not one characteristic mineral with an associated absorption feature that can be used to map their distribution. The overall shapes of the reflectance spectra have proven more diagnostic, which hyperspectral images provide in great detail. Using the power of AVIRIS-class imagery it is possible, for example, to look for multiple hydroclastic and/or dry vents and try to reconstruct the eruptive/hydrologic history of the volcanic field. Relatively few works have dealt so far with the detection of either active or inactive volcanic features from AVIRIS data. Hot spots and gas emanations were investigated by, e.g., Oppenheimer et al. (1993), DeJong et al. (1996). Thorough analysis of compositional distribution of tephras has been done for the Lunar Crater Volcanic Field in a number of works by Farrand and co-workers. We will present a detailed spectral classification of the volcanic field near Popocate'petl and attempt mineralogic interpretation based on earlier works and laboratory spectra. In a subsequent phase, field work is also planned, which will help interpretation. It will also further refine our knowledge of reflectance spectra of pyroclastic and hydroclastic volcanic products and their recognition from AVIRIS images.
Author
Volcanology; Spectrum Analysis; Magma; Mineralogy; Remote Sensing; Mexico; Volcanoes; Reflectance; Spectroscopy

20000064573 Geological Survey, Denver, CO USA
Using Imaging Spectroscopy to Better Understand the Hydrothermal and Tectonic History of the Cuprite Mining District, Nevada
Swayze, Gregg A., Geological Survey, USA; Clark, Roger N., Geological Survey, USA; Goetz, Alex F. H., Colorado Univ., USA; Livo, K. Eric, Geological Survey, USA; Sutley, Steven S., Geological Survey, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 383-384; In English; See also 20000064520; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The Cuprite area consists of two acid-sulfate hydrothermal alteration centers straddling U.S. Highway 95 in southwestern Nevada. Alteration in the hydrothermal centers involves Tertiary volcanic rocks in the eastern center and Cambrian metasedimentary rocks in the western center. The purpose of this study was to determine if these late-Miocene hydrothermal centers developed independently or whether they were created by lystric-faulting of a single conduit along an east-dipping detachment that moved the cooler upper portion of the system to the east relative to the hotter lower portion. The answer has implications for mineral exploration. Geology of the area was studied using imaging spectroscopy, isotopic dates, geologic maps, drill hole data, and D-C resistivity soundings.
Derived from text
Remote Sensing; Imaging Spectrometers; Spectroscopy; Hydrothermal Systems; Tectonics; Nevada

20000064574 Geological Survey, Denver, CO USA
Using Imaging Spectroscopy to Cost-Effectively Locate Acid-Generating Minerals at Mine Sites: An Example from the California Gulch Superfund Site in Leadville, Colorado
Swayze, Gregg A., Geological Survey, USA; Clark, Roger N., Geological Survey, USA; Smith, Kathleen S., Geological Survey, USA; Hageman, Philip L., Geological Survey, USA; Sutley, Stephen J., Geological Survey, USA; Pearson, Ronald M., Bureau of Reclamation, USA; Rust, Gary S., ISSI, Inc., USA; Briggs, Paul H., Geological Survey, USA; Meier, Allen L., Geological Survey, USA; Singleton, Michael J., Washington Univ., USA; Roth, Shelly, Geological Survey, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 385-389; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Leadville mining district, located at an elevation of 3000 in in the Central Colorado Rockies, has been mined for gold, silver, lead and zinc for more than 100 years. This activity has resulted in the dispersal of waste rock and tailings, rich in pyrite and other sulfides, over a 30 km area including the city of Leadville. Oxidation of these sulfides releases lead, arsenic, cadmium, silver, and zinc into snowmelt and thunderstorm runoff, which drains into the Arkansas River, a main source of water for Front Range urban centers and agricultural communities. The U.S. Environmental Protection Agency (EPA), U.S. Bureau of Reclamation (USBR), contractors, and responsible parties are remediating the mined areas to curtail further releases of heavy metals into various drainage tributaries of the Arkansas River. Mineral maps made by the U.S. Geological Survey (USGS) from AVIRIS data collected over this mining district were used to focus remediation efforts by locating the point sources of acid drainage.
Derived from text
Environmental Cleanup; Geological Surveys; Spectroscopy; Remote Sensing; Mines (Excavations); Water Runoff; Colorado

20000065652 Scripps Institution of Oceanography, Inst. of Geophysics and Planetary Physics, La Jolla, CA USA
Distribution of Slip at the Northern Sumatran Fault System
Genrich, J. F., Scripps Institution of Oceanography, USA; Bock, Y., Scripps Institution of Oceanography, USA; McCaffrey, R., Rensselaer Polytechnic Inst., USA; Prawirodirdjo, L., Scripps Institution of Oceanography, USA; Stevens, C. W., Rensselaer Polytechnic Inst., USA; Puntodewo, S. S. O., Badan Koordinasi Survey dan Permetaan Nasional, Indonesia; Subarya, C., Badan Koordinasi Survey dan Permetaan Nasional, Indonesia; Wdowinski, S., Tel-Aviv Univ., Ramat-Aviv, Israel; May 04, 2000; 33p; In English
Contract(s)/Grant(s): NAGW-2641; NSF EAR-88-17067; NSF EAR-90-04376; NSF EAR-89-08759; NSF EAR-91-14349
Report No.(s): Paper 1999JB990253; Copyright; Avail: Issuing Activity
We model spatial variations in horizontal displacements of 117 geodetic sites measured during annual surveys in 1989-1996 with the Global Positioning System (GPS) as elastic strain across a locked strike-slip fault to infer the contemporary slip rate, locking depth, and location of the Sumatran fault (SF) in northern Sumatra (1 S-3 N). GPS-derived slip rate estimates increase slightly northward from 23 plus or minus 3 mm/yr at 0.8 deg S to 26 plus or minus 2mm/yr at 2.7 N. They agree with geologic estimates north of the Equator, but at 0.5 S they are about 10 mm/yr higher. Strain appears to be distributed asymmetrically about the fault. South of 2 N, about 5 mm/yr of shear is required within the offshore forearc, west of the fault, to achieve a closer agreement of fault locations inferred from GPS velocities with geologically identified traces of the SF. Locking depth estimates are on the order of 10-20 km. The western branch of the major fault bifurcation near 1 N slips at a rate five times higher than the eastern branch. The two main strands of the fault at the northwestern tip of Sumatra (5.5 N) appear to be nearly free of horizontal strain; significant slip must occur away from the two strands, probably further east at two other geologically active branches. The Banda Aceh embayment is extruded to the northwest at a rate of 5 plus or minus 2 mm/yr. Within the estimated velocity uncertainties of several mm/yr, fault-normal deformation along the SF is insignificant. Almost strain free, the northern part of the back-arc basin is part of a rigid Sunda shelf, while the northern forearc is subjected to 8 plus or minus 5 x 10 (exp -8)/yr of extension nearly parallel to the arc.
Author
Geodesy; Annual Variations; Geodetic Surveys; Geological Faults; Spatial Distribution

20000066617 Naval Research Lab., Command Control Communications Computers and Intelligence, Washington, DC USA
Notes On Improved Exponential Troposphere Model *Final Report*
Choi, Junho; Kwak, Sung; Apr. 17, 2000; 42p; In English
Report No.(s): AD-A377195; NRL/MR/8140--00-8450; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Atmospheric data extraction and processing procedures are presented for four different Databases: ECM, HIRAS, MRF, and FNL. Details of database utility are described for application of geolocation measure and semi-major/semi-minor axis EEP plot generation with miss-distance calculation procedure. New improved Exponential troposphere model algorithm has great utility reducing in processing time as well as improving geolocation accuracy by more than 50% for both performance and speed with storage requirements of databases.
DTIC
Troposphere; Data Bases; Signal Processing; Miss Distance

20000067644 NASA Marshall Space Flight Center, Huntsville, AL USA
Multiple Satellite Observations of High-Latitude Ionospheric Outflows
Horwitz, J., NASA Marshall Space Flight Center, USA; Zeng, W., NASA Marshall Space Flight Center, USA; Stevenson, B. A., NASA Marshall Space Flight Center, USA; Wu, X.-Y., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Craven, Paul D., NASA Marshall Space Flight Center, USA; Rich, F. J., NASA Marshall Space

Flight Center, USA; Moore, T. E., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 1st; 1st S-RAMP Conference, 4 Oct. 2000, Sapporo, Japan; No Copyright; Avail: Issuing Activity; Abstract Only

We will present reported observations of up- and down-flows of topside ionospheric thermal plasmas from multiple near-simultaneous tracks through the high-latitude topside ionosphere. From several Southern polar passes, it has been possible to construct plots of field-aligned flows of O+ observed by the Thermal Ion Dynamics Experiment(TIDE) on the POLAR spacecraft near 5000 km altitude together with vertical ion flow observations from one or more DMSP spacecraft near 800 km altitude. We will also involve simulations from our Dynamic Fluid-Kinetic(DyFK) modeling of polar plasma transport and display resulting altitude profiles of ion parallel velocities and densities, and overlay those profiles with the ”conjunction” measurements by DMSP(800 km) and POLAR(approx. 5000 km altitude). We also will present simultaneous observations of POLAR auroral UVI images with field-aligned flows.

Author

Satellite Observation; Thermal Plasmas; Auroras; Ionospheres

20000067657 Texas A&M Univ., Dept. of Atmospheric Sciences, College Station, TX USA

Transport and Mixing in the Stratosphere and Troposphere

Bowman, Kenneth P., Texas A&M Univ., USA; [2000]; 3p; In English

Contract(s)/Grant(s): NAG1-1896; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Long-term changes in the composition of the atmosphere are known to have significant effects on atmospheric chemistry and stratospheric ozone. Increasing levels of greenhouse gases have the potential to change the global climate in the middle and upper atmospheres, as well as in the troposphere. Volcanic eruptions, El Nino events, and other natural variations can also cause changes in atmospheric composition and climate. Whether the causes are natural or manmade, changes in the global climate system can have impacts on human society. In order to understand and predict the consequences of these changes, and of control measures such as the Montreal Protocol, it is necessary to understand the complex interactions between radiation, chemistry, and dynamics in the atmosphere. Much of the uncertainty in our understanding of atmospheric processes comes from an incomplete understanding of atmospheric transport. A complete and self-consistent model of transport requires not only an understanding of trace-species transport, but also the transport of dynamically active quantities such as heat and potential vorticity. Therefore, the goal of the proposed research is to better understand large-scale transport and mixing processes in the middle atmosphere and troposphere.

Author

Atmospheric Composition; Upper Atmosphere; Stratosphere; Troposphere; Atmospheric Chemistry; Climatology

20000067672 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Antarctic Rebound and the Time-Dependence of the Earth’s Shape

Ivins, Erik R., Jet Propulsion Lab., California Inst. of Tech., USA; James, Thomas S., Geological Survey of Canada, Canada; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Great strides have been made during the past 30 years in refining models of the last global glaciation. The refinements draw upon a vastly expanded relative sea level and sedimentary core record. Furthermore, we now possess a sharpened understanding of the mechanisms that drive climate changes associated with deglaciation. Some 15 years ago, using only 5.5 years of ranging data, analyses of the drift in LAGEOS I node acceleration was used to infer that postglacial rebound was responsible for a secular change in the Earth’s ellipsoidal shape (Yoder et al., .1983]. Today there exists a wealth of geodynamics satellite orbit data that constrain the secular time-dependence of the Earth’s shape and low order gravity field, which includes mass redistribution from present-day glacier and great ice sheet imbalance and from postglacial rebound. We have shown that an unambiguous determination of the secular variation in the Earth’s pear shaped harmonic ($l = 3$, $m = 0$) might provide information that bears on the present-day mass balance of Antarctica. This issue is revisited in light of new constraints on glacial loading during the late-Pleistocene and Holocene. An especially critical issue for the interpretation of secular odd degree zonal harmonics, $l = 3$ to 7, is the timing and magnitude of the deglaciation of Antarctica from Last Glacial Maximum. We explore ways in which the recovery of secular variation in both zonal and non-zonal harmonics for $l = 2$ through 7 can improve constraints on both rebound and present-day ice sheet balance.

Author

Glaciers; Secular Variations; Time Dependence; Climate Change; Glaciology; Zonal Harmonics

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METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification

20000062469 ENSCO, Inc., Applied Meteorology Unit, Cocoa Beach, FL USA
Improved Anvil Forecasting *Final Report*
Lambert, Winifred C., ENSCO, Inc., USA; May 2000; 32p; In English
Contract(s)/Grant(s): NAS10-96018
Report No.(s): NASA/CR-2000-208573; NAS 1.26:208573; Rept-00-002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the outcome of Phase 1 of the AMU's Improved Anvil Forecasting task. Forecasters in the 45th Weather Squadron and the Spaceflight Meteorology Group have found that anvil forecasting is a difficult task when predicting LCC and FR violations. The purpose of this task is to determine the technical feasibility of creating an anvil-forecasting tool. Work on this study was separated into three steps: literature search, forecaster discussions, and determination of technical feasibility. The literature search revealed no existing anvil-forecasting techniques. However, there appears to be growing interest in anvils in recent years. If this interest continues to grow, more information will be available to aid in developing a reliable anvil-forecasting tool. The forecaster discussion step revealed an array of methods on how better forecasting techniques could be developed. The forecasters have ideas based on sound meteorological principles and personal experience in forecasting and analyzing anvils. Based on the information gathered in the discussions with the forecasters, the conclusion of this report is that it is technically feasible at this time to develop an anvil forecasting technique that will significantly contribute to the confidence in anvil forecasts.
Author
Technology Assessment; Feasibility Analysis; Forecasting; Predictions; Computer Systems Simulation

20000063498 NASA Goddard Space Flight Center, Greenbelt, MD USA
Effect of Combined Spaceborne Microwave and Continuous Lightning Measurements on Precipitation Forecasts of the 1998 Ground-Hog Day Storm
Weinman, James A., NASA Goddard Space Flight Center, USA; Chang, Dong-Eon, Universities Space Research Association, USA; Morales, Carlos A., Connecticut Univ., USA; [2000]; 2p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We evaluated the impact of several newly available sources of meteorological data on mesoscale model forecasts of precipitation produced by the extra-tropical cyclone that struck Florida on February 2, 1998. Precipitation distributions of convective rainfall events were derived from Special Sensor Microwave Imager (SSM/I) and Multi-Channel Passive Microwave Sensor (TMI) microwave radiometric data by means of the Goddard PROFiling (GPROF) algorithm. Continuous lightning distributions were obtained from sferics measurements obtained from a network of VLF radio receivers. Histograms of coincident sferics frequency distributions were matched to those of precipitation to derive bogus convective rainfall rates from the continuously available sferics measurements. SSM/I and TMI microwave data were used to derive Integrated Precipitable Water (IPW) distributions. The TMI also provided sea surface temperatures (SSTS) of the Loop Current and Gulf Stream with improved structural detail. A series of experiments assimilated IPW and latent heating from the bogus convective rainfall for six-hours in the MM5 mesoscale forecast model to produce nine-hour forecasts of all rainfall as well as other weather parameters. Although continuously assimilating latent heating only slightly improved the surface pressure distribution forecast, it significantly improved the precipitation forecasts. Correctly locating convective rainfall was found critical for assimilating latent heating in the forecast model, but measurement of the rainfall intensity proved to be less important. The improved SSTs also had a positive impact on rainfall forecasts for this case. Assimilating bogus rainfall in the model produced nine-hour forecasts of radar reflectivity distributions that agreed well with coincident observations from the TRMM spaceborne precipitation radar, ground based radar and spaceborne microwave measurements.
Author
Lightning; Meteorological Radar; Microwave Radiometers; Precipitation (Meteorology); Weather Forecasting; Mesometeorology; Radar Measurement; Rainstorms

20000063521 ENSCO, Inc., Applied Meteorology Unit, Cocoa Beach, FL USA
IRIS Product Recommendations *Final Report*
Short, David A., ENSCO, Inc., USA; March 2000; 28p; In English
Contract(s)/Grant(s): NAS10-96018
Report No.(s): NASA/CR-2000-208572; NAS 1.26:208572; Rept-00-001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents the Applied Meteorology Unit's (AMU) evaluation of SIGMET Inc.'s Integrated Radar Information System (IRIS) Product Generator and recommendations for products emphasizing lightning and microburst tools. The IRIS Product Generator processes radar reflectivity data from the Weather Surveillance Radar, model 74C (WSR-74C), located on Patrick Air Force Base. The IRIS System was upgraded from version 6.12 to version 7.05 in late December 1999. A statistical analysis of atmospheric temperature variability over the Cape Canaveral Air Force Station (CCAFS) Weather Station provided guidance for the configuration of radar products that provide information on the mixed-phase (liquid and ice) region of clouds, between 0 C and -20 C. Mixed-phase processes at these temperatures are physically linked to electrification and the genesis of severe weather within convectively generated clouds. Day-to-day variations in the atmospheric temperature profile are of sufficient magnitude to warrant periodic reconfiguration of radar products intended for the interpretation of lightning and microburst potential of convectively generated clouds. The AMU also examined the radar volume-scan strategy to determine the scales of vertical gaps within the altitude range of the 0 C to -20 C isotherms over the Kennedy Space Center (KSC)/CCAFS area. This report present's two objective strategies for designing volume scans and proposes a modified scan strategy that reduces the average vertical gap by 37% as a means for improving radar observations of cloud characteristics in the critical 0 C to -20 C layer. The AMU recommends a total of 18 products, including 11 products that require use of the IRIS programming language and the IRIS User Product Insert feature. Included is a cell trends product and display, modeled after the WSR-88D cell trends display in use by the National Weather Service.
Author
Information Systems; Meteorological Radar; Reflectance; Weather Forecasting; Products; Radar Data

20000064012 NASA Marshall Space Flight Center, Huntsville, AL USA
A Comparison of the Automated Meteorological Profiling System High Resolution Flight Element to the Kennedy Space Center 50 MHz Doppler Wind Profiler
Roberts, Barry C., NASA Marshall Space Flight Center, USA; Leahy, Frank, Raytheon Co., USA; [2000]; 5p; In English; 9th; Aviation, Range and Aerospace Meteorology, 11-15 Sep. 2000, Orlando, FL, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Wind profile measurement and the simulation of aerodynamic loads on a launch vehicle play an important role in determining launch capability and post launch assessment of the vehicle's performance. to date, all USA range certified wind profile measurement systems have been based on balloon tracking. Since the 1960's, the standard used by the National Aeronautics and Space Administration and the Air Force at the Cape Canaveral Air Station (CCAS) for detailed wind profile measurements has been the radar tracked, aerodynamically stabilized Jimsphere balloon system. Currently, the Air Force is nearing certification and operational implementation of the Automated Meteorological Profiling System (AMPS) at CCAS and Vandenburg Air Force Base (VAFB). AMPS uses the Global Positioning System for tracking the Jimsphere balloon. It is anticipated that the AMPS/Jimsphere, named the High Resolution Flight Element (HRFE), will have equivalent, or better resolution than the radar tracked Jimsphere, especially when the balloon is far downrange, at a low elevation angle. by the 1980's, the development of Doppler Wind Profilers (DWP) had become sufficiently advanced to justify an experimental measurement program at Kennedy Space Center (KSC). In 1989 a 50 MHz DWP was installed at KSC. In principal, the 50 MHz DWP has the capability to track the evolution of wind profile dynamics within 5 minutes of a launch. Because of fundamental differences in the measurement technique, there is a significant time and space differential between 50 MHz DWP and HRFE wind profiles. This paper describes a study to quantify these differences from a sample of 50 MHz DWP/HRFE pairs obtained during the AMPS certification test program.
Author
Aerodynamic Loads; High Resolution; Wind Profiles; Jimsphere Balloons; Wind (Meteorology); Automatic Control; Doppler Radar

20000064537 NASA Goddard Space Flight Center, Greenbelt, MD USA
Removal of Thin Cirrus Path Radiances in the 0.4-1.0 micron Spectral Region Using the 1.375-micron Strong Water Vapor Absorption Channel
Gao, Bo-Cai, Naval Research Lab., USA; Kaufman, Yoram J., NASA Goddard Space Flight Center, USA; Han, Wei, Sachs/Freeman Associates, Inc., USA; Wiscombe, Warren J., NASA Goddard Space Flight Center, USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 121-129; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Through analysis of spectral imaging data acquired with the Airborne Visible Infrared Imaging Spectrometer (AVIRIS) from an ER-2 aircraft at 20 km altitude during several field programs, it was found that narrow channels near the center of the strong 1.38-micron water vapor band are very sensitive in detecting thin cirrus clouds. Based on this observation from AVIRIS data, a channel centered at 1.375 microns with a width of 30 nm was selected for the Moderate Resolution Imaging Spectrometer

(MODIS) for remote sensing of cirrus clouds from space. The sensitivity of the 1.375-micron MODIS channel to detect thin cirrus clouds during the day time is expected to be one to two orders of magnitude better than the current infrared emission techniques. As a result, a larger fraction of the satellite data will likely be identified as containing cirrus clouds. In order to make better studies of surface reflectance properties, thin cirrus effects must be removed from satellite images. We have developed an empirical approach for removing/correcting thin cirrus effects in the 0.4 - 1.0 micron region using channels near 1.375 microns. This algorithm will be incorporated into the present MODIS atmospheric correction algorithms for ocean color and land applications and will yield improved MODIS atmospheric aerosol, land surface, and ocean color products.
Author
Radiance; Cirrus Clouds; Remote Sensing; Spectral Reflectance; Atmospheric Correction; Imaging Techniques; Algorithms

20000066620 Naval Postgraduate School, Monterey, CA USA
Southern Hemisphere Application of the Systematic Approach to Tropical Cyclone Track Forecasting. Part 3, Updated Environmental Structure Characteristics ***Interim Report, Oct. 1998-Sep. 1999***
Reader, Grahame; Boothe, Mark A.; Elsberry, Russell L.; Carr, Lester E., III; Sep. 1999; 80p; In English
Report No.(s): AD-A377204; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Meteorological knowledge base of the Systematic Approach to tropical cyclone track forecasting in the Southern Hemisphere has been updated to reflect a more global terminology. Examples of these new environment structures in operational (NOGAPS) analyses and tracks are given. Perhaps the most important conclusion is that all cases in the 1990-91 through 1998-1999 seasons could be classified into one of these 14 synoptic pattern/region combinations. The nine-year ”climatology” of the occurrences of each of the 14 combinations is given for the South Indian and Pacific Oceans separately, and the characteristic tracks in each of these 14 combinations are provided. Some new transitional mechanisms between these combinations have also been defined. The importance of these transitions from one pattern/region combinations to another is that the TC track then also changes. The frequency of recurring (greater than three) transitions in this nine-year sample is summarized. Because the TC is at any time in only one pattern/region combination, the concern of the forecaster is on the possible transitions from that pattern/region. to assist the forecaster, the percentages of these transitions from each pattern/region combination are also summarized& Some of these transitions are clearly more favored than others, which is useful dance to the forecaster.
DTIC
Cyclones; Southern Hemisphere; Tropical Storms; Weather Forecasting; Meteorology

20000066631 Air Univ., Maxwell AFB, AL USA
Weather Constrained Throughput: Substituting Spangdahlem and Ramstein for Rhein Main
MacKeeb, Richard P.; Jun. 1999; 77p; In English
Report No.(s): AD-A372325; AFIT/GOM/LAC/99Y-9; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

As the USA Air Force enters the 2lst Century, it is transitioning from a strategy of forward presence to a force projection capability. This strategy has been adopted by the US military as a whole and therefore, places a heavy reliance on the airlift capability of the United States Air Force. As the operations out of Rhein Main AB are absorbed by Ramstein AB and Spangdahlem AB, Air Force leadership needs to be aware of the impact the weather differences have on operations. This paper looks at the operational differences between these bases from a standpoint of weather constrained throughput. to get to the final weather constraining factors, a ten-year history of weather conditions at the bases in question were analyzed. The analysis was based off of the percent of each month that operations were limited due to ceiling, visibility, and crosswind limitations. The final result is a group of tables containing correction factors that can be applied to each base on a monthly basis. The throughput can thus be corrected and more accurate planning can be accomplished in line with the Air Force concept of force projection and Mobility operations in support of humanitarian and disaster relief.
DTIC
Weather Forecasting; Meteorological Parameters

20000067673 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
SSMI Wind Speed Climatology of the Time of Monsoon Wind Offset in the Western Arabian Sea
Halpern, David, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Forecasting the time of onset of monsoon wind in the western Arabian Sea, which is believed to precede the onset of rainfall along the west coast of India, is an important unsolved problem. Prior to measurements of the surface wind field by satellite, there was an absence of suitable surface wind observations. NASA scatterometer (NSCAT) surface wind vectors revealed that the time of the 1997 onset of 12 m/s southwest monsoon wind speeds in the western Arabian Sea preceded the onset of monsoon rainfall

in Goa, India, by 3 - 4 days. Wind speed and direction data were necessary to establish a dynamical mechanism between times of onset of 12 m/s wind speed off Somalia and rainfall in Goa. Except for NSCAT, no satellite scatterometer wind product recorded adequately sampled 2-day 1deg x 1deg averaged wind vectors, which are the required space and time scales, to examine the wind-rain relationship in other years. However, the greater-than-95% steadiness of summer monsoon winds allows an opportunity to use satellite measurements of surface wind speed. The Special Sensor Microwave Imager (SSMI) recorded surface wind speed with adequate sampling to produce a 1-day, 1deg x 1deg data product during 1988 - 1998. SSMI data had been uniformly processed throughout the period. Times of onset of 12 m/s wind speed off Somalia determined with the SSMI data set were 21 May 1988, 24 May 1989, 17 May 1990, 28 May 1991, 8 June 1992, 28 May 1993, 30 May 1994, 7 June 1995, 29 May 1996, 12 June 1997, and 15 May 1998. Uncertainty of the 1992 and 1996 times of onset were increased because of the absence of SSMI data on 6 and 7 June 1992 and on 30 May 1996. Correlations of timing of monsoon wind onset with El Nino will be described. Variability of the time difference between times of onset of 12 m/s wind speed and Goa rainfall will be discussed. At the time of submission of the abstract, the Goa rainfall data have not arrived from the India Meteorological Department.
Author
Climatology; Wind Velocity; Monsoons; Rain; Forecasting

48
OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics, and marine resources. For related information see also 43 Earth Resources and Remote Sensing.

20000062848 Lamont-Doherty Geological Observatory, Palisades, NY USA
Tritium/He-3 and O-18 Measurements During the ACSYS Expedition 1996 ***Final Report, 1 Apr. 1996 - 31 Mar. 1999***
Schlosser, Peter; Apr. 20, 2000; 3p; In English
Contract(s)/Grant(s): N00014-96-1-0612
Report No.(s): AD-A377474; LDEO-5-21759; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
This proposal requested half the funds required for collection, measurement, and interpretation of about 500 tritium/He-3 and 500 O-18 samples in the framework of the Swedish/German ACSYS (Arctic Climate System Study) cruise to the eastern Arctic Ocean in 1996. The work was focused on closing the existing tracer data gap in the eastern part of the Eurasian Basin. Coverage of this part of the Arctic Ocean will provide the link between the tracer distributions observed just north of Fram Strait and in the central Eurasian Basin along about 30 deg. E and the region where shelf waters enter the Transpolar Drift.
DTIC
Tritium; Helium Isotopes; Oxygen 18; Radioactive Isotopes

20000063527 California Univ., Ocean Physics Lab., Santa Barbara, CA USA
High Resolution Time Series Observations of Bio-Optical and Physical Variability in the Arabian Sea ***Final Report***
Dickey, Tommy D.; May 01, 2000; 5p; In English
Contract(s)/Grant(s): N00014-96-1-0505
Report No.(s): AD-A377005; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
A mooring instrumented with optical and physical sensors within the upper 300 m was deployed for two consecutive 6-month periods (October 15, 1994 through October 20, 1995) in the central Arabian Sea (15 degrees 30’N, 61 degrees 30’E). Both the Northeast (NE) and southwest (5W) Monsoons were observed. During the NE Monsoon, wind speeds averaged 6m/s and reached up to 15 m during the 5W Monsoon. Intermonsoon periods (Spring, SI, and Fall, H) were characterized by weak and variable winds. Shortwave radiation and photosynthetically available radiation (PAR) displayed biannual cycles, peaking during the inter-monsoon periods. The maximum winter mixed layer depth (MLD(1 degree C) 110 m) was deeper than the summer mixed layer (MLD(1 degree C) 80 m) primarily because of surface cooling and convection. A biannual cycle in chlorophyll was evident with greater values occurring during each monsoon and into the intermonsoon periods. High chlorophyll values associated with cool mesoscale features were also apparent during each monsoon. These mesoscale features and others have been documented using remotely sensed sea-surface height anomaly maps. Our results indicate that biological variability is important for the seasonal variability of the upper ocean heat budget of the central Arabian Sea.
DTIC
Marine Biology; Optical Measuring Instruments; Remote Sensing; Arabian Sea; Chlorophylls

20000064561 Brown Univ., Dept. of Geological Sciences, Providence, RI USA

Diverse Spectral Properties in a Temperature Estuary: First Results from Narragansett Bay, Rhode Island

Mustard, John F., Brown Univ., USA; Prell, Warren, Brown Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 285-289; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Coastal embayments and estuaries are important ecosystems containing a number of critical habitats and resources. They are currently threatened by changes to their surrounding watersheds. Although there has been a wealth of new knowledge generated over the last decade about these ecosystems, the spatial and temporal patterns of biologic and physical processes, as well as anthropogenic influences are not fully understood. Remotely sensed data offer a unique perspective on these processes because of the synoptic view and that quantitative algorithms can be used to extract geophysical and biophysical information from them. We are conducting a number of investigations using remotely sensed data to develop a better understanding of the visible-near infrared reflectance of water, substrate, and land components that will be used to develop algorithms and analytical tools for analysis of processes in the near shore and estuarine environment (patterns of productivity, spatial and temporal patterns of algal blooms, turbidity, etc.). The study area for our work is Narragansett Bay, Rhode Island. The bay and coastal salt ponds are Rhode Island's premier natural resource and provide the state with numerous jobs ranging from tourism to shellfishing. The objectives of this proposal are complementary to many Bay Project initiatives and thus support a number of high quality goals. These include: effects of land use and land use change on estuarine systems, links between existing data sets for Narragansett Bay and coastal salt ponds with regional perspectives of remote sensing, and a better understanding of the relationships between physical and biological processes. Visible-near infrared reflectance spectra of coastal and estuarine waters are a complex convolution of the optical properties of water, phytoplankton, gelbstoff, dissolved organic matter, and suspended sediment. Our long term goals are to develop quantitative methods for extraction of the physical abundances of these contributing constituents to the observed reflectance spectra. The work consists of observations with airborne sensors such as AVIRIS and in situ measurements using water samples, towed salinity, temperature, and fluorescence sensors, and field spectra obtained with portable spectrometers. In this abstract, we report on the first results of data obtained by AVIRIS on August 19, 1997. The data discussed here were obtained at 11:22 EDT on a flight path from the north to the south along the eastern border of the bay. The solar zenith angle was 55.5 deg and the solar azimuth was 141 deg.

Derived from text

Bays (Topographic Features); Coastal Water; Dissolved Organic Matter; Remote Sensing; Estuaries; Spectral Reflectance

20000066598 Scripps Institution of Oceanography, Center for Coastal Studies, La Jolla, CA USA

Internal Waves on the Continental Margin ***Final Report, 1 Nov. 1995-31 Oct. 1998***

Winant, Clinton D.; Hendershott, Myrl C.; Apr. 25, 2000; 4p; In English

Contract(s)/Grant(s): N00014-96-1-0031

Report No.(s): AD-A376807; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Internal wave antennas composed of moored acoustic doppler current profilers (ADCP's) generally covering the middle 80% of the water column plus one to seven continuously recording temperature loggers distributed along the mooring line were deployed in waters just offshore of San Diego at depths ranging from 15 m to 500 m during the summer and fall of 1996 and 1997. Simultaneous meteorological observations are available from Scripps Pier in La Jolla. OTD yoyo's were carried out over periods ranging from about 3 to about 24 hours during mooring deployment, service and recovery, and a bottom pressure sensor was deployed at the 15 m mooring. The data provide a new degree of vertical and horizontal resolution of the velocity and temperature fields associated with internal tidal band motions (including diurnal motions apparently driven by the land-seabreeze cycle) and borelike and apparently solitary disturbances in shallow (tens of m) water during summertime.

DTIC

Internal Waves; Meteorological Parameters; Solitary Waves; Mooring

51
LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see categories 52 through 55.

20000064567 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Investigating the Relationship Between Liquid Water and Leaf Area in Clonal Populus

Roberts, Dar, California Univ., USA; Brown, K., Washington Univ., USA; Green, R., Jet Propulsion Lab., California Inst. of Tech., USA; Ustin, S., California Univ., USA; Hinckley, T., Washington Univ., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 335-344; In English; See also 20000064520

Contract(s)/Grant(s): W/GEC95-062A; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Leaf Area Index (LAI) is one of the most commonly employed biophysical parameters used to characterize vegetation canopies and scale leaf physiological processes to larger scales. For example, LAI is a critical parameter used in regional scale estimates of evapotranspiration, photosynthesis, primary productivity, and carbon cycling (Running et al., 1989; Dorman and Sellers, 1989; Potter et al., 1993). LAI is typically estimated using ratio-based techniques, such as the Normalized Difference Vegetation Index (NDVI: e.g. Tucker 1979; Asrar et al., 1989; Sellers 1985, 1987). The physical basis behind this relationship depends on the high spectral contrast between scattered near-infrared (NIR) and absorbed red radiation in canopies. As the number of leaves present in a canopy increases over a unit area, NIR reflectance increases, while red reflectance decreases, resulting in an increase in the ratio. Through time series and image compositing, NDVI provides an additional temporal measure of how these parameters change, providing a means to monitor fluxes and productivity (Tucker et al., 1983). NDVI, while highly successful for agriculture and grassland ecosystems has been found to be less successful in evergreen chaparral and forested ecosystems (Badhwar et al., 1986; Gamon et al., 1993; Hall et al., 1995). Typically, the relationship between NDVI and LAI becomes progressively more asymptotic at LAI values above three (Sellers, 1985), although linear relationships have been observed in conifers at LAis as high as 13 (Spanner et al., 1990). In this paper, we explore an alternative approach for estimating LAI for remotely sensed data from AVIRIS based on estimates of canopy liquid water. Our primary objective is to test the hypothesis that the depth of the liquid water bands expressed in canopy reflectance spectra at 960, 1200, 1400 and 1900 nm increases with increasing LAI in canopies. This study builds from work by Roberts et al. (1997), in which liquid water was shown to increase following a gradient of increasing LAI ranging from grasslands to coniferous forests. In that study, it was observed that forests, which showed little variation in NDVI, showed significant variation in liquid water. In order to test this hypothesis, we analyzed field spectra measured over Populus resprouts of known LAI and monitored changes in liquid water in young Populus stands as they aged over a 4-year time span. The study was conducted in south-central Washington, in a clonal Populus fiber farm owned and operated by Boise-Cascade near the town of Wallula.

Derived from text

Canopies (Vegetation); Chaparral; Leaf Area Index; Remote Sensing; Moisture Content; Spectral Reflectance

20000064603 NASA Ames Research Center, Moffett Field, CA USA

Molecular Simulations in Astrobiology

Pohorille, Andrew, NASA Ames Research Center, USA; Wilson, Michael A., NASA Ames Research Center, USA; Schweighofer, Karl, NASA Ames Research Center, USA; Chipot, Christophe, NASA Ames Research Center, USA; New, Michael H., NASA Ames Research Center, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

One of the main goals of astrobiology is to understand the origin of cellular life. The most direct approach to this problem is to construct laboratory models of protocells. Such efforts, currently underway in the NASA Astrobiology Program, are accompanied by computational studies aimed at explaining self-organization of simple molecules into ordered structures that are capable of performing protocellular functions. Many of these functions, such as importing nutrients, capturing energy and responding to changes in the environment, are carried out by proteins bound to membranes. We use computer simulations to address the following questions about these proteins: (1) How do small proteins self-organize into ordered structures at water-membrane interfaces and insert into membranes? (2) How do peptides form membrane-spanning structures (e.g. channels)? (3) by what mechanisms do such structures perform their functions? The simulations are performed using the molecular dynamics method. In this method, Newton's equations of motion for each atom in the system are solved iteratively. At each time step, the forces exerted on each atom by the remaining atoms are evaluated by dividing them into two parts. Short-range forces are calculated in real space while long-range forces are evaluated in reciprocal space, using a particle-mesh algorithm which is of order O(NInN). With a time step of 2 femtoseconds, problems occurring on multi-nanosecond time scales (10(exp 6)-10(exp 8) time steps) are accessible. to

address a broader range of problems, simulations need to be extended by three orders of magnitude, which requires algorithmic improvements and codes scalable to a large number of processors. Work in this direction is in progress. Two series of simulations are discussed. In one series, it is shown that nonpolar peptides, disordered in water, translocate to the nonpolar interior of the membrane and fold into helical structures (see Figure). Once in the membrane, the peptides exhibit orientational flexibility with changing conditions, which may have provided a mechanism of transmitting signals between the protocell and its environment. In another series of simulations, the mechanism by which a simple protein channel efficiently mediates proton transport across membranes was investigated. This process is a key step in cellular bioenergetics. In the channel under study, proton transport is gated by four histidines that occlude the channel pore. The simulations identify the mechanisms by which protons move through the gate.
Author
Computerized Simulation; Exobiology; Protobiology; Chemical Evolution; Organic Compounds; Cell Membranes (Biology)

52
AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science. For the effects of space on animals and plants see 51 Life Sciences.

20000061488 Jackson (Henry M.) Foundation, Rockville, MD USA
Stress-Induced Neurodegeneration: Mechanisms and Interventions ***Annual Report, 1 Jan. - 31 Dec. 1999***
Meyerhoff, James L.; Jan. 2000; 48p; In English
Contract(s)/Grant(s): DAMD17-98-1-8634
Report No.(s): AD-A377128; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Soldiers face a broad range of occupational/environmental threats which are hazardous to central nervous system (CNS) function. One of these, exposure to prolonged, extreme stress, has been recently associated with neuronal loss. Vietnam veterans with PTSD have decreased hippocampal volume on MRI, as well as decreased scores on standardized tests of memory. Short term (recent) memory function has been localized to the hippocampus. Humans exposed to extreme stress for sustained periods have suffered deterioration of memory and inability to concentrate, as well as CNS atrophy. chronic stress in several species, including mouse, rat, tree shrew and monkey, have been reported to develop alterations in hippocampal morphology, including apical dendritic atrophy, depletion of vesicles in mossy fiber terminals, as well as actual loss of neurons. A number of stress-induced molecular pathophysiological mechanisms leading to neuronal loss/dysfunction have been described, including: (1) excessive release of excitatory amino acids (in particular, glutamate), leading to massive influx of extracellular calcium into neurons; (2) excessive release of adrenal glucocorticoids, which exacerbates the effect of excitatory amino acids. We have successfully characterized acute social defeat in the mouse as a model for eliciting high plasma levels of adrenal glucocorticoids, inducing high levels of stress and persistent avoidance behavior, as well as increased brain regional levels of mRNA for corticotrophin-releasing hormone and decreased hippocampal levels of mRNA for brain-derived neurotropic factor BDNF. We will characterize the hippocampal neuronal changes induced in this paradigm, and then after chronic stress attempt to block them with a range of pharmaceutical interventions, including neurosteroids, antagonists to CRH and antagonists to excitatory amino acids.
DTIC
Stress (Physiology); Central Nervous System; Adrenal Gland; Aerospace Medicine; Hippocampus; Atrophy

20000062012 NASA Langley Research Center, Hampton, VA USA
Aerospace Medicine and Biology: A Continuing Bibliography with Indexes, Supplement 501
June 2000; 39p; In English
Report No.(s): NASA/SP-2000-7011/SUPPL501; NAS 1.21:7011/SUPPL501; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database.
Derived from text
Aerospace Medicine; Bibliographies; Indexes (Documentation)

20000062717 Joint Inst. for Nuclear Research, Div. of Radiation and Radiobiological Research, Dubna, USSR

Induction of aberrations in human lymphocytes by (gamma)-rays and fast heavy ions

Govorun, R. D.; Repin, M. V.; Krasavin, E. A.; Lukasova, E.; Kozubek, S.; Dec. 31, 1998; 23p; In English

Report No.(s): DE99-607972; JINR-E-19-98-31; No Copyright; Avail: Department of Energy Information Bridge

Frequencies of aberrations induced by different doses of (gamma)-rays and (sup 14)N ions (LET (approx) 77 keV/(mu)m) in the chromosomes 1 and 2 of human lymphocytes as detected by FISH were compared with those detected by conventional staining in the whole genome. The results have shown that the induction of aberrations in the chromosomes 1 and 2 is more frequent than that in the rest of genome. The frequencies of dicentrics detected by FISH in the chromosomes 1 and 2 recalculated for the whole genome are in good agreement with those detected by conventional staining at different doses of (sup 14)N, but they are about 2 times lower at low doses of (gamma)-rays. Translocation frequencies calculated in the same manner from the frequencies induced in the chromosome 1 by (gamma)-rays correspond to the frequencies of dicentrics detected by conventional staining, however, they are about 2 times higher than those detected by convectional staining at doses lower than 2 Gy of (sup 14)N. The differences between the frequencies of these aberration types increase at higher doses of both radiation types.

NTIS

Aberration; Lymphocytes; Aerospace Medicine

20000062935 Geological Survey, Biological Resources Div., Columbia, MO USA

Development of physiological and Behavioral Measures of Acute Chemical Neurotoxicity ***Final Report, 8 Jan. 1997 - 7 Jan. 2000***

Jones, Susan B.; Little, Edward; Jan. 2000; 161p; In English

Contract(s)/Grant(s): MIPR-H3BM7721

Report No.(s): AD-A376880; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

US military personnel may be exposed to a wide variety of potentially toxic chemicals. The chemicals personnel may encounter, particularly in combat situations, often are neurotoxicants. Predeployment screening methods such as behavioral and physiological measurements can be used to rapidly assess these potential health hazards. The objectives of this research were: (1) to develop and use computer aided methods in evaluation of neurotoxicity; (2) to evaluate physiological and behavioral endpoints of neurotoxicity in fish following exposure to the organophosphates malathion and diazinon; a carbamate, carbaryl; a metal, cadmium; a polycyclic aromatic hydrocarbon, pyrene; a biocide, fenvalerate; and a simulated semi-permeable membrane device mixture, malathion and fenvalerate; and, to assess the correlation between physiology and behavior; (3) to adapt neurotoxic methods for use with passive sentinel monitoring devices; and (4) to provide instrumental protocols, standardized operating procedures, and quality control for neurotoxicity monitoring. These objectives were achieved. Results indicated strong correlations between behavioral indices and brain cholinesterase activity when animals were exposed to traditional cholinesterase inhibitors. Correlations with other chemicals were less clear and indicate the need for mechanistic studies associated with other chemical classes that may be important to military personnel.

DTIC

Physiology; Behavior; Toxicity; Computer Aided Design; Neurology; Aerospace Medicine

20000063382 NASA Ames Research Center, Moffett Field, CA USA

Drinking-Induced Plasma Vasopressin and Norepinephrine Changes in Dehydrated Humans

Geelen, Ghislaine, NASA Ames Research Center, USA; Greenleaf, John E., NASA Ames Research Center, USA; Keil, Lanny C., NASA Ames Research Center, USA; Journal of Clinical Endocinology and Metabolism; 1996; ISSN 0021-972X; Volume 81, No. 6, pp. 2131-2135; In English

Contract(s)/Grant(s): RTOP 199-18-12-07; Copyright; Avail: Issuing Activity

After 24-h water deprivation, five men (23-41 yr; 78 +/- 3.6 kg) consumed, within 4.0-6.2 min, 12 mL/kg of one of six fluid formulations (16.5 C) once a week over a period of 6 weeks: water, hypotonic saline (0.045% Na(+)), isotopic saline (0.36%, Na(+)), hypertonic glucose 9 7%, glucose), and two commercial mildly hypertonic 9.7% carbohydrate drinks. Blood samples were drawn 5 min before and: 3, 9, 15, 30, and 70 min after completion of drinking. Ingestion induced no significant change in plasma Na(+), K(+), osmotic, or protein concentrations, blood pressure; or heart rate. Plasma volume (PV) was increases (P is less than 0.05) between 30-70 min with isotonic saline and the two commercial drinks. Ingestion induced a decrease in plasma AVP (PAVP) at 3 min, which was maximal (P is less than 0.05) at 15 min with all drinks. Thus, the act of drinking, independent of the composition or osmolality of the fluid absorbed, leads to a prompt inhibition of PAVP secretion in man. With the exception of rehydration with isotonic saline, this prompt response was followed by a long lasting inhibition of PAVP. There was no change in PRA, plasma

aldosterone, atrial natriuretic peptide, or epinephrine, but an increase in plasma norepinephrine occurred immediately after ingestion, which suggests, like that for PAVP depression, a drinking-stimulate neural mechanism.
Author
Drinking; Water Deprivation; Plasmas (Physics); Antidiuretics; Norepinephrine; Dehydration; Human Beings

20000063383 NASA Ames Research Center, Moffett Field, CA USA
Exercise and Human Immunodeficiency Virus (HIV-1) Infection
Lawless, DeSales, Rockefeller Univ., USA; Jackson, Catherine G. R., University of Northern Colorado, USA; Greenleaf, John E., NASA Ames Research Center, USA; Sports Medicine; 1995; ISSN 0112-1642; Volume 19, No. 4, pp. 235-239; In English
Contract(s)/Grant(s): NAG8-227; RTOP 199-18-12-07; Copyright; Avail: Issuing Activity

The human immune system is highly efficient and remarkably protective when functioning properly. Similar to other physiological systems, it functions best when the body is maintained with a balanced diet, sufficient rest and a moderately stress-free lifestyle. It can be disrupted by inappropriate drug use and extreme emotion or exertion. The functioning of normal or compromised immune systems can be enhanced by properly prescribed moderate exercise conditioning regimens in healthy people, and in some human immunodeficiency virus (HIV-1)-infected patients but not in others who unable to complete an interval training program. Regular exercise conditioning in healthy people reduces cardiovascular risk factors, increases stamina, facilitates body-weight control, and reduces stress by engendering positive feelings of well-being. Certain types of cancer may also be suppressed by appropriate exercise conditioning. Various exercise regimens are being evaluated as adjunct treatments for medicated patients with the HIV-1 syndrome. Limited anecdotal evidence from patients suggests that moderate exercise conditioning is per se responsible for their survival well beyond expectancy. HIV-1-infected patients respond positively, both physiologically and psychologically, to moderate exercise conditioning. However, the effectiveness of any exercise treatment programme depends on its mode, frequency, intensity and duration when prescribed o complement the pathological condition of the patient. The effectiveness of exercise conditioning regimens in patients with HIV-1 infection is reviewed in this article. In addition, we discuss mechanisms and pathways, involving the interplay of psychological and physiological factors, through which the suppressed immune system can be enhanced. The immune modulators discussed are endogenous opioids, cytokines, neurotransmitters and other hormones. Exercise conditioning treatment appears to be more effective when combined with other stress management procedures.
Author
Human Immunodeficiency Virus; Acquired Immunodeficiency Syndrome; Immune Systems; Infectious Diseases; Physical Exercise

20000063522 Civil Aeromedical Inst., Oklahoma City, OK USA
A Novel Method for the Determination of Sildenafil (Viagra(Registered Trademark)) and its Metabolite (UK-103,320) in Postmortem Specimens Using LC/MS/MS and LC/MS/MS/MS *Final Report*
Lewis, Russell J., Civil Aeromedical Inst., USA; Johnson, Robert D., Oklahoma Univ., USA; Blank, C. LeRoy, Oklahoma Univ., USA; May 2000; 20p; In English
Contract(s)/Grant(s): AM-B-98-TOX-202
Report No.(s): DOT/FAA/AM-00/20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During the investigation of aviation accidents, postmortem samples from victims are submitted to the FAA's Civil Aeromedical Institute for drug analysis. Because new drugs are continually being released to the market, it is our laboratory's responsibility to develop methods which can identify these new drugs. This paper presents a rapid and reliable method for the identification and quantitation of sildenafil (Viagra(R)) and its metabolite, UK-103,320. Sildenafil, when used properly, is relatively safe. There are, however, certain side effects that could create potential hazards. For example, Sildenafil has been shown to potentiate the hypotensive effects of nitrates commonly employed in the treatment of certain heart conditions. The procedure described herein incorporates solid-phase extraction and LC/MS/MS and MS/MS/MS utilizing an atmospheric pressure chemical ionization (APCI) ion trap mass spectrometer (MS) in the positive ionization (PCI) mode. Solid-phase extraction provided an efficient sample extraction yielding recoveries of approximately 80%. This method is highly selective and sensitive, having a limit of detection of 1 ng/mL for both compounds. Sildenafil and UK-103,320 were found to have a linear dynamic range of 2-800 ng/mL and 4-800 ng/mL, respectively. This procedure showed intra- day (within day) relative error of less than or = 6% and relative standard deviation (RSD) within 4% for both the 50 ng/mL and 200 ng/mL controls. The inter-day (between day) relative errors were less than or = 6% while the RSD was within 12% for both control concentrations. Sildenafil and UK-103,320 were found to be stable in blood for at least one week at 4 C. This method was also used for the determination of sildenafil and UK-103,320 in postmortem fluid and tissue specimens collected from fatal aviation accident victims.
Author
Drugs; Blood; Dynamic Range; Extraction; Hazards; Heart; Hypotension; Metabolites

20000064015 Institute for Human Factors TNO, Soesterberg, Netherlands

The Assessment of Aftereffects of Real and Simulated Self Motion: Motion Sickness and Other Symptoms ***Interim Report***

Wertheim, A. H., Institute for Human Factors TNO, Netherlands; Nov. 15, 1999; 50p; In English

Contract(s)/Grant(s): A98/KLu/310; TNO Proj. 789.2

Report No.(s): TD-99-0364; TM-99-A074; Copyright; Avail: Issuing Activity

After having spent some time in a simulator subjects often suffer from disturbing aftereffects. For a large part these consist of a continuation of motion sickness symptoms, but other symptoms, such as postural and visual problems are often reported as well. As a first step towards finding methods of reducing the risks associated with these symptoms (e.g. interference with everyday activities following a simulator trial), a literature review is provided, in which the most frequently used methods for assessing the magnitude of these aftereffects, are evaluated. Recommendations are given as to which methods are likely to be the best assessment tools, and as to what questions remain to be answered in future research.

Author

Motion Sickness; Signs and Symptoms; Biological Effects

20000064079 NASA Ames Research Center, Moffett Field, CA USA

Mechanism of Thirst Attenuation During Head-Out Water Immersion in Men

Wada, F., NASA Ames Research Center, USA; Sagawa, S., NASA Ames Research Center, USA; Miki, K., NASA Ames Research Center, USA; Nagaya, K., NASA Ames Research Center, USA; Nakamitsu, S., NASA Ames Research Center, USA; Shiraki, K., NASA Ames Research Center, USA; Greenleaf, J. E., NASA Ames Research Center, USA; [1994]; 9p; In English

Contract(s)/Grant(s): Proj. 03454138; RTOP 199-18-12-07; Copyright; Avail: Issuing Activity

The purpose was to determine whether extracellular volume or osmolality was the major contributing factor for reduction of thirst in air and head-out water immersion in hypohydrated subjects. Eight males (19 - 25 yr) were subjected to thermoneutral immersion and thermoneutral air under two hydration conditions without further drinking: euhydration in water (Eu-H2O) and euhydration in air, and hypohydration in water (Hypo-H2O) and hypohydration in air (3.7% wt loss after exercise in heat). The increased thirst sensation with Hypo-H2O decreased (P less than 0.05) within 10 min of immersion and continued thereafter. Mean plasma osmolality (288 +/- 1 mosmol/kg H2O) and sodium (140 +/- 1 meq/1) remained elevated, and plasma volume increased by 4.2 +/- 1.0% (P less than 0.05) throughout Hypo-H2O. A sustained increase (P less than 0.05) in stroke volume accompanied the prompt and sustained decrease in plasma renin activity and sustained increase (P less than 0.05) in plasma atrial natriuretic peptide during Eu-H2O and Hypo-H2O. Plasma vasopressin decreased from 5.3 +/- 0.7 to 2.9 +/- 0.5 pg/ml (P less than 0.05) during Hypo-H2O but was unchanged in Eu-H2O. These findings suggest a sustained stimulation of the atrial baroreceptors and reduction of a dipsogenic stimulus without major alterations of extracellular osmolality in Hypo-H2O. Thus it appears that vascular volume induced stimuli of cardiopulmonary baroreceptors play a more important role than extracellular osmolality in reducing thirst sensations during immersion in hypohydrated subjects. Thus the purpose for this study was to determine the relative importance of volume and osmotic stimuli, and associated hormonal interaction, for attenuation of thirst during immersion.

Derived from text

Antidiuretics; Cardiovascular System; Human Beings; Hydration; Immunoassay; Peptides; Water Immersion

20000064093 Georgetown Univ., Washington, DC USA

Advanced Medical Technology and Network Systems Research ***Annual Report, 31 Aug. 1998 - 31 Aug. 1999***

Mun, Seong K.; Sep. 1999; 170p; In English

Contract(s)/Grant(s): DAMD17-94-V-4015

Report No.(s): AD-A376158; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

The focus of the Medical Vanguard Project has continued to progress in the fields of telemedicine, surgical simulation, and distance education. The key areas that the annual report presents includes: The shift from interactive video based telemedicine to non-interactive, store and forward applications that are Internet based: This switch comes from the difficulties in scheduling interactive sessions with physicians who already have tight schedules and therefore make the telemedicine consult difficult. We have launched an extensive Internet telemedicine program in two chronic illness areas, diabetes and home peritoneal dialysis from the previous efforts dealing with telemedicine support for acute care. Also reported this year is the development of a global MRI teleradiology network to support medical research of rare diseases where studies from multiple institutions, including international sites. The support of distance medical education, a comprehensive database containing pathology slides of 240 prostate surgical specimens was established at the ISIS Center. Our simulated biopsy indicates that the current biopsy protocol is suboptimal. The integration of imaging systems and surgical procedures effort is accomplished in part by establishing the technology

requirements for image-guided therapies. Advanced technologies included in this report are impedance imaging and a palpation training system.
DTIC
Biotechnology; Telemedicine; Medical Science; Aerospace Medicine

20000064713 NASA Ames Research Center, Moffett Field, CA USA
Hypervolemia from Drinking Hyperhydration Solutions at Rest and Exercise
Greenleaf, John E., NASA Ames Research Center, USA; Looft-Wilson, Robin, NASA Ames Research Center, USA; Jackson, Catherine G. R., University of Northern Colorado, USA; Geelen, Ghislaine, Lyon-1 Univ., France; Barnes, Paul R., San Francisco State Univ., USA; Jensen, Christopher D., Shaklee US, Inc., USA; Whittam, James H., Shaklee US, Inc., USA; Apr. 05, 1995, pp. 95-96; In English; Life Sciences and Space Medicine Conference, 3-5 Apr. 1995, Houston, TX, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The mechanism of muscular fatigue from physical work and exercise (high metabolism) is not clear, but involves disturbances of muscle surface membrane excitation-contraction coupling from changes in sarcoplasmic reticulum Ca2+ release, cell H+ and Pi responses, and carbohydrate metabolism. Fatigue in people at rest (low metabolism) involves both psychological and physiological factors, probably in different proportions. One common factor appears to be the level and distribution of water and electrolytes within muscle cells and other vascular, interstitial, body fluid compartments. The vascular fluid volume, composed of plasma and red blood cells, is a primary regulatory factor for cardiovascular function; reduction of vascular volume (hypovolemia) and total body water (hypohydration) adversely affect exercise performance. Plasma volume and plasma ionic-osmotic constituent concentrations are also regulatory factors for body thermoregulation, which is often compromised from exercise induced hypovolemia and hypohydration. Rehydration of dehydrated people on earth is relatively easy with appropriate food (osmols), fluid, and a restful environment. But ad libitum drinking under stressful conditions; e.g., heat, exercise, or prior dehydration, results in involuntary dehydration defined as the delay in full fluid replacement (euhydration) during and following loss of body fluid. Astronauts, with their reduced total body water are euhydrated while in weightlessness, but become ”dehydrated” during reentry and landing. Thus, people subjected to acute or chronic stress are probably somewhat ”dehydrated” as well as fatigued. Many rehydration drinks are more concentrated (hypertonic-hyperosmotic) with respect to the normal plasma osmolality of 285 mOsm/kg H2O and more of the drink osmols are contributed by carbohydrates than by ionized substances. There have been few studies on the efficacy of various drink formulations for increasing body fluid compartment volumes, especially plasma volume, in rested hydrated subjects. Recent findings from our laboratory have indicated that drinks containing greater concentrations of ionized substances (Performance 1 and AstroAde) up to 157 mEq/L Na+ induced greater levels of hypervolemia in resting, moderately dehydrated men, and were also better than water for attenuating the characteristic hypovolemia during supine, submaximal, leg ergometer exercise.
Author
Drinking; Hydration; Hypervolemia; Physical Exercise; Solutions; Bed Rest; Aerospace Medicine

20000064924 Institute for Human Factors TNO, Soesterberg, Netherlands
Positive Pressure Breathing During Rest and Exercise ***Final Report Ademen met Overdruk Tijdens Rust en Inspanning***
denHartog, E. A., Institute for Human Factors TNO, Netherlands; Heus, R., Institute for Human Factors TNO, Netherlands; vandeWater, G. J., Institute for Human Factors TNO, Netherlands; Aug. 20, 1999; 27p; In Danish
Contract(s)/Grant(s): B97-043; TNO Proj. 789.2
Report No.(s): TD-99-0334; TM-99-8010; Copyright; Avail: Issuing Activity

Using a positive pressure respirator a higher level of protection can be attained than with the current gasmask. An optimal positive pressure respirator produces a pressure just above atmospheric pressure during the whole breathing cycle under all circumstances. It is not known whether the commercially available respirator systems can maintain the positive pressure during heavy exercise. The high inspiratory peakflows (5 to 10 l/s) can cause short periods of negative pressure, which may significantly decrease the protection level. A possible solution might be to control the blower so that it can generate a higher (peak)flow during heavy exercise. From the literature it is found that during exercise there are some effects of positive pressure breathing on ventilation and blood circulation. In this study we investigated whether it was possible to maintain a positive pressure during heavy exercise with a blower that may be used integrated in a portable system. Furthermore, the physiological effects and feelings of discomfort were investigated during exercise while breathing under positive pressure. Eight subjects participated in this study. They used the respirator system (blower and gasmask@ during rest and heavy exercise on the bicycle ergonometer. During exercise the subject cycled at 80% of their individual maximum. The experiments were performed at different levels of the blower (low and high flow) and at different pressures (0 to 10 mbar). The different pressure levels were set by changing the expiratory resistance. An extra set of conditions was created by using the pressure under the gasmask as a feedback signal for the blower. This caused the air flow from the blower to increase as the pressure decreased. Without the blower the pressure became negative

during 50% (SD 4%) of the breathing cycle. With the blower the negative pressure averaged for 15% (SD 10% of the breathing cycle. With the highest setting of the blower the pressure still became negative for 5% (SD 10%) of the breathing cycle. We found no significant effects on ventilation or blood pressure caused by the increased breathing pressure. We did find an increase in oxygen consumption compared to the situation without gasmask and blower. This means that breathing through a respirator system with gasmask and blower requires more effort than normal breathing. The feedback of the pressure to the blower produces a decrease in power requirements. Besides, there was a trend that it caused less discomfort, probably caused by the decrease in pressure difference between inspiration and expiration. However, due to the large variance in the data we found no significant differences between most conditions. From the results it was deduced that the currently available commercial blower systems do not supply a sufficient air flow to maintain a positive pressure during heavy exercise. This decreases the advantage of the positive pressure respirator system. to maintain the positive pressure during heavy exercise a more powerful blower is required, which can generate a larger air flow at higher pressures. However, physiological effects on ventilation and blood circulation can be expected, if such systems are used.
Author
Atmospheric Pressure; Blood Circulation; Expiration; Oxygen Consumption; Physiological Effects; Pressure Breathing; Pressure Effects; Respirators

20000065651 NASA Johnson Space Center, Houston, TX USA
The Physiology of Bed Rest, Chapter 39
Fortney, Suzanne M., NASA Johnson Space Center, USA; Schneider, Victor S., NASA Johnson Space Center, USA; Greenleaf, John E., NASA Ames Research Center, USA; Handbook of Physiology. Section 4: Environmental Physiology. 3: The Gravitational Environment; 1996; Volume 2, Chapter 39, pp. 889-939; In English
Contract(s)/Grant(s): NIH-RR-00350; NIH-RR-02558; RTOP 199-18-12-07; RTOP 199-26-11-01; RTOP 199-14-11-13; Copyright; Avail: Issuing Activity

Prolonged rest in bed has been utilized by physicians and other health-care workers to immobilize and confine patients for rehabilitation and restoration of health since time immemorial. The sitting or horizontal position is sought by the body to relieve the strain of the upright or vertical postures, for example during syncopal situations, bone fractures, muscle injuries, fatigue, and probably also to reduce energy expenditure. Most health-care personnel are aware that adaptive responses occurring during bed rest proceed concomitantly with the healing process; signs and symptoms associated with the former should be differentiated from those of the latter. Not all illnesses and infirmities benefit from prolonged bed rest. Considerations in prescribing bed rest for patients-including duration, body position, mode and duration of exercise, light-dark cycles, temperature, and humidity-have not been investigated adequately. More recently, adaptive physiological responses have been measured in normal, healthy subjects in the horizontal or slightly head-down postures during prolonged bed rest as analogs for the adaptive responses of astronauts exposed to the microgravity environment of outer and bed-rest research.
Derived from text
Astronauts; Bed Rest; Bones; Health; Microgravity; Muscles; Physical Exercise; Signs and Symptoms

20000066613 Institute for Human Factors TNO, Soesterberg, Netherlands
Revision of Visual Standards for the Netherlands Royal Navy: Binocular Depth Perception Reconsidered ***Interim Report Herziening Visuele Keuringseisen voor de Koninklijke Marine; Eisen voor het Binoculair Dieptezien***
Walraven, J., Institute for Human Factors TNO, Netherlands; Kooi, F. L., Institute for Human Factors TNO, Netherlands; Sep. 22, 1999; 30p; In Dutch
Contract(s)/Grant(s): A98/KM/306; TNO Proj. 786.2
Report No.(s): TD-99-0340; TM-99-A062; Copyright; Avail: Issuing Activity

In the context of the revision of the visual standards for the Netherlands Royal Navy, this study addresses the need for a pass/fail score for binocular depth perception. On the basis of a literature search and our own expertise we conclude that the potential advantages of binocular depth perception are not essential for the visual aspects of an adequate functional performance within the services of the Netherlands Royal Navy. An exception is made for operators of stereoscopic measuring equipment. One of the main considerations underlying the above conclusion was, that the monocular cues for depth perception are so effective that there is no need for the additional information provided by binocular parallax. This is also consistent with the results of various accident analyses studies, showing that the lack of binocular depth perception cannot be linked to an enhanced risk in road and flight accidents. Also experiments in which binocular and monocular performance is compared of drivers maneuvering through a slalom circuit, or the performance of pilots landing their planes, indicate that binocular depth perception is not essential for these tasks. The present pass/fail score presently used by the Netherlands Royal Navy (i.e. 400” on the TNO stereo test) already implies, in effect, that depth perception should not be taken too seriously. A score of 400” attests to a very low level of stereoscopic acuity,

which means for example, that the difference in distance between 10 m and 14 m cannot be discriminated on the basis of the binocular parallax cue. Therefore, a further lowering of the pass/fail criterion, or even abandoning it altogether, should not be considered as an enhanced risk due to inadequate functional performance. Although the depth perception score may be relinquished as a selection criterion, we nevertheless recommend that candidates take the test for diagnostic purposes. The test score still provides additional information about the status of the visual system, in particular with respect to eye coordination. This may also become relevant when it comes to the employment of the Helmet Mounted Display (HMD), as is to be anticipated in the context of the future Soldier Modernization Program (SMP).
Author
Binocular Vision; Criteria; Space Perception; Stereoscopic Vision; Visual Acuity; Acceptability; Human Performance

20000066624 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
A Pharmacokinetic Study of the Effects of Stress on Chemical Exposure
Suhajda, Sierra H.; Mar. 2000; 145p; In English
Report No.(s): AD-A377269; AFIT/GEE/ENV/00M-16; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Following the Gulf War there were many concerns raised about human exposure to the combination of chemicals and stress. Stress causes several changes in basic functions of a human body, from breathing and blood flow changes to hormonal and enzyme changes, and increased permeability of the blood-brain barrier. Each of these changes can strongly influence chemical uptake, distribution, and accumulation in the body. The purpose of this thesis was to model and predict the changes that will occur when stress is combined with chemical exposure. Physiologically-based pharmacokinetic (PBPK) modeling is one tool that can be used to visualize, predict, and generate a hypothesis about chemical exposures. A PBPK model was developed that simulated human tissue compartments during chemical exposure and different levels of exercise. The PBPK model developed is a valid tool for helping explain and predict the fate and transport of a chemical on an individual under stress. The results suggest that the brain compartment is of high importance when addressing the uptake of chemicals during exercise. The maximal uptake of a chemical from the blood-brain barrier, as well as the decreased enzymatic levels in the brain compartment have been identified as key parameters for further study.
DTIC
Chemical Reactions; Stress (Physiology); Blood Flow; Pharmacology

53
BEHAVIORAL SCIENCES

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

20000062463 California Univ., San Diego, Dept. of Family and Preventative Medicine, La Jolla, CA USA
The Evolution of Networks in Extreme and Isolated Environment *Final Report*
Johnson, Jeffrey C., East Carolina Univ., USA; Boster, James S., Connecticut Univ., USA; Palinkas, Lawrence A., California Univ., San Diego, USA; [2000]; 42p; In English
Contract(s)/Grant(s): NAG5-4571; NSF BNS-90-11351; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This article reports on the evolution of network structure as it relates to the formal and informal aspects of social roles in well bounded, isolated groups. Research was conducted at the Amundsen-Scott South Pole Station over a 3-year period. Data was collected on crewmembers' networks of social interaction and personal advice over each of the 8.5-month winters during a time of complete isolation. In addition, data was collected on informal social role structure (e.g., instrumental leadership, expressive leadership). It was hypothesized that development and maintenance of a cohesive group structure was related to the presence of and group consensus on various informal social roles. The study found that core-periphery structures (i.e., reflecting cohesion) in winter-over groups were associated with the presence of critically important informal social roles (e.g., expressive leadership) and high group consensus on such informal roles. On the other hand, the evolution of clique structures (i.e., lack of cohesion) were associated with the absence of critical roles and a lack of consensus on these roles, particularly the critically important role of instrumental leader.
Author
Networks; Evolution (Development); Isolation; Environments; Range (Extremes)

20000064711 Massachusetts Inst. of Tech., Dept. of Aeronautics and Astronautics, Cambridge, MA USA

Situational Awareness Issues in the Implementation of Datalink: Shared Situational Awareness in the Joint Flight Deck-ATC Aviation System ***Final Report, 1 Jan. 1991 - 30 Sep. 1999***

Hansman, Robert John, Jr., Massachusetts Inst. of Tech., USA; [1999]; 7p; In English

Contract(s)/Grant(s): NAG2-716; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

MIT has investigated Situational Awareness issues relating to the implementation of Datalink in the Air Traffic Control environment for a number of years under this grant activity. This work has investigated: 1) The Effect of ”Party Line” Information. 2) The Effect of Datalink-Enabled Automated Flight Management Systems (FMS) on Flight Crew Situational Awareness. 3) The Effect of Cockpit Display of Traffic Information (CDTI) on Situational Awareness During Close Parallel Approaches. 4) Analysis of Flight Path Management Functions in Current and Future ATM Environments. 5) Human Performance Models in Advanced ATC Automation: Flight Crew and Air Traffic Controllers. 6) CDTI of Datalink-Based Intent Information in Advanced ATC Environments. 7) Shared Situational Awareness between the Flight Deck and ATC in Datalink-Enabled Environments. 8) Analysis of Pilot and Controller Shared SA Requirements & Issues. 9) Development of Robust Scenario Generation and Distributed Simulation Techniques for Flight Deck ATC Simulation. 10) Methods of Testing Situation Awareness Using Testable Response Techniques. The work is detailed in specific technical reports that are listed in the following bibliography, and are attached as an appendix to the master final technical report.

Derived from text

Air Traffic Control; Data Links; Avionics; Human Factors Engineering

20000064923 NASA Johnson Space Center, Houston, TX USA

Preparing for Long Duration Space Missions: Discussion and Resource Guide for Astronauts

Galarza, Laura, Wyle Labs., Inc., USA; Holland, Albert, NASA Johnson Space Center, USA; Hysong, Sylvia J., Rice Univ., USA; Lugg, Desmond J., Australian Antarctic Div., Australia; Palinkas, Lawrence A., California Univ., USA; Stuster, Jack, Anacapa Sciences, Inc., USA; Witham, Lynn, Witham and Associates, USA; Wood, JoAnna, National Space Biomedical Research Inst., USA; Nov. 30, 1999; 18p; In English

Contract(s)/Grant(s): NAG5-4571; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This guide was developed in support of the Flight Crew Operations Directorate’s Long Duration Expedition Training Workshops. Contents include the following: effective team behavior; the role of team members; dimensions of group effectiveness; factors affecting team performance (selected examples); and general subthemes for teamwork and group living.

Derived from text

Education; Flight Crews; Human Performance; Teams

20000066602 Institute for Human Factors TNO, Soesterberg, Netherlands

Uni and Cross Modal Tracking of Visual and Vibro-Tactile Stimuli ***Interim Report Uni-en Kruismodaal Volgen van Visuele en Vibrotactiele Stimuli***

vanErp, J. B. F., Institute for Human Factors TNO, Netherlands; Feb. 16, 2000; 33p; In English

Contract(s)/Grant(s): B99-031; TNO Proj. 788.1

Report No.(s): TD-2000-0113; TM-00-B002; Copyright; Avail: Issuing Activity

Contemporary tactile display technology presents the observer with dynamic tactile stimuli. The present study investigates performance in pursuit and compensatory tracking tasks with tactile and/or visual presentation of target and cursor. Normally, the tactile modality is not extensively used as information channel in man-machine interfaces. The current investigation tries to cover two deficiencies in the literature: knowledge on pursuit tracking performance with tactile displays, and the use of error coding that is natural and equivalent to visual displays. The results show that tracking errors are 2.5 times higher with the tactile display than with the visual display. The largest problems seem to arise when external disturbances are presented to the tactile modality. Especially noteworthy is the increased tracking delay in these situations. Adding additional sensory information (e.g., feedback of the motor system with manual control) can improve the perception of dynamic tactile stimuli. Moreover, the tactile modality is suitable to present target or set-point information in compensatory tracking tasks, and as cursor in pursuit tracking tasks. The results of the cross-modal tasks on the tracking error fit well to an ’additional model’, the tracking delay can be described by a serial model. The latter model gives a slight overestimation, which may be due to the cross-modal advantage of the absence of an attentional blink.

Author

Display Devices; Pursuit Tracking; Electrocutaneous Communication; Sensory Perception; Tactile Discrimination; Mechanoreceptors

20000067670 California Univ., San Diego, Dept. of Family and Preventative Medicine, La Jolla, CA USA
Summary of Research Issues in Behavior and Performance in Isolated and Confined Extreme (ICE) Environments
Palinkas, Lawrence A., California Univ., San Diego, USA; [2000]; 8p; In English
Contract(s)/Grant(s): NAG5-4571; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The papers presented in this section describe changes in behavior and performance in various isolated and confined extreme (ICE) environments, including Antarctic expeditions and research stations, space simulators and isolation chambers, and submarines. Each of these environments possesses characteristics that are in some way analogous to those found on long-duration space missions. Despite differences in length of mission, characteristics of mission personnel or crew, and characteristics in the physical environment, the various ICE environments described in this collection of papers appear to produce similar changes in behavior and performance. These changes include increased disturbances of mood, increased rates of psychiatric disorder, increased interpersonal tension, and a disruption of circadian rhythms. However, these environments do not inherently produce decrements in performance. Palinkas and colleagues suggest that prolonged exposure to the isolation and confinement in the Antarctic can actually have positive or ”salutogenic” effects as well, evidenced by a decrease in mood disturbances and increase in performance measures.
Derived from text
Antarctic Regions; Confinement; Controlled Atmospheres; Human Factors Engineering; Human Behavior; Human Performance

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also 16 Space Transportation and 52 Aerospace Medicine..

20000061487 Air Force Research Lab., Human Effectiveness Directorate, Wright-Patterson AFB, OH USA
Helmet Impact Tests with a Modified ACES 2 Headrest ***Interim Report, Nov 1998 - May 1999***
Perry, Chris E.; May 1999; 32p; In English
Contract(s)/Grant(s): AF Proj. 7184
Report No.(s): AD-A377142; AFRL-HE-WP-SR-1999-0005; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To counteract the effects of brain injury, head protection has been designed into environments where severe head impact is probable. An experimental effort was conducted to evaluate the effectiveness of various foam pads in reducing trauma to the head resulting from impact with the ACES II headrest. A series of vertical drops with a Helmet Drop Tower (HDT) facility and an instrumented head form were conducted using the HGU-55/P flight helmet, a current ACES II headrest, and samples of two types of foam (Confor and F-Cell foam). The probability of head injury, as determined by the Head Injury Criteria (HIC), was calculated using measured impact acceleration of the head from for each impact surface. The head form acceleration, resulting HIC values, and probability of severe brain injury values for the Confor foam tests were all less than the comparative values for either the standard ACES II headrest or the headrest with the F-Cell foam.
DTIC
Helmets; Impact Tests; Brain; Head (Anatomy); Protective Clothing

20000062843 Cherry (R. G. W.) and Associates Ltd., Hertford, UK
Benefit Analysis for Aircraft 16-g Dynamic Seats ***Final Report***
Cherry, Ray; Warren, Kevin; Chan, Aaron; Apr. 2000; 242p; In English
Report No.(s): AD-A377374; ANM-100; DOT/FAA/AR-00/13; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The objective of this study was to assess the number of serious injuries and fatalities that might have been avoided by the use of 16-g dynamic seats during the period of 1984 to 1998 for survivable accidents involving transport category aircraft operating under 14 CFR Part 121. Twenty-five impact-related accidents involving aircraft operating to 14 CFR Part 121, or equivalent, were identified during the period from 1984 to 1998 that may have had seat-related fatal or serious injuries. Each of these accidents was analyzed in detail and a mathematical technique was used to model each accident scenario. Monte Carlo simulations were used to assess a high, median, and low value for the total achievable benefits over the period 1984 to 1998 to U.S. registered aircraft operating under 14 CFR Part 121. Two methodologies were used. The first was based on worldwide accident data for aircraft operating under 14 CFR Part 121 or equivalent. This analysis results in the following prediction of benefit: (1) Reduction in Fatalities = 51 with a 95 percentile range from 33 to 68; and (2) Reduction in Serious Injuries = 54 with a 95 percentile range from 28 to 79. The second analysis was carried out on the accident data pertaining to U.S. aircraft operating under 14 CFR Part 121 only.

The analysis of this smaller data set has resulted in the following prediction of lives to be saved: (1) Reduction in Fatalities = 23 with a 95 percentile range from 12 to 40; and (2) Reduction in Serious Injuries = 18 with a 95 percentile range from -1 to 32.
DTIC
Injuries; Monte Carlo Method; Simulation

20000064102 Institute for Human Factors TNO, Soesterberg, Netherlands
Helmet-Mounted Systems for Moncular Night Vision Goggles ***Final Report Helmbevestigingen voor Monoculaire HV-Kijkers***
Hin, A. J. S., Institute for Human Factors TNO, Netherlands; Tan, T. K., Institute for Human Factors TNO, Netherlands; Feb. 18, 2000; 26p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A99/KL/337; TNO Proj. 786.2
Report No.(s): TD-00-0114; TM-00-A009; Copyright; Avail: Issuing Activity

Helmet-mounted systems for night vision goggles of two producers are tested on proper positioning in front of the eyes. A small but representative selection of persons from the Royal Netherlands Army is used as test population. Testing is performed using 3D scanning. Scans are taken from persons wearing different helmets. and scans from helmets with various mounting constructions. The positioning of the image intensifier in front of the eyes is evaluated by matching the helmets on both scans. The DSS image intensifier fixed with a frame construction on the standard Schubert helmet is positioned too low for the eyes. The ITL model fixed with a frame mount as well as a strap mount is reasonably well positioned in front of the eyes of potential users. Only a small adaptation of the positioning in height of the goggles is desirable, as well as getting the ocular closer to the eye. Although the strap-mount of the ITL image intensifier was not designed for the Gentex tank helmet, it shows the consequences of a similar type of construction as applied to the Schubert helmet. It can be decided to design a bow for each type of helmet. However, in this study we can show that one design can be developed to apply to both type of helmet. Important is to determine the proper corresponding spot on both helmets to fix the construction. Due to experiences during the research it is expected that not all constructions will operate well for long. Therefor it is recommended to proof the durability of the constructions. Frame mounts are fixed to the helmet with screws. It is recommended to perform ballistic research to check whether this modification still meets the protection level requirements of the helmet. The research produced more insight in helmets. how they are worn by persons with differences in head geometry and where the eyes are positioned underneath the rim of the helmet. The size of the region where the eyes of the different persons are located is not directly related to the differences in head size. Wearing a helmet reduces the region's size: the helmet reduces large differences.
Author
Durability; Goggles; Helmets; Image Intensifiers; Night Vision; Performance Tests

20000064691 NASA Marshall Space Flight Center, Huntsville, AL USA
Volatile Removal Assembly Flight Experiment and KC-135 Packed Bed Experiment: Results and Lessons Learned
Holder, Donald W., NASA Marshall Space Flight Center, USA; Parker, David, Hamilton Sundstrand, USA; [2000]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Volatile Removal Assembly (VRA) is a high temperature catalytic oxidation process that will be used as the final treatment for recycled water aboard the International Space Station (ISS). The multiphase nature of the process had raised concerns as to the performance of the VRA in a microgravity environment. to address these concerns, two experiments were designed. The VRA Flight Experiment (VRAFE) was designed to test a full size VRA under controlled conditions in microgravity aboard the SPACEHAB module and in a 1 -g environment and compare the performance results. The second experiment relied on visualization of two-phase flow through small column packed beds and was designed to fly aboard NASA's microgravity test bed plane (KC-135). The objective of the KC-135 experiment was to understand the two-phase fluid flow distribution in a packed bed in microgravity. On Space Transportation System (STS) flight 96 (May 1999), the VRA FE was successfully operated and in June 1999 the KC-135 packed bed testing was completed. This paper provides an overview of the experiments and a summary of the results and findings.
Author
Volatility; High Temperature; Oxidation; Water; Catalytic Activity; Procedures; Recycling

20000064729 Analysis and Technology, Inc., North Stonington, CT USA
Evaluation of Night Vision Goggles (NVG) for Maritime Search and Rescue: HH-65A Sweep Width Verification and Laser Illuminator Evaluation ***Final Report***
Gross, K.; Wallace, H.; Larson, D.; McClay, T.; Oct. 1999; 146p; In English
Contract(s)/Grant(s): DTCG39-94-D-E56616
Report No.(s): AD-A377094; CGR/DC-231-99; USCG-D-07-00; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The U.S. Coast Guard R&D Center conducted field tests to evaluate the search effectiveness of Coast Guard HH-65A helicopters equipped with night vision goggles (NVG). The purpose of the tests was to determine if the HH-65A's NVG search performance differed significantly from that of the Coast Guard HH-60J, and to assist the Coast Guard in deciding whether to continue to experiment with a near-infrared (IR), wide-area illuminator as an alternative to the aircraft's landing/hover lights. Helicopters searched test ranges for small boats, life rafts, and mannequins. Analysts collected aircraft and target positions, target detection logs, and environmental and human factors data. Following reconstruction and analysis, sweep width data from the two aircraft were compared. No statistically significant differences in NVG search performance were found between the two aircraft. HH-65A data were combined with existing HH-60J data to produce updated sweep width tables incorporating additional illumination, environmental, and human factors conditions. Active illumination improved sweep width under all conditions tested. Low-intensity, near-IR illumination provided a small sweep width improvement over landing lights when whitecaps were present.
DTIC
Hh-65 Helicopter; Goggles; Night Vision; Field Tests

20000066595 Institute for Human Factors TNO, Soesterberg, Netherlands
Digital Human Modelling Systems: Anthropometric Verification and Validation, Report 1, Test Methods and Test Instructions *Interim Report Procedure voor Verificatie en Validatie van Digitale Mensmodelsystemen*
Oudenhuijzen, A. J. K., Institute for Human Factors TNO, Netherlands; Hudson, J. A., Institute for Human Factors TNO, Netherlands; Feb. 02, 2000; 31p; In English; Original contains color illustrations
Contract(s)/Grant(s): A97/KLu/325; TNO Proj. 789.1
Report No.(s): TD-2000-0110; TM-00-A007; Copyright; Avail: Issuing Activity

The project 'Anthropometric accommodation in crew systems' is a co-operative effort of the Air Force Research Lab at Wright Patterson Air Force Base (AFRL/HECP Dayton, Ohio, USA) and TNO Human Factors Research Institute (TNO HFRI) in the Netherlands. The Royal Netherlands Airforce for the Dutch part funds this project. The main objective of the project is to identify methods for achieving anthropometric accommodation in crew systems more effective during he design process of military (and civilian?) aircraft. Human Modelling Systems (HMS's) are considered a basic element of these methods. However, the validity of the HMS's has to be proven before they can be used successfully. A procedure for verification and validation for HMS's is described in this report. The procedure consists of two separate phases. The first phase is the verification phase, the second the validation phase: 1. The output of the HMS's (for instance, limb links lengths, joint mobility, body volume, motion paths, functional measures etc.) will be compared with the corresponding variables of corresponding subjects in the verification phase; 2. The results of the overall HMS's functions will be compared to corresponding results of a field test with subjects in the validation phase. This report describes the activities for the digital analysis on the crew station of the F-16, a task to be carried out using HMS's. Other consecutive reports will describe the activities for the field test and the results of the above mentioned comparisons. The digital analysis is in fact a straightforward task for HMS'S. The results of this task will be a set of data. These data will be compared with the corresponding data from field tests on the crew station of the F-16. The data from the field tests result from comparable studies with subjects. Successive reports will describe the results of the actual verification and validation efforts using the F- 1 6 crew system as a standard, well known, database. The aim is to evaluate all leading and commercially available HMS's in this fashion. It is intended that these results will be used in the development of procedures and test methods for the assessment of anthropometric accommodation in planned crew systems.
Author
Anthropometry; Field Tests; Computer Aided Design; Models

20000066605 Institute for Human Factors TNO, Soesterberg, Netherlands
Evaluation of Hands-Free Night Vision Goggles *Interim Report Evaluatie 'Hands-Free' HV-Kijkers*
Kooi, F. L., Institute for Human Factors TNO, Netherlands; Feb. 10, 2000; 28p; In Dutch
Contract(s)/Grant(s): A99/KL/337; TNO Proj. 786.2
Report No.(s): TD-2000-0111; TM-00-A009; Copyright; Avail: Issuing Activity

The image quality, ease of use, and the user comfort of four night vision goggles have been compared: the ITL 'Mini Nseas' 3D with Gen 3 ITT tube, the Litton M 893 with Gen 3 Litton tube, and the DSS 'Munos' 3D with XD4 or Litton tube. The image quality (resolution and contrast) of the four systems is comparable, the XD4 showing just a bit poorer performance. In a simulated search time experiment no difference was found. The visual comfort is limited due to the monocular viewing. The DSS optics and the XD4 tube lead to slower fusion with the other, free viewing eye, indicating a risk of a further reduction of visual comfort. The most important deviations from the stated requirements ('PVE') are: (1) fogging of the NVGs with the eye cup in place (all systems); (2) too much image shift (Litton, DSS with XD4 tube); (3) absence of a dioptre marking (ITL). The ITL goggle outperforms the DSS goggle in a number of respects. The compatibility of the head mount with the helmet is insufficient. ITL has pro-

vided a functional helmet mount. The ITL was judged to be better suited for driving due to its lower weight, more comfortable head mount, and its somewhat better image quality. The compatibility with the gas mask is sub optimal. A binocular NVG was preferred over a monocular NVG for driving. Even though the driving speed for the monocular and binocular NVGs was the same, the low comfort rating indicates that a binocular NVG is the better choice for long driving periods and difficult terrain.
Author
Goggles; Image Resolution; Night Vision; Image Intensifiers; Enhanced Vision

20000067662 Boeing Co., Huntington Beach, CA USA
EVA Design, Verification, and On-Orbit Operations Support Using Worksite Analysis
Hagale, Thomas J., Boeing Co., USA; Price, Larry R., Boeing Co., USA; [2000]; ISSN 0148-7191; 8p; In English; 30th; 30th International Conference on Environmental Systems, 10-13 Jul. 2000, Toulouse, France; Sponsored by Engineering Society for Advancing Mobility Land, Sea, USA
Contract(s)/Grant(s): NAS8-39400
Report No.(s): SAE-TPS-00ICES-208; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The International Space Station (ISS) design is a very large and complex orbiting structure with thousands of Extravehicular Activity (EVA) worksites. These worksites are used to assemble and maintain the ISS. The challenge facing EVA designers was how to design, verify, and operationally support such a large number of worksites within cost and schedule. This has been solved through the practical use of computer aided design (CAD) graphical techniques that have been developed and used with a high degree of success over the past decade. The EVA design process allows analysts to work concurrently with hardware designers so that EVA equipment can be incorporated and structures configured to allow for EVA access and manipulation. Compliance with EVA requirements is strictly enforced during the design process. These techniques and procedures, coupled with neutral buoyancy underwater testing, have proven most valuable in the development, verification, and on-orbit support of planned or contingency EVA worksites.
Author
Extravehicular Activity; Computer Aided Design; Spacecraft Design

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see categories 60 through 67.

20000062855 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Mekh-mat Entrance Examinations Problems
Vardi, I.; Jan. 2000; 52p; In English
Report No.(s): PB2000-103802; IHES/M/00/06; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The recent article of Anatoly Vershik and Alexander Shen describes discrimination against Jews in Soviet universities during the 1970's and 1980's. The article contains a report by Alexander Shen on the specific role of examinations in discrimination against Jewish applicants to the Mekh-mat at Moscow State University during the 1970's and 1980's. The article goes on to list 'killer problems' that were given to Jewish candidates. However, solutions to the problems were not given in the article, so in order to judge their difficulty, one must try the problems for oneself. The aim of this note is to relieve readers of this time consuming task by providing a full set of solutions to the problems. Hopefully, this will help readers gain some insight into the ethical equations involved. Section 2 consists of a personal evaluation of the problems in the style of a referee's report. It was written to provide a template for readers to make a similar evaluation of the problems. This evaluation also reflects the author's own mathematical strengths and weaknesses as well approach to problem solving. Readers are therefore encouraged to make up their own minds.
NTIS
Problem Solving; Readers

60
COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see 33 Electronics and Electrical Engineering. For computer vision see 63 Cybernetics, Artificial Intelligence and Robotics.

20000063494 Nanogen, Inc., San Diego, CA USA
Photo-Electronic Optical Memory - Write/Read System ***Final Report, Jun. 1997 - Jun. 1999***
Heller, Michael; Apr. 2000; 31p; In English
Contract(s)/Grant(s): F30602-97-C-0229; AF Proj. 4594
Report No.(s): AD-A376242; AFRL-IF-RS-TR-2000-36; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Chromophoric DNA polymers are being developed for high density optical data storage applications. This project involves the design and synthesis of chromophoric DNA polymers which absorb light energy at a single wavelength and re-emit at predetermined multiple wavelengths. by emitting spectra rather than binary on/off bits, the data word size can be increased significantly and parallel access is enabled. The diffraction limit normally experienced with classical optical interrogation of a binary data site can now be overcome, because the number of data bits per unit area is increased in relation to the number of wavelengths produced at that site. In relation to this DNA optical memory project, a potentially more powerful write process is now being proposed for incorporating higher bit/byte densities in these DNA optical materials. This process, called a ”photo-electronic write”, involves using spatial light addressing to a photoactive substrate material which creates microscopic electric fields. These electric fields affect the rapid transport and attachment of charged chromophoric (color) DNA’s to the selected write locations. The ”photoelectronic write process” has advantages over this earlier UV write process for the optical storage systems, with potential capacities approaching petabytes on a 5 1/4” disc.
DTIC
Optical Memory (Data Storage); Data Structures; Data Storage; Read-Only Memory Devices

20000065638 New Mexico State Univ., Klipsch School of Electrical and Computer Engineering, Las Cruces, NM USA
Concatenated Coding and Equalization of Data Transmission and Storage
Ghrayeb, Ali, New Mexico State Univ., USA; Ryan, William, New Mexico State Univ., USA; Jun. 05, 2000; 138p; In English
Contract(s)/Grant(s): NAG5-7520
Report No.(s): NMSU-ECE-00-008; Copyright; Avail: Issuing Activity

The steady growth of data rates in magnetic recording systems is translated into an increase in recording densities. This results in an increase in the nonlinear intersymbol interference (ISI), which degrades the reliability of the retrieved data. The resulting ISI comprises both precursor and postcursor terms. In this dissertation, we introduce new equalization and coding techniques that are superior to previously knovm techniques. In the equalization area, we propose two new nonlinear equalizers for mitigating the effects of nonlinear ISI in magnetic recording systems. These equalizers, which we call RAM-Search algorithms, have been devised to cancel both precursor and postcursor (nonlinear) ISI. They were tested against two nonlinear models: a simple partial-erasure model for the nonlinear write process, and a third-order polynomial model for the nonlinear read process. A performance improvement of about 2.5 dB at a bit error rate of P (sub b) = 10 (exp -5) has been shown possible via simulations. The efficacy of these equalizers has also been demonstrated on captured spinstand signals which siiffer from a significant amount of nonlinear ISI. In the coding area, we study the serial concatenation of a single convolutional code (CC) and a precoded partial response (PR) channel separated by an interleaver, and is decoded using two iterative decoders that implement the a posteriori probability (APP) algorithm. One of the weaknesses of this scheme is that its error rate curves tend to hit an error rate floor near P (sub b) = 10 (exp -6). The level of the floors have been found to depend on the interleaver and precoder (for a given outer CC and a PR channel). In this regard, we discuss analytical techniques that lead to the joint optimization of interleaver and precoder for a fixed outer CC and a given PR channel, where optimality is in the sense of achieving the lowest floor. Such techniques result in lowering the error rate floor significantly at no additional decoder complexity. Additionally, the soft-output Viterbi algorithm (SOVA), which is a suboptimal version of the APP algorithm, is derived for PR channels. We also introduce a slight modification of the SOVA so that it works for arbitrarily high code rates.
Author
Concatenated Codes; Data Transmission; Equalizers (Circuits); Data Storage; Mathematical Models

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COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20000061434 Rensselaer Polytechnic Inst., Mechanical Engineering, Aeronautical Engineering and Mechanics, Troy, NY USA
Soft Computing in Multidisciplinary Aerospace Design: New Directions for Research
Hajela, Prabhat, Rensselaer Polytechnic Inst., USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 17-1 - 17-13; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

There has been increased activity in the study of methods for multidisciplinary analysis and design. This field of research has been a busy one over the past decade, driven by advances in computational methods and significant new developments in computer hardware. There is a concern, however, that while new computers will derive their computational speed through parallel processing, current algorithmic procedures that have roots in serial thinking are poor candidates for use on such machines - a paradigm shift is required! Among new advances in computational methods, soft computing techniques have enjoyed a remarkable period of development and growth. of these, methods of neural computing, evolutionary search, and fuzzy logic have been the most extensively explored in problems of multidisciplinary analysis and design. The paper will summarize important accomplishments to-date, of neurocomputing, fuzzy-logic, and evolutionary search, including immune network modeling, in the field of multidisciplinary aerospace design.
Author
Algorithms; Computation; Fuzzy Systems; Aircraft Design; Hardware

20000061451 DaimlerChrysler Aerospace A.G., Ottobrun, Germany
Rapid Generation of Conceptual and Preliminary Design Aerodynamic Data by a Computer Aided Process
Fornasier, Luciano, DaimlerChrysler Aerospace A.G., Germany; Gottmann, Thomas, DaimlerChrysler Aerospace A.G., Germany; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 35-1 - 35-11; In English; See also 20000061419; Sponsored in part by the JULIUS partners; Copyright Waived; Avail: CASI; A03, Hardcopy

A multidisciplinary integration framework (MIDAS- an acronym for Multidisciplinary Integration for Design and Analysis Software) is developed for a quick and accurate assessment of aircraft performance. The system allows for the continues integration of the conceptual and preliminary design stages. The MIDAS system is starting from the definition of the configuration layout to provide basic aerodynamic data- for performance analysis, sizing, structural layout and early handling qualities. The first aerodynamic dataset is provided by an Excel-based module in a highly automated way. This data base can be updated by computational and experimental fluid dynamics findings. Another MIDAS module integrate the preparation of CFD meshes. The paper deals with the integration of aerodynamic methods within the aircraft design.
Author
Aircraft Design; Computer Aided Design; Computer Techniques; Reliability Analysis

20000062014 NASA Glenn Research Center, Cleveland, OH USA
National Combustion Code: Parallel Implementation and Performance
Quealy, A., DYNACS Engineering Co., Inc., USA; Ryder, R., Flow Parametrics, LLC, USA; Norris, A., NASA Glenn Research Center, USA; Liu, N.-S., NASA Glenn Research Center, USA; April 2000; 16p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 509-10-24
Report No.(s): NASA/TM-2000-209801; E-12106; NAS 1.15:209801; AIAA Paper 2000-0336; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The National Combustion Code (NCC) is being developed by an industry-government team for the design and analysis of combustion systems. CORSAIR-CCD is the current baseline reacting flow solver for NCC. This is a parallel, unstructured grid code which uses a distributed memory, message passing model for its parallel implementation. The focus of the present effort has been to improve the performance of the NCC flow solver to meet combustor designer requirements for model accuracy and analysis turnaround time. Improving the performance of this code contributes significantly to the overall reduction in time and cost of the combustor design cycle. This paper describes the parallel implementation of the NCC flow solver and summarizes its current parallel performance on an SGI Origin 2000. Earlier parallel performance results on an IBM SP-2 are also included. The perfor-

mance improvements which have enabled a turnaround of less than 15 hours for a 1.3 million element fully reacting combustion simulation are described.
Author
Combustion Chambers; Costs; Reacting Flow; Simulation; Unstructured Grids (Mathematics); Design Analysis; Standards

20000062362 NASA Langley Research Center, Hampton, VA USA
Resiliency of the Multiscale Retinex Image Enhancement Algorithm
Rahman, Zia-Ur, College of William and Mary, USA; Jobson, Daniel J., NASA Langley Research Center, USA; Woodell, Glenn A., NASA Langley Research Center, USA; [1998]; 8p; In English; 6th; Color Imaging Conference: Color Science, Systems and Applications, Nov. 1998, Scottsdale, AZ, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The multiscale retinex with color restoration (MSRCR) continues to prove itself in extensive testing to be very versatile automatic image enhancement algorithm that simultaneously provides dynamic range compression, color constancy, and color rendition, However, issues remain with regard to the resiliency of the MSRCR to different image sources and arbitrary image manipulations which may have been applied prior to retinex processing. In this paper we define these areas of concern, provide experimental results, and, examine the effects of commonly occurring image manipulation on retinex performance. In virtually all cases the MSRCR is highly resilient to the effects of both the image source variations and commonly encountered prior image-processing. Significant artifacts are primarily observed for the case of selective color channel clipping in large dark zones in a image. These issues are of concerning the processing of digital image archives and other applications where there is neither control over the image acquisition process, nor knowledge about any processing done on th data beforehand.
Author
Algorithms; Dynamic Range; Image Enhancement; Image Processing

20000062457 Office of Management and Budget, Washington, DC USA
Progress on Year 2000 Conversion, 10th Quarterly Report (Office of Management and Budget)
Sep. 1999; 98p; In English
Report No.(s): PB2000-106042; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This report is the tenth in a series of quarterly reports to Congress on the Administrations progress in fixing the Year 2000 (Y2K) computer problem in Federal agencies. This report summarizes data received on August 13, 1999, from the 24 large agencies that make up the Federal Chief Information Officers (CIO) Council. It also summarizes data from 47 small and independent Federal agencies. This report builds on previous reports by updating the following: agency progress on fixing mission critical and non-mission critical systems, estimates of costs, and recent Government wide activities.
NTIS
Congressional Reports; Computer Programs; Software Engineering; Software Reliability; Program Verification (Computers); Checkout

20000062850 Defence Science and Technology Organisation, Surveillance Systems Div., Salisbury, Australia
A Comparison of Recursive Style Angle-Only Target Motion Analysis Algorithms
Arulampalam, Sanjeev, Defence Science and Technology Organisation, Australia; January 2000; 48p; In English
Report No.(s): DSTO-TR-0917; AR-011-173; Copyright; Avail: Issuing Activity

This report presents a comparison of existing angle-only target motion analysis algorithms which have applications in tracking under jamming conditions. Though a number of different algorithms have been proposed for this problem, the particular emphasis in this report is recursive style algorithms which are more suited to airborne applications. In particular, six algorithms are considered, which are derivatives of either the standard or the extended Kalman filter. Four of these algorithms are single- filter trackers while the other two are based on weighted sum of multiple filter outputs. Simulation results are presented to verify the claimed properties of these algorithms
Author
Algorithms; Kalman Filters; Simulation; Angles (Geometry); Acceleration (Physics)

20000062897 College of William and Mary, Dept. of Computer Science, Williamsburg, VA USA
Retinex Preprocessing for Improved Multi-Spectral Image Classification
Thompson, B., College of William and Mary, USA; Rahman, Z., College of William and Mary, USA; Park, S., College of William and Mary, USA; [2000]; 23p; In English
Contract(s)/Grant(s): NCC1-258; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of multi-image classification is to identify and label ”similar regions” within a scene. The ability to correctly classify a remotely sensed multi-image of a scene is affected by the ability of the classification process to adequately compensate for the effects of atmospheric variations and sensor anomalies. Better classification may be obtained if the multi-image is preprocessed before classification, so as to reduce the adverse effects of image formation. In this paper, we discuss the overall impact on multi-spectral image classification when the retinex image enhancement algorithm is used to preprocess multi-spectral images. The retinex is a multi-purpose image enhancement algorithm that performs dynamic range compression, reduces the dependence on lighting conditions, and generally enhances apparent spatial resolution. The retinex has been successfully applied to the enhancement of many different types of grayscale and color images. We show in this paper that retinex preprocessing improves the spatial structure of multi-spectral images and thus provides better within-class variations than would otherwise be obtained without the preprocessing. For a series of multi-spectral images obtained with diffuse and direct lighting, we show that without retinex preprocessing the class spectral signatures vary substantially with the lighting conditions. Whereas multi-dimensional clustering without preprocessing produced one-class homogeneous regions, the classification on the preprocessed images produced multi-class non-homogeneous regions. This lack of homogeneity is explained by the interaction between different agronomic treatments applied to the regions: the preprocessed images are closer to ground truth. The principle advantage that the retinex offers is that for different lighting conditions classifications derived from the retinex preprocessed images look remarkably ”similar”, and thus more consistent, whereas classifications derived from the original images, without preprocessing, are much less similar.
Author
Image Classification; Remote Sensing; Image Enhancement; Agriculture; Preprocessing; Spectral Reflectance

20000062936 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia
Translating Deeply Structured Information
Reid, Darryn J.; Feb. 2000; 60p; In English
Report No.(s): AD-A376791; DSTO-TR-0936; DODA-AR-011-201; Copyright; Avail: Defense Technical Information Center (DTIC)

The problem of interfacing Command, Control, Communications and Intelligence (C3I) systems and applicable simulations is considered. In particular, this document focusses on the requirements and design of an engine to Support translation between systems expecting to communicate using dissimilar message languages. This engine interprets a given behavioural specification written in a high-level declarative language built around standard SQL. It is therefore natural and convenient to consider implementation using an appropriate relational database system to facilitate data storage and manipulation. Beginning with an overview of the broader context and background, the discussion considers the way in which the semantic structures of the input and output languages can be captured using a conceptual modeling language. Such models can be readily mapped into a relational schema, and the actions that a translator should perform are easily expressed using SQL. Each of these actions must occur when a given set of conditions is satisfied; the engine is therefore a specialized rule-based system that manipulates the tuples of a relational database.
DTIC
Command and Control; Translating; Support Systems; Message Processing

20000062937 Air Force Logistics Management Center, Gunter AFS, AL USA
Quality Assurance Tracking and Trend Analysis System (QANTTAS) Revision, *Jan. 1999 - Jan. 2000*
Barton, Maura A.; Mynczywor, Stanley G.; Donald, Mary; Mar. 2000; 3p; In English
Report No.(s): AD-A376788; AFLMA-LM199832400; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

QANTTAS is an automated system used by Quality Assurance (QA) sections to track and perform trend analysis on maintenance personnel evaluations and equipment condition inspections. QANTTAS also provides the option to track other programs that are assigned to QA to include abort incidents (air or ground), dropped objects, foreign object damage, functional check flights, lost tools, impoundments, local manufacture, modification proposals, one-time inspections, quality deficiency reports, source maintenance recoverability (SMR) code change proposals, Time Compliance Technical Order monitoring, technical order improvements proposals, IDEA Program, and zero overpricing.
DTIC
Quality Control; Trend Analysis; Software Engineering

20000063388 College of William and Mary, Dept. of Computer Science, Williamsburg, VA USA

Fidelity Analysis of Sampled Imaging Systems

Park, Stephen K., College of William and Mary, USA; Rahman, Zia-ur, College of William and Mary, USA; Optical Engineering; May 1999; Volume 38, No. 5, pp. 786-800; In English; Sponsored in part by Battelle

Contract(s)/Grant(s): NCC1-258; DAAL03-91-C-0034; Copyright; Avail: Issuing Activity

Many modeling, simulation and performance analysis studies of sampled imaging systems are inherently incomplete because they are conditioned on a discrete-input, discrete-output model that only accounts for blurring during image acquisition and additive noise. For those sampled imaging systems where the effects of digital image acquisition, digital filtering and reconstruction are significant, the modeling, simulation and performance analysis should be based on a more comprehensive continuous-input, discrete-processing, continuous-output end-to-end model. This more comprehensive model should properly account for the low-pass filtering effects of image acquisition prior to sampling, the potentially important noiselike effects of the aliasing caused by sampling, additive noise due to device electronics and quantization, the generally high-boost filtering effects of digital processing, and the low-pass filtering effects of image reconstruction. This model should not, however, be so complex as to preclude significant mathematical analysis, particularly the mean-square (fidelity) type of analysis so common in linear system theory. We demonstrate that, although the mathematics of such a model is more complex, the increase in complexity is not so great as to prevent a complete fidelity-metric analysis at both the component level and at the end-to-end system level: that is, computable mean-square-based fidelity metrics are developed by which both component-level and system-level performance can be quantified. In addition, we demonstrate that system performance can be assessed qualitatively by visualizing the output image as the sum of three component images, each of which relates to a corresponding fidelity metric. The cascaded, or filtered, component accounts for the end-to-end system filtering of image acquisition, digital processing, and image reconstruction; the random noise component accounts for additive random noise, modulated by digital processing and image reconstruction filtering; and the aliased noise component accounts for the frequency folding effect of sampling, modulated by digital processing and image reconstruction filtering. Author

Imaging Techniques; Mathematical Models; Sampling; Mean Square Values; Linear Systems; End-to-End Data Systems

20000063390 ViA, Inc., Northfield, MN USA

Wrist Interactive Device for Wearable PC ***Monthly Report, 1-31 Mar. 2000***

Dini, Paolo; Apr. 07, 2000; 8p; In English

Contract(s)/Grant(s): N00421-97-C-1293

Report No.(s): AD-A377319; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

No Abstract Available.

DTIC

Applications Programs (Computers); Software Development Tools; Software Engineering

20000063508 Army Research Lab., Cleveland, OH USA

The NPARC Alliance: A Science and Technology/Test and Evaluation Partnership Example

Acosta, Waldo A., Army Research Lab., USA; Matty, Jere J., Arnold Engineering Development Center, USA; May 2000; 12p; In English; Test and Evaluation and Science and Technology: Forging Partnerships for the Future of Aerospace, 12-15 Oct. 1999, Tullahoma, TN, USA; Sponsored by International Test and Evaluation Association, Unknown; Original contains color illustrations

Contract(s)/Grant(s): RTOP 714-04-50; DA Proj. 1L1-62211-A-47-A

Report No.(s): NASA/TM-2000-210064; E-12291; NAS 1.15:210064; ARL-TR-2112; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NPARC Alliance is a partnership between NASA's Glenn Research Center, the Air Force's Arnold Engineering Development Center, and industry. We have been working together since the early 90s to produce flow solvers for use in advanced aerospace applications. This flow simulation system (WIND) is continuously being improved and validated by the NPARC Alliance to address the U.S. aerospace community's requirements for an efficient general-purpose tool. The Alliance provides support to all user organizations, serves as the national focal point for NPARC software development/ validation, and ensures that these efforts remain customer focused by actively seeking feedback from the user community. This paper provides an overview of the capabilities of the NPARC Alliance simulation system, a description of the development process, and discusses the history and progress of the Alliance to date.

Author

Aerospace Engineering; Organizations; Research and Development; Software Engineering

20000063526 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia
A Comparison of Recursive Style Angle-Only Target Motion Analysis Algorithms
Arulampalam, Sanjeev; Jan. 2000; 39p; In English
Report No.(s): AD-A376954; DSTO-TR-0917; DODA-AR-011-173; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents a comparison of existing angle-only target motion analysis algorithms which have applications in tracking under jamming conditions. Though a number of different algorithms have been proposed for this problem, the particular emphasis in this report is recursive style algorithms which are more suited to airborne applications. In particular, six algorithms are considered, which are derivatives of either the standard or the extended Kalman filter. Four of these algorithms are single-filter trackers while the other two are based on weighted sum of multiple filter outputs. Simulation results are presented to verify the claimed properties of these algorithms.
DTIC
Algorithms; Moving Target Indicators; Jamming; Tracking (Position); Angles (Geometry)

20000063531 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Practical Issues in Implementing Software Reliability Measurement
Nikora, Allen P., Jet Propulsion Lab., California Inst. of Tech., USA; Schneidewind, Norman F., Naval Postgraduate School, USA; Everett, William W., SPRE, Inc., USA; Munson, John C., Idaho Univ., USA; Vouk, Mladen A., North Carolina State Univ., USA; Musa, John D.; [1999]; 5p; In English; 10th; Software Reliability and Engineering, 1-4 Nov. 1999, Boca Raton, FL, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Many ways of estimating software systems' reliability, or reliability-related quantities, have been developed over the past several years. Of particular interest are methods that can be used to estimate a software system's fault content prior to test, or to discriminate between components that are fault-prone and those that are not. The results of these methods can be used to: 1) More accurately focus scarce fault identification resources on those portions of a software system most in need of it. 2) Estimate and forecast the risk of exposure to residual faults in a software system during operation, and develop risk and safety criteria to guide the release of a software system to fielded use. 3) Estimate the efficiency of test suites in detecting residual faults. 4) Estimate the stability of the software maintenance process.
Derived from text
Software Engineering; Software Reliability; Estimating

20000064014 Physics and Electronics Lab. TNO, The Hague, Netherlands
Motion Detection Methods for Surveillance Systems Using Image Sequences ***Final Report Bewegingsdetectie voor Waarnemingssystemen met Behulp van Beeldreeksen***
Benoist, K. W., Physics and Electronics Lab. TNO, Netherlands; Lerou, R. J. L., Physics and Electronics Lab. TNO, Netherlands; September 1999; 43p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A96/KL/776; TNO Proj. 28427
Report No.(s): TD-99-0204; FEL-99-A044; Copyright; Avail: Issuing Activity

Several motion detection methods using digital image sequences are tested using software modules written in Matlab and C. Results, advantages and disadvantages of the methods are discussed. A motivation for continuation of this research, aiming at a suitable reference motion detection algorithm, is given.
Author
Detection; Motion; Procedures; Surveillance; Performance Tests

20000064051 Syracuse Univ., Center for Science and Technology, NY USA
Pragmatic Approaches to Composition and Verification of Assured Software ***Final Report, Feb. 1998 - Aug. 1999***
Zhou, Dan; Older, Susan; Chin, Shiu-Kai; Mar. 2000; 26p; In English
Contract(s)/Grant(s): F30602-98-1-0063; AF Proj. 2304
Report No.(s): AD-A376282; AFRL-IF-RS-TR-2000-18; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Mature engineering fields have methods of construction that have high likelihoods of success, and that guarantee the proper functioning of systems, even within hostile environments. These methods relate behavior to structure and have underlying notions of composition related to the implementation domain. Unfortunately, the construction of computer systems has not yet reached the same level of maturity. While many mathematical theories have been developed, they have in yet been brought into standard engineering practice. Bridging the gap between theory and engineering practice requires sound and pragmatic principles of construction and composition for software systems. One potentially promising and practical approach employs a combination of

higher-order logic, category theory, and algebraic specifications, as incorporated into the HOL theorem prover and the Specware system for specification composition, refinement, and code synthesis. This report presents a HOL formulation of the primary mathematical concepts underlying Specware, fully explicating the underlying principles of construction and composition. Furthermore, the purpose of computer-assisted reasoning is to allow nonexperts in a given domain to nonetheless have confidence in their analysis. The HOL formulation describes the relevant concepts in an executable form that nonexperts can use in the future to construct assured specifications and ultimately assured code.
DTIC
Software Engineering; Program Verification (Computers); Computer Techniques

20000064085 California Univ., Dept. of Electrical and Computer Engineering, Davis, CA USA
Error Control Coding Techniques for Space and Satellite Communications
Lin, Shu, California Univ., USA; May 24, 2000; 30p; In English
Contract(s)/Grant(s): NAG5-9025
Report No.(s): Rept-00-001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a concatenated turbo coding system in which a Reed-Solomom outer code is concatenated with a binary turbo inner code. In the proposed system, the outer code decoder and the inner turbo code decoder interact to achieve both good bit error and frame error performances. The outer code decoder helps the inner turbo code decoder to terminate its decoding iteration while the inner turbo code decoder provides soft-output information to the outer code decoder to carry out a reliability-based soft-decision decoding. In the case that the outer code decoding fails, the outer code decoder instructs the inner code decoder to continue its decoding iterations until the outer code decoding is successful or a preset maximum number of decoding iterations is reached. This interaction between outer and inner code decoders reduces decoding delay. Also presented in the paper are an effective criterion for stopping the iteration process of the inner code decoder and a new reliability-based decoding algorithm for nonbinary codes.
Author
Concatenated Codes; Binary Codes; Bit Error Rate; Error Analysis; Reed-Solomon Codes; Decoding; Decoders

20000064580 NASA Ames Research Center, Moffett Field, CA USA
A Parallel Genetic Algorithm for Automated Electronic Circuit Design
Long, Jason D., NASA Ames Research Center, USA; Colombano, Silvano P., NASA Ames Research Center, USA; Haith, Gary L., NASA Ames Research Center, USA; Stassinopoulos, Dimitris, NASA Ames Research Center, USA; Welcome to the NASA High Performance Computing and Communications Computational Aerosciences (CAS) Workshop 2000; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Parallelized versions of genetic algorithms (GAs) are popular primarily for three reasons: the GA is an inherently parallel algorithm, typical GA applications are very compute intensive, and powerful computing platforms, especially Beowulf-style computing clusters, are becoming more affordable and easier to implement. In addition, the low communication bandwidth required allows the use of inexpensive networking hardware such as standard office ethernet. In this paper we describe a parallel GA and its use in automated high-level circuit design. Genetic algorithms are a type of trial-and-error search technique that are guided by principles of Darwinian evolution. Just as the genetic material of two living organisms can intermix to produce offspring that are better adapted to their environment, GAs expose genetic material, frequently strings of 1s and Os, to the forces of artificial evolution: selection, mutation, recombination, etc. GAs start with a pool of randomly-generated candidate solutions which are then tested and scored with respect to their utility. Solutions are then bred by probabilistically selecting high quality parents and recombining their genetic representations to produce offspring solutions. Offspring are typically subjected to a small amount of random mutation. After a pool of offspring is produced, this process iterates until a satisfactory solution is found or an iteration limit is reached. Genetic algorithms have been applied to a wide variety of problems in many fields, including chemistry, biology, and many engineering disciplines. There are many styles of parallelism used in implementing parallel GAs. One such method is called the master-slave or processor farm approach. In this technique, slave nodes are used solely to compute fitness evaluations (the most time consuming part). The master processor collects fitness scores from the nodes and performs the genetic operators (selection, reproduction, variation, etc.). Because of dependency issues in the GA, it is possible to have idle processors. However, as long as the load at each processing node is similar, the processors are kept busy nearly all of the time. In applying GAs to circuit design, a suitable genetic representation 'is that of a circuit-construction program. We discuss one such circuit-construction programming language and show how evolution can generate useful analog circuit designs. This language has the desirable property that virtually all sets of combinations of primitives result in valid circuit graphs. Our system allows circuit size (number of devices), circuit topology, and device values to be evolved. Using a parallel genetic algorithm and circuit simulation software, we present experimental results as applied to three analog filter and two amplifier design tasks. For example, a figure shows an

85 dB amplifier design evolved by our system, and another figure shows the performance of that circuit (gain and frequency response). In all tasks, our system is able to generate circuits that achieve the target specifications.
Author
Genetic Algorithms; Computer Aided Design; Circuits; Control Systems Design

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Automation of the CFD Process on Distributed Computing Systems
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A script system was developed to automate and streamline portions of the CFD process. The system was designed to facilitate the use of CFD flow solvers on supercomputer and workstation platforms within a parametric design event. Integrating solver pre- and postprocessing phases, the fully automated ADTT script system marshalled the required input data, submitted the jobs to available computational resources, and processed the resulting output data. A number of codes were incorporated into the script system, which itself was part of a larger integrated design environment software package. The IDE and scripts were used in a design event involving a wind tunnel test. This experience highlighted the need for efficient data and resource management in all parts of the CFD process. to facilitate the use of CFD methods to perform parametric design studies, the script system was developed using UNIX shell and Perl languages. The goal of the work was to minimize the user interaction required to generate the data necessary to fill a parametric design space. The scripts wrote out the required input files for the user-specified flow solver, transferred all necessary input files to the computational resource, submitted and tracked the jobs using the resource queuing structure, and retrieved and post-processed the resulting dataset. For computational resources that did not run queueing software, the script system established its own simple first-in-first-out queueing structure to manage the workload. A variety of flow solvers were incorporated in the script system, including INS2D, PMARC, TIGER and GASP. Adapting the script system to a new flow solver was made easier through the use of object-oriented programming methods. The script system was incorporated into an ADTT integrated design environment and evaluated as part of a wind tunnel experiment. The system successfully generated the data required to fill the desired parametric design space. This stressed the computational resources required to compute and store the information. The scripts were continually modified to improve the utilization of the computational resources and reduce the likelihood of data loss due to failures. An ad-hoc file server was created to manage the large amount of data being generated as part of the design event. Files were stored and retrieved as needed to create new jobs and analyze the results. Additional information is contained in the original.
Author
Applications Programs (Computers); Computational Fluid Dynamics; Object-Oriented Programming; Distributed Processing

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Developing CORBA-Based Distributed Scientific Applications from Legacy FORTRAN Programs
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Recent progress in distributed object technology has enabled software applications to be developed and deployed easily such that objects or components can work together across the boundaries of the network, different operating systems, and different languages. A distributed object is not necessarily a complete application but rather a reusable, self-contained piece of software that co-operates with other objects in a plug-and-play fashion via a well-defined interface. The Common Object Request Broker Architecture (CORBA), a middleware standard defined by the Object Management Group (OMG), uses the Interface Definition Language (IDL) to specify such an interface for transparent communication between distributed objects. Since IDL can be mapped to any programming language, such as C++, Java, Smalltalk, etc., existing applications can be integrated into a new application and hence the tasks of code re-writing and software maintenance can be reduced. Many scientific applications in aerodynamics and solid mechanics are written in FORTRAN. Refitting these legacy FORTRAN codes with CORBA objects can increase the codes reusability. For example, scientists could link their scientific applications to vintage FORTRAN programs such as Partial Differential Equation(PDE) solvers in a plug-and-play fashion. Unfortunately, CORBA IDL to FORTRAN mapping has not been proposed and there seems to be no direct method of generating CORBA objects from FORTRAN without having to resort to manually writing C/C++ wrappers. In this paper, we present an efficient methodology to integrate FORTRAN legacy programs into a distributed object framework. Issues and strategies regarding the conversion and decomposition of FORTRAN codes into

CORBA objects are discussed. The following diagram shows the conversion and decomposition mechanism we proposed. Our goal is to keep the FORTRAN codes unmodified. The conversion- aided tool takes the FORTRAN application program as input and helps programmers generate C/C++ header file and IDL file for wrapping the FORTRAN code. Programmers need to determine by themselves how to decompose the legacy application into several reusable components based on the cohesion and coupling factors among the functions and subroutines. However, programming effort still can be greatly reduced because function headings and types have been converted to C++ and IDL styles. Most FORTRAN applications use the COMMON block to facilitate the transfer of large amount of variables among several functions. The COMMON block plays the similar role of global variables used in C. In the CORBA-compliant programming environment, global variables can not be used to pass values between objects. One approach to dealing with this problem is to put the COMMON variables into the parameter list. We do not adopt this approach because it requires modification of the FORTRAN source code which violates our design consideration. Our approach is to extract the COMMON blocks and convert them into a structure-typed attribute in C++. Through attributes, each component can initialize the variables and return the computation result back to the client. We have tested successfully the proposed conversion methodology based on the f2c converter. Since f2c only translates FORTRAN to C, we still needed to edit the converted code to meet the C++ and IDL syntax. For example, C++/IDL requires a tag in the structure type, while C does not. In this paper, we identify the necessary changes to the f2c converter in order to directly generate the C++ header and the IDL file. Our future work is to add GUI interface to ease the decomposition task by simply dragging and dropping icons.
Author
Applications Programs (Computers); Programming Environments; Subroutines; Graphical User Interface; Object-Oriented Programming; Software Development Tools; Computer Programming; Computer Programs

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Evolutionary Cell Computing: From Protocells to Self-Organized Computing
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On the path from inanimate to animate matter, a key step was the self-organization of molecules into protocells - the earliest ancestors of contemporary cells. Studies of the properties of protocells and the mechanisms by which they maintained themselves and reproduced are an important part of astrobiology. These studies also have the potential to greatly impact research in nanotechnology and computer science. Previous studies of protocells have focussed on self-replication. In these systems, Darwinian evolution occurs through a series of small alterations to functional molecules whose identities are stored. Protocells, however, may have been incapable of such storage. We hypothesize that under such conditions, the replication of functions and their interrelationships, rather than the precise identities of the functional molecules, is sufficient for survival and evolution. This process is called non-genomic evolution. Recent breakthroughs in experimental protein chemistry have opened the gates for experimental tests of non-genomic evolution. On the basis of these achievements, we have developed a stochastic model for examining the evolutionary potential of non-genomic systems. In this model, the formation and destruction (hydrolysis) of bonds joining amino acids in proteins occur through catalyzed, albeit possibly inefficient, pathways. Each protein can act as a substrate for polymerization or hydrolysis, or as a catalyst of these chemical reactions. When a protein is hydrolyzed to form two new proteins, or two proteins are joined into a single protein, the catalytic abilities of the product proteins are related to the catalytic abilities of the reactants. We will demonstrate that the catalytic capabilities of such a system can increase. Its evolutionary potential is dependent upon the competition between the formation of bond-forming and bond-cutting catalysts. The degree to which hydrolysis preferentially affects bonds in less efficient, and therefore less well-ordered, peptides is also critical to evolution of a non-genomic system. Based on these results, a new computational object called a ”molnet” is defined. Like a neural network, it is formed of interconnected units that send ”signals” to each other. Like molecules, neural networks have a specific function once their structure is defined. The difference between a molnet and traditional neural networks, is that input to molnets is not simply passed along and processed from input to output units, but rather it is utilized to form and break connections(bonds), and thus to form new structures. Molnets represent a powerful tool that can be used to understand the conditions under which chemical systems can form large molecules, such as proteins, and display ever more complex functions. This has direct applications, for example to the design of smart,synthetic fabrics. Additional information is contained in the original.
Author
Cells (Biology); Neural Nets; Protobiology; Biological Evolution; Computer Networks

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High-Performance Algorithms and Applications for SMP Clusters

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The future of high-performance computing relies on the efficient and scalable use of clusters with symmetric multiprocessor (SMP) nodes and low-latency, high-bandwidth interconnection networks. Current examples of such platforms include Sun Ultra HPC machines, Compaq AlphaServers with Quadrics switches, SGI Origins, and the IBM SP system with SMP nodes. Moreover, the future of NASA mission-critical computing for computational aerosciences relies on the success of computational clusters (e.g., SMP Linux clusters at Goddard Space Flight Center, and large SGI Origin arrays at Ames Research Center). Hardware benchmark results reveal awesome performance rates for each component; however, few applications on SMP clusters ever reach a fraction of these peak speeds. While methodologies for symmetric multiprocessors (e.g., OpenMP or POSIX threads) and message-passing primitives for clusters (e.g., MPI) are well developed, performance dictates the use of a hybrid solution. We present preliminary results of our complexity model and programming methodology that is based hierarchically upon realistic model components for message-passing and for symmetric multiprocessor parallel architectures. The current deployment of teraflops and the future development of petaflops systems will certainly require the exploitation of similar hybrid programming models. Our goal is to validate and refine a core complexity model, efficient primitives and algorithmic libraries needed to support the effective use of SMP clusters for computational aeroscience (CAS) and earth and space science (ESS) codes. In addition, we will show how to design, implement, analyze, and refine algorithms that take advantage of the hybrid programming model and contribute to significant speed-ups for real computational science problems. These will include some basic combinatorial support tasks used in numerical aerodynamics simulations (e.g., sorting integers for particle-in-cell codes) and selected numerical computations (e.g., fast transforms). These algorithmic kernels exhibit promising performance improvements. Our hybrid programming environment also must support mission-critical high-performance computing applications. Thus, we use real computational aeroscience and Earth and space science codes drive our algorithmic development. These applications include segmentation and classification of remotely-sensed imagery, and navigation, calibration, and registration of terascale data sets, for remote sensing (AVHRR and MODIS) and three-dimensional numerical relativity with the CACTUS computational astrodynamics toolkit. Additional information is contained in the original.

Author

Multiprocessing (Computers); Programming Environments; Interprocessor Communication; Parallel Programming; Algorithms; Models

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Multiresolution With Super-Compact Wavelets

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The solution data computed from large scale simulations are sometimes too big for main memory, for local disks, and possibly even for a remote storage disk, creating tremendous processing time as well as technical difficulties in analyzing the data. The excessive storage demands a corresponding huge penalty in I/O time, rendering time and transmission time between different computer systems. In this paper, a multiresolution scheme is proposed to compress field simulation or experimental data without much loss of important information in the representation. Originally, the wavelet based multiresolution scheme was introduced in image processing, for the purposes of data compression and feature extraction. Unlike photographic image data which has rather simple settings, computational field simulation data needs more careful treatment in applying the multiresolution technique. While the image data sits on a regular spaced grid, the simulation data usually resides on a structured curvilinear grid or unstructured grid. In addition to the irregularity in grid spacing, the other difficulty is that the solutions consist of vectors instead of scalar values. The data characteristics demand more restrictive conditions. In general, the photographic images have very little inherent smoothness with discontinuities almost everywhere. On the other hand, the numerical solutions have smoothness almost everywhere and discontinuities in local areas (shock, vortices, and shear layers). The wavelet bases should be amenable to the solution of the problem at hand and applicable to constraints such as numerical accuracy and boundary conditions. In choosing a suitable wavelet basis for simulation data among a variety of wavelet families, the supercompact wavelets designed by Beam and Warming provide one of the most effective multiresolution schemes. Supercompact multi-wavelets retain the compactness of Haar wavelets, are piecewise polynomial and orthogonal, and can have arbitrary order of approximation. The advantages of the multiresolution algorithm are that no special treatment is required at the boundaries of the interval, and that the application to functions which are only piecewise continuous (internal boundaries) can be efficiently implemented. In this presentation, Beam's supercompact wavelets are generalized to higher dimensions using multidimensional scaling and wavelet functions rather than alternating the directions as in the 1D version. As a demonstration of actual 3D data compression, supercompact wavelet transforms are applied to a 3D data

set for wing tip vortex flow solutions (2.5 million grid points). It is shown that high data compression ratio can be achieved (around 50:1 ratio) in both vector and scalar data set.
Author
Data Compression; Image Resolution; Unstructured Grids (Mathematics); Wavelet Analysis; Computerized Simulation

20000064611 NASA Glenn Research Center, Cleveland, OH USA
NPSS on NASA's IPG: Using CORBA and Globus to Coordinate Multidisciplinary Aeroscience Applications
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Within NASA's High Performance Computing and Communication (HPCC) program, the NASA Glenn Research Center is developing an environment for the analysis/design of aircraft engines called the Numerical Propulsion System Simulation (NPSS). The vision for NPSS is to create a "numerical test cell" enabling full engine simulations overnight on cost-effective computing platforms. to this end, NPSS integrates multiple disciplines such as aerodynamics, structures, and heat transfer and supports "numerical zooming" between O-dimensional to 1-, 2-, and 3-dimensional component engine codes. In order to facilitate the timely and cost-effective capture of complex physical processes, NPSS uses object-oriented technologies such as C++ objects to encapsulate individual engine components and CORBA ORBs for object communication and deployment across heterogeneous computing platforms. Recently, the HPCC program has initiated a concept called the Information Power Grid (IPG), a virtual computing environment that integrates computers and other resources at different sites. IPG implements a range of Grid services such as resource discovery, scheduling, security, instrumentation, and data access, many of which are provided by the Globus toolkit. IPG facilities have the potential to benefit NPSS considerably. For example, NPSS should in principle be able to use Grid services to discover dynamically and then co-schedule the resources required for a particular engine simulation, rather than relying on manual placement of ORBs as at present. Grid services can also be used to initiate simulation components on parallel computers (MPPs) and to address inter-site security issues that currently hinder the coupling of components across multiple sites. These considerations led NASA Glenn and Globus project personnel to formulate a collaborative project designed to evaluate whether and how benefits such as those just listed can be achieved in practice. This project involves firstly development of the basic techniques required to achieve co-existence of commodity object technologies and Grid technologies; and secondly the evaluation of these techniques in the context of NPSS-oriented challenge problems. The work on basic techniques seeks to understand how "commodity" technologies (CORBA, DCOM, Excel, etc.) can be used in concert with specialized "Grid" technologies (for security, MPP scheduling, etc.). In principle, this coordinated use should be straightforward because of the Globus and IPG philosophy of providing low-level Grid mechanisms that can be used to implement a wide variety of application-level programming models. (Globus technologies have previously been used to implement Grid-enabled message-passing libraries, collaborative environments, and parameter study tools, among others.) Results obtained to date are encouraging: we have successfully demonstrated a CORBA to Globus resource manager gateway that allows the use of CORBA RPCs to control submission and execution of programs on workstations and MPPs; a gateway from the CORBA Trader service to the Grid information service; and a preliminary integration of CORBA and Grid security mechanisms. The two challenge problems that we consider are the following: 1) Desktop-controlled parameter study. Here, an Excel spreadsheet is used to define and control a CFD parameter study, via a CORBA interface to a high throughput broker that runs individual cases on different IPG resources. 2) Aviation safety. Here, about 100 near real time jobs running NPSS need to be submitted, run and data returned in near real time. Evaluation will address such issues as time to port, execution time, potential scalability of simulation, and reliability of resources. The full paper will present the following information: 1. A detailed analysis of the requirements that NPSS applications place on IPG. 2. A description of the techniques used to meet these requirements via the coordinated use of CORBA and Globus. 3. A description of results obtained to date in the first two challenge problems.
Author
Computerized Simulation; Object-Oriented Programming; Software Engineering; Computer Systems Design; Graphical User Interface

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Performance Assessment of OVERFLOW on Distributed Computing Environment

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The aerodynamic computer code, OVERFLOW, with a multi-zone overset grid feature, has been parallelized to enhance its performance on distributed and shared memory paradigms. Practical application benchmarks have been set to assess the efficiency of code's parallelism on high-performance architectures. The code's performance has also been experimented with in the context of the distributed computing paradigm on distant computer resources using the Information Power Grid (IPG) toolkit, Globus. Two parallel versions of the code, namely OVERFLOW-MPI and -MLP, have developed around the natural coarse grained parallelism inherent in a multi-zonal domain decomposition paradigm. The algorithm invokes a strategy that forms a number of groups, each consisting of a zone, a cluster of zones and/or a partition of a large zone. Each group can be thought of as a process with one or multithreads assigned to it and that all groups run in parallel. The -MPI version of the code uses explicit message-passing based on the standard MPI library for sending and receiving interzonal boundary data across processors. The -MLP version employs no message-passing paradigm; the boundary data is transferred through the shared memory. The -MPI code is suited for both distributed and shared memory architectures, while the -MLP code can only be used on shared memory platforms. The IPG applications are implemented by the -MPI code using the Globus toolkit. While a computational task is distributed across multiple computer resources, the parallelism can be explored on each resource alone. Performance studies are achieved with some practical aerodynamic problems with complex geometries, consisting of 2.5 up to 33 million grid points and a large number of zonal blocks. The computations were executed primarily on SGI Origin 2000 multiprocessors and on the Cray T3E. OVERFLOW's IPG applications are carried out on NASA homogeneous metacomputing machines located at three sites, Ames, Langley and Glenn. Plans for the future will exploit the distributed parallel computing capability on various homogeneous and heterogeneous resources and large scale benchmarks. Alternative IPG toolkits will be used along with sophisticated zonal grouping strategies to minimize the communication time across the computer resources.

Author

Algorithms; Computer Programs; Multiprocessing (Computers); Parallel Processing (Computers); Distributed Processing; Computer Systems Design; Software Engineering

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Performance of an Optimized Eta Model Code on the Cray T3E and a Network of PCs

Kouatchou, Jules, NASA Goddard Space Flight Center, USA; Rancic, Miodrag, NASA Goddard Space Flight Center, USA; Geiger, Jim, NASA Goddard Space Flight Center, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In the year 2001, NASA will launch the satellite TRIANA that will be the first Earth observing mission to provide a continuous, full disk view of the sunlit Earth. As a part of the HPCC Program at NASA GSFC, we have started a project whose objectives are to develop and implement a 3D cloud data assimilation system, by combining TRIANA measurements with model simulation, and to produce accurate statistics of global cloud coverage as an important element of the Earth's climate. For simulation of the atmosphere within this project we are using the NCEP/NOAA operational Eta model. In order to compare TRIANA and the Eta model data on approximately the same grid without significant downscaling, the Eta model will be integrated at a resolution of about 15 km. The integration domain (from -70 to +70 deg in latitude and 150 deg in longitude) will cover most of the sunlit Earth disc and will continuously rotate around the globe following TRIANA. The cloud data assimilation is supposed to run and produce 3D clouds on a near real-time basis. Such a numerical setup and integration design is very ambitious and computationally demanding. Thus, though the Eta model code has been very carefully developed and its computational efficiency has been systematically polished during the years of operational implementation at NCEP, the current MPI version may still have problems with memory and efficiency for the TRIANA simulations. Within this work, we optimize a parallel version of the Eta model code on a Cray T3E and a network of PCs (theHIVE) in order to improve its overall efficiency. Our optimization procedure consists of introducing dynamically allocated arrays to reduce the size of static memory, and optimizing on a single processor by splitting loops to limit the number of streams. All the presented results are derived using an integration domain centered at the equator, with a size of 60 x 60 deg, and with horizontal resolutions of 1/2 and 1/3 deg, respectively. In accompanying charts we report the elapsed time, the speedup and the Mflops as a function of the number of processors for the non-optimized version of the code on the T3E and theHIVE. The large amount of communication required for model integration explains its poor performance on theHIVE. Our initial implementation of the dynamic memory allocation has contributed to about 12% reduction of memory but has introduced a 3% overhead in computing time. This overhead was removed by performing loop splitting in some of the high demanding subroutines. When the Eta code is fully optimized in order to meet the memory requirement for TRIANA simulations, a non-neglige-

able overhead may appear that may seriously affect the efficiency of the code. to alleviate this problem, we are considering implementation of a new algorithm for the horizontal advection that is computationally less expensive, and also a new approach for marching in time.
Author
Algorithms; Software Engineering; Computerized Simulation; Numerical Integration; Software Reliability; Computer Systems Performance

20000064617 NASA Ames Research Center, Moffett Field, CA USA
Performance of the OVERFLOW-MLP and LAURA-MLP CFD Codes on the NASA Ames 512 CPU Origin System
Taft, James R., NASA Ames Research Center, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The shared memory Multi-Level Parallelism (MLP) technique, developed last year at NASA Ames has been very successful in dramatically improving the performance of important NASA CFD codes. This new and very simple parallel programming technique was first inserted into the OVERFLOW production CFD code in FY 1998. The OVERFLOW-MLP code's parallel performance scaled linearly to 256 CPUs on the NASA Ames 256 CPU Origin 2000 system (steger). Overall performance exceeded 20.1 GFLOP/s, or about 4.5x the performance of a dedicated 16 CPU C90 system. All of this was achieved without any major modification to the original vector based code. The OVERFLOW-MLP code is now in production on the inhouse Origin systems as well as being used offsite at commercial aerospace companies. Partially as a result of this work, NASA Ames has purchased a new 512 CPU Origin 2000 system to further test the limits of parallel performance for NASA codes of interest. This paper presents the performance obtained from the latest optimization efforts on this machine for the LAURA-MLP and OVERFLOW-MLP codes. The Langley Aerothermodynamics Upwind Relaxation Algorithm (LAURA) code is a key simulation tool in the development of the next generation shuttle, interplanetary reentry vehicles, and nearly all "X" plane development. This code sustains about 4-5 GFLOP/s on a dedicated 16 CPU C90. At this rate, expected workloads would require over 100 C90 CPU years of computing over the next few calendar years. It is not feasible to expect that this would be affordable or available to the user community. Dramatic performance gains on cheaper systems are needed. This code is expected to be perhaps the largest consumer of NASA Ames compute cycles per run in the coming year.The OVERFLOW CFD code is extensively used in the government and commercial aerospace communities to evaluate new aircraft designs. It is one of the largest consumers of NASA supercomputing cycles and large simulations of highly resolved full aircraft are routinely undertaken. Typical large problems might require 100s of Cray C90 CPU hours to complete. The dramatic performance gains with the 256 CPU steger system are exciting. Obtaining results in hours instead of months is revolutionizing the way in which aircraft manufacturers are looking at future aircraft simulation work. Figure 2 below is a current state of the art plot of OVERFLOW-MLP performance on the 512 CPU Lomax system. As can be seen, the chart indicates that OVERFLOW-MLP continues to scale linearly with CPU count up to 512 CPUs on a large 35 million point full aircraft RANS simulation. At this point performance is such that a fully converged simulation of 2500 time steps is completed in less than 2 hours of elapsed time. Further work over the next few weeks will improve the performance of this code even further.The LAURA code has been converted to the MLP format as well. This code is currently being optimized for the 512 CPU system. Performance statistics indicate that the goal of 100 GFLOP/s will be achieved by year's end. This amounts to 20x the 16 CPU C90 result and strongly demonstrates the viability of the new parallel systems rapidly solving very large simulations in a production environment.
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Computational Fluid Dynamics; Parallel Programming; Supercomputers; Computer Systems Performance; Parallel Processing (Computers)

20000064619 DYNACS Engineering Co., Inc., Brook Park, OH USA
Progress in the Semantic Analysis of Scientific Code
Stewart, Mark, DYNACS Engineering Co., Inc., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Existing software analysis tools use the semantics of the programming language to check our codes: Are variables declared and initialized? Do variable types match? Where do memory leaks and memory errors occur? However, the meaning or semantics that a code developer builds into his/her code extends far beyond programming language semantics. Scientific code developers use variables to represent physical and mathematical quantities (mass, derivative), expressions of quantities to represent physical formulae (Navier-Stokes equation), loops over expression to apply these formulae in a domain, and conditional expressions to control execution. These semantic details are crucial when developers and users try to understand and check their scientific and engineering codes; further, this analysis is manual, time-consuming, and error-prone. This paper reports progress in an experiment to automatically recognize and check these physical and mathematical semantics. The experimental procedure combines semantic

declarations with a pattern recognition capability; the code C? MA == mass, ACC == acceleration; FF = MA * ACC contains two semantic declarations for MA and ACC, and with Newton's law among the recognizable patterns, the procedure recognizes this code as Force assigned to FF. This experiment's objective is to understand the limits of this automatic recognition technique: Does it apply to a wide range of scientific and engineering codes? Can it reduce the time, risk, and effort required to develop and modify scientific code? Previous work' demonstrated that scientific concepts and formulae could be represented and recognized. In fact, for part of one reacting flow code, 50% of operations can be recognized. However, this preliminary work posed several questions: Can additional semantic details be represented and recognized? How well do the recognition rules work in blind test cases? to answer these questions, refinements and extensions have been developed for vector analysis, non-dimensionalized variable analysis, representing and deducing array structure, and boundary condition analysis.To test the procedure's performance on large blind test cases, semantic declarations for solution variables and coordinates were included in the ADPAC code (a 3D NavierStokes, curvilinear coordinate, turbomachinery code with 86k lines of code (loc)) and the ENG10 code (an axisymmetric, curvilinear coordinate, engine simulation code with 20k loc). The fraction of operations recognized is shown. These results provide some evidence of generality: that is, the rules and recognition capability can apply to a range of codes. Future work will continue to pursue these issues and test the procedure on additional codes.
Author
Semantics; Computer Programming; Program Verification (Computers); Checkout; Software Development Tools; Software Reliability

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Progress Towards a Comprehensive Knowledge-Based Monitoring System for the Development and Evolution of Software
Teller, Patricia J., Texas Univ., USA; Gates, Ann Q., Texas Univ., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Because the verification and validation of large, complex systems are difficult, a monitoring facility that checks for software failures during program execution is desirable. Although the usefulness of software-fault monitors cannot be disputed, they have not been as widely used in practice as hardware or analysis monitors. The main reasons for this are the difficulties inherent in maintaining a program that has been annotated with software-fault checks and the detrimental effect that dynamic monitoring can have on performance. Dynamic Monitoring with Integrity Constraints (DynaMICs) extends existing methods of verification and validation, producing a comprehensive, knowledge-based system that is useful during every phase of the software life cycle. Integrity constraints capture knowledge about real-world objects and are maintained separate from the program. During the requirements phase, they are elicited from domain experts, customers, and users, providing an additional layer of communication among development team members and facilitating identification of potential requirements conflicts. In developing large systems, the complexity of management and probability of introducing conflicts increases with the volume of information. Because integrity constraints capture stand-alone properties that are maintained in a database, the constraint analysis process is simplified, increasing the potential for error detection. Linking constraints to artifacts that are stored in another database facilitates identification of the sources of errors. In the design phase, constraints capture limitations imposed by designers. Although software may be deemed valid and correct with respect to the specification, the problem space may change over time from the original requirements, and its unanticipated use may lead to failure. Similarly, assumptions made by the development team also can be captured by constraints, rather than being buried in documentation and program comments. During the maintenance phase, as the system evolves due to changes in requirements and existing code, constraints can be modified accordingly. As a result, it is possible to ensure that changes in the code do not inadvertently alter constraints, and that added or modified code does not violate existing constraints. Because constraints are not part of source code, maintenance of the specifications and code is simplified. In production, a subset of constraints can be selected for monitoring critical properties of software. to realize this approach the research focuses on definition of methodologies for eliciting effective constraints and formally specifying them, automatic generation of monitoring code and program instrumentation, design and implementation of monitors that execute concurrently with the processor executing the application code, and development of a tracing tool. A study is in progress that examines the elicitation process, instrumentation, and effectiveness of constraints. The programs under study serve as a test bed for evaluating the use of event-condition-action rules for specifying constraints, which are expressed in a slightly modified version of the VDM specification language. A current effort translates specifications to monitoring code. Automatic program instrumentation, which is built upon a DynaMICs algorithm for instrumenting programs written in a subset of Pascal, requires analysis of program execution paths through a regular expression derived from a program control-flow graph. Each node of the graph models a basic block and is annotated with a write list that names the program variables associated with constraints modified within the block. Analysis of these expressions determines instrumentation points. In addition to in-line checking, several different monitor designs address performance, including a mechanism based on a coprocessor that employs snoopy hardware similar to that used to ensure cache consis-

tency in shared-memory multiprocessor systems. Design of a parallel, discrete-event simulation of this monitor is in progress. A design of a tracing tool that facilitates the reconciliation of constraint violations is near completion.
Author
Complex Systems; Computer Systems Performance; Design Analysis; Expert Systems; Software Engineering

20000064626 NASA Ames Research Center, Moffett Field, CA USA
Use Computer-Aided Tools to Parallelize Large CFD Applications
Jin, H., NASA Ames Research Center, USA; Frumkin, M., NASA Ames Research Center, USA; Yan, J., NASA Ames Research Center, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Porting applications to high performance parallel computers is always a challenging task. It is time consuming and costly. With rapid progressing in hardware architectures and increasing complexity of real applications in recent years, the problem becomes even more sever. Today, scalability and high performance are mostly involving handwritten parallel programs using message-passing libraries (e.g. MPI). However, this process is very difficult and often error-prone. The recent reemergence of shared memory parallel (SMP) architectures, such as the cache coherent Non-Uniform Memory Access (ccNUMA) architecture used in the SGI Origin 2000, show good prospects for scaling beyond hundreds of processors. Programming on an SMP is simplified by working in a globally accessible address space. The user can supply compiler directives, such as OpenMP, to parallelize the code. As an industry standard for portable implementation of parallel programs for SMPs, OpenMP is a set of compiler directives and callable runtime library routines that extend FORTRAN, C and C++ to express shared memory parallelism. It promises an incremental path for parallel conversion of existing software, as well as scalability and performance for a complete rewrite or an entirely new development. Perhaps the main disadvantage of programming with directives is that inserted directives may not necessarily enhance performance. In the worst cases, it can create erroneous results. While vendors have provided tools to perform error-checking and profiling, automation in directive insertion is very limited and often failed on large programs, primarily due to the lack of a thorough enough data dependence analysis. to overcome the deficiency, we have developed a toolkit, CAPO, to automatically insert OpenMP directives in FORTRAN programs and apply certain degrees of optimization. CAPO is aimed at taking advantage of detailed inter-procedural dependence analysis provided by CAPTools, developed by the University of Greenwich, to reduce potential errors made by users. Earlier tests on NAS Benchmarks and ARC3D have demonstrated good success of this tool. In this study, we have applied CAPO to parallelize three large applications in the area of computational fluid dynamics (CFD): OVERFLOW, TLNS3D and INS3D. These codes are widely used for solving Navier-Stokes equations with complicated boundary conditions and turbulence model in multiple zones. Each one comprises of from 50K to 1,00k lines of FORTRAN77. As an example, CAPO took 77 hours to complete the data dependence analysis of OVERFLOW on a workstation (SGI, 175MHz, R10K processor). A fair amount of effort was spent on correcting false dependencies due to lack of necessary knowledge during the analysis. Even so, CAPO provides an easy way for user to interact with the parallelization process. The OpenMP version was generated within a day after the analysis was completed. Due to sequential algorithms involved, code sections in TLNS3D and INS3D need to be restructured by hand to produce more efficient parallel codes. An included figure shows preliminary test results of the generated OVERFLOW with several test cases in single zone. The MPI data points for the small test case were taken from a handcoded MPI version. As we can see, CAPO's version has achieved 18 fold speed up on 32 nodes of the SGI O2K. For the small test case, it outperformed the MPI version. These results are very encouraging, but further work is needed. For example, although CAPO attempts to place directives on the outer- most parallel loops in an interprocedural framework, it does not insert directives based on the best manual strategy. In particular, it lacks the support of parallelization at the multi-zone level. Future work will emphasize on the development of methodology to work in a multi-zone level and with a hybrid approach. Development of tools to perform more complicated code transformation is also needed.
Author
Applications Programs (Computers); Software Engineering; Software Development Tools; Parallel Processing (Computers); Interprocessor Communication; Computational Fluid Dynamics; Computer Systems Performance

20000064718 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Comparative Study of Interferometric Regridding Algorithms
Hensley, Scott, Jet Propulsion Lab., California Inst. of Tech., USA; Safaeinili, Ali, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 17p; In English; PIERS 99, 23 Mar. 1999, Pasadena, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

THe paper discusses regridding options: (1) The problem of interpolating data that is not sampled on a uniform grid, that is noisy, and contains gaps is a difficult problem. (2) Several interpolation algorithms have been implemented: (a) Nearest neighbor - Fast and easy but shows some artifacts in shaded relief images. (b) Simplical interpolator - uses plane going through three points

containing point where interpolation is required. Reasonably fast and accurate. (c) Convolutional - uses a windowed Gaussian approximating the optimal prolate spheroidal weighting function for a specified bandwidth. (d) First or second order surface fitting - Uses the height data centered in a box about a given point and does a weighted least squares surface fit.
Derived from text
Algorithms; Computational Grids; Weighting Functions; Interpolation

20000064723 Logistics Management Inst., McLean, VA USA
The Economic Benefits of Advanced Product Data *Final Report*
Kordell, Michelle M.; Gentsch, Eric L.; Dec. 1999; 66p; In English
Contract(s)/Grant(s): DASW01-99-F-3309
Report No.(s): AD-A377031; LMI-DL910T1; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The benefits of computer-aided design (CAD) are widely accepted for new designs. What, however, are the economic benefits of converting drawings to CAD models for military mechanical spare parts procurement and production? Based on our analysis, we estimate that repetitive conversions from raster to vector drawings following the first spares procurement cost the Defense Logistics Agency an extra $48 million over the last 10 years for consumable spare and replacement parts procurements. Had DoD taken delivery of CAD data from the original equipment manufacturer, an additional $35 million potentially could have been avoided. We conducted this analysis in order to assess the opportunity for future cost savings through the acquisition and distribution of CAD data. This analysis also serves as a benchmark to measure the offsetting cost of this opportunity, such as data management and possibly the development and implementation costs associated with neutral CAD formats.
DTIC
Computer Aided Design; Costs; Data Management

20000064730 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Fast and Flexible Application-level Networking on Exokernel Systems
Ganger, Gregory R.; Engler, Dawson R.; Kaashoek, M. F.; Briceno, Hector M.; Hunt, Russell; Mar. 2000; 31p; In English; Prepared in cooperation with Stanford Univ., Stanford, CA, Massachusetts Inst of Tech, Cambridge, MA and ExoTec Inc.
Contract(s)/Grant(s): F30602-97-2-0288
Report No.(s): AD-A377106; CMU-CS-00-117; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Application-level networking is a promising software organization for improving performance and functionality for important network services. The xok/ExOS exokernel system includes application-level support for standard network services, while at the same time allowing application writers to specialize networking services. This paper describes how xok/ExOS's kernel mechanisms and library operating system organization achieves this flexibility, and shares our experiences and lessons learned (both positive and negative). It also describes how we have used this flexibility to build and specialize three network data services: the Cheetah HTTP server, the webswamp web benchmarking tool, and an application-level TCP forwarder. Overall measurements show large performance improvements relative to similar services built on conventional interfaces in each case reaching the maximum possible end-to-end performance for the experimental platform. For example, Cheetah provides factor of 2-4 increases in throughput compared to highly-tuned socket-based implementations and 3-8 compared to conventional systems. Webswamp can offer loads that are 2-8 compared heavier. The TCP forwarder provides 50-300% higher throughput while also providing end-to-end TCP semantics that cannot be achieved with POSIX sockets. With more detailed measurements and profiling, these overall performance improvements are also broken down and attributed to the specific specializations described, providing server writers with insights into where to focus their optimization efforts.
DTIC
Client Server Systems; Software Engineering; Operating Systems (Computers)

20000064914 Office of Management and Budget, Washington, DC USA
Progress on Year 2000 Conversion, 8th Quarterly Report (U.S. Office of Management and Budget)
Mar. 18, 1999; 56p; In English
Report No.(s): PB2000-106044; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report is the eighth in a series of quarterly reports to Congress on the Administrations progress in fixing the year 2000 (Y2K) computer problem in Federal systems. This report builds on previous reports by updating previous measures of progress and cost including information on Federally supported, State-run programs. This report also provides more information on the efforts that Federal agencies are undertaking on business continuity and contingency planning. This report summarizes data

received on February 12, 1999 from the 24 agencies that make up the Federal Chief Information Officers (CIO) Council. It also summarizes data from 44 small and independent agencies.
NTIS
Progress; Congressional Reports; Computer Programs; Checkout; Program Verification (Computers); Software Reliability; Software Engineering

20000064915 Office of Management and Budget, Washington, DC USA
Progress on Year 2000 Conversion, 9th Quarterly Report (U.S. Office of Management and Budget)
Jun. 15, 1999; 62p; In English
Report No.(s): PB2000-106048; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report is the ninth in a series of quarterly reports to Congress on the Administrations progress in fixing the year 2000 (Y2K) computer problem in Federal agencies. This report summarizes data received on May 14, 1999 from the 24 agencies that make up the Federal Chief Information Officers (CIO) Council. It also summarizes data from 46 small and independent agencies. The Office of Management and Budget (OMB) has requested that all small and independent agencies report on their status each quarter until all of their systems are fixed.
NTIS
Progress; Congressional Reports; Computer Programs; Checkout; Program Verification (Computers); Software Reliability

20000065616 Institute for Human Factors TNO, Soesterberg, Netherlands
Structural Development of CBT-Using Templates: Specification ***Final Report Gestructureerde Ontwikkeling van Computer Ondersteund Onderwijs Met Behulp van Templates: Specificatie***
Boot, E. W., Institute for Human Factors TNO, Netherlands; vanRooij, J. C. G. M., Institute for Human Factors TNO, Netherlands;
Jan. 26, 2000; 86p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A99/KL/307; TNO Proj. 790.1
Report No.(s): TD-00-0107; TM-00-A004; Copyright; Avail: Issuing Activity
TNO-HFRI has been asked to assist in structuring the development of Computer Based Training (CBT) by the Training Centers (OCa) of the Royal Netherlands Army (RNLA). This project is a cooperative effort of Staff Training Command Royal Netherlands Army (St-COKL), the ExpertiseCentre (KC) and MediaCentre (MC) of the Institute of Leadership, Media and Training (ILMO), and the CBT user-group. It should result into a kind of CBT development that fits CBT-developers and is both effective (in terms of delivering qualitatively sound CBT) as well as efficient (high production in short time). This should promote the application of CBT within the OCa. The project consists of a number of phases. In the first phase, an analysis has been conducted (Boot and Van Rooij 199a), which indicated that there are a number of problems. First, there is a concrete need for support in the actual development of CBT. For this end, a 'building-block method' using templates is proposed. Second, the relation between policy and the actual process of CBT development should be improved. For this end, a design method is proposed, This prescribes a systematic, structured approach of CBT development, by means of the template-based building-block method, and translate ST-COKL- and ILMO policies into concrete guidelines for CBT developers of the first echelon. This report describes the activities within the second phase. In this phase, the recommendations of the first phase are elaborated, and the first set of templates and the design method are specified. It is concluded that if the resulting specifications of the templates and the design method are implemented, they can meet the signaled needs. Finally, recommendations are formulated concerning CBT development within the RNLA in general, and continuation of the template project in particular.
Author
Computer Assisted Instruction; Training Devices; Multimedia; Education; Training Analysis

20000065617 Institute for Human Factors TNO, Soesterberg, Netherlands
Structured Development of Computer-Based Training Using Templates: Analysis ***Final Report Gestructureerde Ontwikkeling van Computer-Ondersteund Onderwijs met Behulp van Templates: Analyse***
Boot, E. W., Institute for Human Factors TNO, Netherlands; vanRooij, J. C. G. M., Institute for Human Factors TNO, Netherlands;
Oct. 20, 1999; 44p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A98/KL/330; TNO Proj. 730.1
Report No.(s): TD-99-0357; TM-99-A068; Copyright; Avail: Issuing Activity
In the context of structuring and supporting the development of Computer Based Training (CBT) by the Training Centres (OCai of the Royal Netherlands Army (RNLA), a needs analysis is conducted in order to investigate how this development process can be improved. On the basis of this assessment, the need for support of the development process based on templates is formulated. CBT is an increasingly used training instrument within the OCa, in order to contribute to their missions. In this, each OCa

has his own responsibility, while the Staff Training Command Royal Netherlands Army (St-COKL) has a supervisory role with respect to overall policy beyond the responsibilities of the OCa. Also, the OCa are supported and advised by the Institute for Leadership, Media and Training (ILMO) of the RNLA. The outcomes of the assessment indicate that there are a number of problems. Among the CBT-developers within the OCa, there is a wide range of experience and expertise. Many are Subject Matter Experts JSME'S) in a certain domain, with knowledge of conventional classroom didactics but with limited multimedia and programming skills. This causes problems in the developing of (more complex kinds of) CBT. Another problem is that there is no clear relation between ST-COKL and ILMO policies about standardization and quality control and the actual CBT development projects within the OCa. It is stated by St-COKL and ILMO that the process of CBT-development should become more structured and efficient. This should eventually lead to a better and higher production and application of CBT. On the basis of the identified needs, a number of recommendations are formulated. 1. Concrete support of CBT-development is recommended by means of the development of CBT-templates and a development method. The purpose is standardizing the development process and promoting more efficient and effective production and application of CBT. 2. Enforcement of the relationship between policy and work floor is recommended by means of the development of a manual, that prescribes a systematic and structured approach of CBT-development and translates and implements ST-COKL and ILMO policies within the OCa. These recommendations, established in close corporation with ST-COKL, ILMO and the CBT-developers, should lead to a kind of CBT development that better accommodates the real needs of the CBT-developers and will result into qualitatively better CBT. This should promote a wide range of applications of CBT within the OCa. It is proposed to evaluate the results of the elaboration of the recommendations by means of a CBT pilot-project. In this project, a CBT-developer will develop a representative CBT by means of the CBT-templates, the development method and the manual. Based on evaluations of both the development process and the resulting CBT, the templates, method and manual can be improved.
Author
Computer Assisted Instruction; Training Devices; Multimedia; Training Analysis

20000065623 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Partial Order Reduction for Verification of Timed Systems
Minea, Marius; Dec. 1999; 129p; In English
Contract(s)/Grant(s): DABT63-96-C-0071; NSF-CCR95-05472
Report No.(s): AD-A377110; CMU-CS-00-102; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
This dissertation presents solutions for the application of partial order methods to the verification of timed systems, with the purpose of reducing the size of the explored state space. Timed systems, which rely on timing information to operate correctly pose special difficulties for automatic verification. Not only does the size of their state space grow exponentially with the number of components as in any concurrent system, but some of the history of past transitions becomes part of the timed state. This hinders the use of partial order reduction, a technique which is applicable if different transition interleavings lead to the same state. We have given a partial order reduction, algorithm for systems described as networks of timed automata, which preserves formulas in a timed extension of linear temporal logic. The algorithm is based on a modified local-time semantics, which allows individual automata to execute independently except for synchronization transitions. More generally we have investigated the application of partial order reduction, in a continuous-time model whose semantics is defined in terms of timed traces. We show how to separate the causal dependence of transitions from their time ordering due to concurrency and how this leads to the application of partial order reduction. As particular instances of this framework we obtain improved algorithms for timed event/level structures and time Petri nets, as well as our algorithm for timed automata. We have evaluated the performance of our partial order reduction approach on several timed automata benchmarks. The resulting reduction in state space stems from two sources: the local-time model reduces the number of generated time regions, while the partial order techniques applied from the domain of untimed systems reduce the explored control state space.
DTIC
Program Verification (Computers); Petri Nets; Concurrent Engineering; Systems Analysis

20000065645 Joint Inst. for Nuclear Research, Flerov Lab. of Nuclear Reactions, Dubna, USSR
PC based code for visual control of spectrometry information
Tsyganov, Y.; Dec. 31, 1998; 11p; In Russian; In English
Report No.(s): DE99-607984; JINR-R-10-98-20; No Copyright; Avail: Department of Energy Information Bridge
PC based code for Windows 95 to provide monitoring of the experiments at the Dubna gas-filled recoil separator is described. It is coded in C++ (Borland Builder v.1.0.). Examples of application in heavy ion-induced nuclear reactions are presented.
NTIS
Coding; Visual Control; Spectroscopy; Software Engineering

20000065648 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Automated Formula Generation and Performance Learning for the FFT
Singer, Bryan; Veloso, Manuela; Jan. 2000; 15p; In English
Contract(s)/Grant(s): DABT63-98-1-0004
Report No.(s): AD-A377113; CMU-CS-00-123; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A single signal processing algorithm can be represented by many different but mathematically equivalent formulas. When these formulas are implemented in actual code, they often have very different running times. Thus, an important problem is finding a formula that implements the signal processing algorithm as efficiently as possible. In this paper we present three major results toward this goal: (1) Different but mathematically equivalent formulas can be generated automatically in a principled way, (2) Simple features describing formulas can be used to distinguish formulas with significantly different running times, and (3) A function approximator can learn to accurately predict the running time of a formula given a limited set of training data.
DTIC
Fast Fourier Transformations; Signal Processing; Neural Nets; Machine Learning

20000065656 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
NFRC spectral data library no. 4 for use with the WINDOW 4.1 computer program, Addendum 4
Feb. 28, 1997; 30p; In English
Report No.(s): DE97-003943; LBL-35298-ADD.4; TA-315-ADD.4; No Copyright; Avail: Department of Energy Information Bridge

This library update contains NFRC approved spectral data for the WINDOW analysis program. This information is an update to the spectral data library that is distributed with WINDOW 4.1 and supersedes the NFRC Spectral Data Library Update no. 3 of April 1996. This library list contains only the NFRC approved files with their most recent ID numbers. Each user may configure their own library to include new NFRC approved data, previous WINDOW data and their own spectral data.
NTIS
Subroutine Libraries (Computers); Information Systems

20000066604 Building and Construction Research TNO, Centre for Mechanical Engineering, Delft, Netherlands
Evaluation of Computer Program TRAQUE, an Analytical Program to Calculate the Strength of Cross-Sections of a Ship *Final Report*
Trouwborst, W., Building and Construction Research TNO, Netherlands; Jan. 14, 2000; 26p; In English
Contract(s)/Grant(s): TNO Proj. 006.93207/01.01; A97/KM/143
Report No.(s): TD-2000-0155; TNO-2000-CMC-R002; Copyright; Avail: Issuing Activity

This report gives an evaluation of the computer program TRAQUE. Some example calculations are reported. TRAQUE uses analytical formulations for plasticity, buckling and postbuckling behaviour to calculate the deterministic strength of intact and damaged cross-sections of a ship. It results in a curve giving the bending moment versus the curvature (sagging and hogging), including the part beyond the curvature corresponding with the maximum bending moment. Buckling of individual panels is allowed. It uses a very uncommon approach to model nonlinear phenomena as buckling and postbuckling behaviour. All nonlinear phenomena are incorporated within the stress-strain curves of the individual panels of a cross-section. Qualitatively the results correspond with physical insights.
Author
Buckling; Stress-Strain Relationships; Applications Programs (Computers); Mathematical Models; Plates (Structural Members)

20000066608 Physics and Electronics Lab. TNO, The Hague, Netherlands
Knowledge Management: Registration of Knowledge and Selection of Personnel, Phase 2 *Final Report Kennismanagement: Kennisregistratie en Selectie van Personeel, Fase 2*
Aarts, M. F. A., Physics and Electronics Lab. TNO, Netherlands; October 1999; 49p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A99/D/643; TNO Proj. 28781
Report No.(s): TD98-0252; FEL-99-A191; Copyright; Avail: Issuing Activity

This report describes the results of the second phase of the TNO-FEL 'Knowledganizer' project. The Knowledganizer is a TNO-FEL Intranet application used to list and find knowledge within the organization. Using a taxonomy of keywords, users can compose their own knowledge profiles and those of their documents and projects. Others can then use the same taxonomy to locate

the people, documents and projects related to the knowledge they are interested in. The Knowledganizer is now technically ready for implementation throughout TNO-FEL.
Author
Computer Networks; Personnel; Information Management; Management Systems

20000066609 Physics and Electronics Lab. TNO, The Hague, Netherlands
Development of Processing Algorithms for the Transient Detection Demonstrator ***Final Report***
Hotho, G. H., Physics and Electronics Lab. TNO, Netherlands; December 1999; 34p; In English; Original contains color illustrations
Contract(s)/Grant(s): A95/KM/634; TNO Proj. 27999
Report No.(s): TD99-0276; FEL-99-A062; Copyright; Avail: Issuing Activity

Algorithms for the detection of transient signals (transients) in passive sonar data are developed in this report. The algorithms are tested for both sonar buoy data and towed array data of a frigate of the RNLN. The results show that submarine transients can be detected at low signal-to-noise ratios. For data that was recorded by Saclantcen in the Kyparissian gulf it is shown that biological transients can also be detected at low signal-to-noise ratios. If a system is going to be developed to assist a sonar operator in a practical way with the detection and classification of submarine transients, classification algorithms have to be developed to distinct the interesting submarine transients from the non-interesting biological transients, as it was experienced that the latter can be present in abundant amounts.
Author
Algorithms; Signal Detection; Proving; Transient Response

20000066610 Physics and Electronics Lab. TNO, The Hague, Netherlands
Possibilities of Computer Support During Instructional Development ***Final Report Mogelijkheden van Computerondersteuning Binnen het Opleidingsontwikkeltraject***
deBock, J. J. P. R., Physics and Electronics Lab. TNO, Netherlands; February 2000; 99p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A94/KLu/638; TNO Proj. 23891
Report No.(s): TD99-0296; FEL-98-A328; Copyright; Avail: Issuing Activity

There is a growing need for tools that support the instructional designer in performing his task. Several tools have become available on the market during the last year. These tools support the instructional designer to some extent. However what is lacking is a well-balanced tool to cover (cognitive) task analysis and a tool that is not only aimed at Computer-based Training but also on other forms of instruction (classroom instruction, simulator instruction, etc.). During the project a demonstrator tool is developed that supports the instructional designer during various stages of the instructional design process. The prototype is developed by order of the Royal Netherlands Airforce. Main goal of the project is to support the RNAirforce to formulate a new vision and policies concerning educational development. Therefore the goal of investigation is to make clear which demands of tools for instructional development need to be specified in order to develop education more effective and efficient.
Author
Computer Techniques; Mental Performance; Prototypes; Education

20000066618 Department of Defense, Office of the Inspector General, Arlington, VA USA
Controls Over Copyrighted Computer Software
Thomas, William F.; Spoons, Harrell D.; Peek, Marvin L.; van Horn, John; Brown, Adrienne; Feb. 19, 1993; 52p; In English
Report No.(s): AD-A377198; IG/DOD-93-056; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Copyrighted computer software programs are used on as many as 377,500 microcomputers throughout the DoD. DoD does not maintain records on the number of software programs on hand, but the proliferation of computers within DoD suggests that millions of software programs may be in use. Federal copyright law grants copyright owners exclusive rights to duplicate or distribute the programs. Although software vendors attempt to control unauthorized use of their products through licensing agreements that invoke the protection available under copyright statutes, compliance with licensing agreements relies on the integrity of the software user. The audit objective was to determine whether policies and procedures for controlling and using computer software programs within the DOD were adequate to ensure compliance with licensing agreements and copyrights. We also evaluated applicable internal controls.
DTIC
Copyrights; Computer Systems Programs; Law (Jurisprudence)

20000066621 Carnegie-Mellon Univ., Dept. of Computer Science, Pittsburgh, PA USA
Automated Disk Drive Characterization
Schindler, Jiri; Ganger, Gregory R.; Dec. 1999; 22p; In English
Report No.(s): AD-A377211; CMU-CS-99-176; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

DiXtrac is a program that automatically characterizes the performance of modern disk drives. This report describes and validates DiXtrac's algorithms, which extract accurate values for over 100 performance- critical parameters in 2 - 6 minutes without human intervention or special hardware support. The extracted data include detailed layout and geometry information, mechanical timings, cache management policies, and command processing overheads. DiXtrac is validated by configuring a detailed disk simulator with its extracted parameters; in most cases, the resulting accuracy match those of the most accurate disk stimulators reported in the literature. to date, DiXtrac has been successfully used on over 20 disk drives, including eight different models from four different manufacturers. Jiri Schindler was supported by funding from Data Storage Systems Center and Parallel Data Laboratory at Carnegie Mellon University. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the respective centers or Carnegie Mellon University.
DTIC
Computer Programs; Algorithms; Computer Storage Devices

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COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see 82 Documentation and Information Science. For computer systems applied to specific applications, see the associated category.

20000062847 General Accounting Office, Accounting and Information Management Div., Washington, DC USA
Testimony Before the Subcommittee on Financial Institutions, Committee on Banking, Housing and Urban Affairs, US Senate. Critical Infrastructure Protection: "ILOVEYOU" Computer Virus Highlights Need for Improved Alert and Coordination Capabilities
May 18, 2000; 12p; In English
Report No.(s): AD-A377465; GAO/T-AIMD-00-181; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

No Abstract Available.
DTIC
Computer Viruses; Computer Program Integrity; Electronic Mail

20000063493 Syracuse Univ., Office of Sponsored Programs, NY USA
Virtual Distributed Computing Environment ***Final Report, Jul. 1995 - Sep. 1998***
Hariri, Salim; Kim, Dongmin; Kim, Yoonhee; Ra, Ilkyeun; Mar. 2000; 51p; In English
Contract(s)/Grant(s): F30602-95-C-0104; AF Proj. 5581
Report No.(s): AD-A376238; AFRL-IF-RS-TR-2000-24; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The next generation of network-centric applications will utilize a large number of computing and storage systems that are connected by global high speed networks. We refer to the environment that provides transparent computing and communication services for large scale parallel and distributed applications as Metacomputing environment. In this report, we present the design and the experimental results with the Virtual Distribute Computing Environment (VDCE) and the Adaptive Distributed Virtual Computing Environment (ADViCE) being developed at the University of Arizona and Syracuse University.
DTIC
Software Engineering; Virtual Memory Systems; Distributed Processing

20000064048 Digital Equipment Corp., Network Systems Lab., Palo Alto, CA USA
Internet Address Space Management in Digital
Reid, Brian K.; Sep. 1992; 24p; In English
Report No.(s): AD-A376218; NSL-NN-11; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

IP/TCP network addressing affords many different schemes for dividing and using the address space in a network. This document describes Digital's IP/TCP address space and the policies and procedures for managing it. Because IP/TCP is an evolving

and experimental technology, many of these policies and procedures are motivated more by technological considerations or by a desire to be compatible with the world outside Digital than by traditional Digital procedures.
DTIC
Internets; Data Management

20000064049 Space and Naval Warfare Systems Command, Charleston, SC USA
The Impact of the Next Generation Internet (NGI) on Naval Engineering
Brig, Michael P.; Mar. 21, 2000; 8p; In English, 21-23 Mar. 2000
Report No.(s): AD-A376225; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

Naval Engineering will be greatly impacted by the emergence and deployment of the Next Generation Internet (NGI) based upon the Transmission Control Protocol/Internet Protocol version 6 (TCP/IPv6) family of protocols; Shipboard Information Technology (IT), IT for the 21st Century (IT-21), the Navy and Marine Corp Intranet (NMCI), and the commercial Internet currently are built upon the Transmission Control Protocol/Internet Protocol version 4 (TCP/IPv4) family of protocols. The TCP/IPv6 protocol family will likely replace the TCP/IPv4 protocol family after an extended transition period, anticipated at up to 10 years, during which both protocol families will need to be supported. The replacement of the TCP/IPv4 protocol family is necessary to ensure the long-term health, scalability, and security of the Internet and DoD Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR). The USN, USMC, and DoD should begin preparing for this costly and complex transition.
DTIC
Command and Control; Internets; Information Systems; Computer Networks

20000064584 NASA Ames Research Center, Moffett Field, CA USA
Bridging the Gap from Networking Technologies to Applications: Workshop Report
Johnson, Marjory J., Research Inst. for Advanced Computer Science, USA; desJardins, Richard, NASA Ames Research Center, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The objective of the Next Generation Internet (NGI) Federal program is threefold, encompassing development of networking technologies, high-performance network testbeds, and revolutionary applications. There have been notable advances in emerging network technologies and several nationwide testbeds have been established, but the integration of emerging technologies into applications is lagging. to help bridge this gap between developers of NGI networking technologies and developers of NGI applications, the NASA Research and Education Network (NREN) project hosted a two-day workshop at NASA Ames Research Center in August 1999. This paper presents a summary of the results of this workshop and also describes some of the challenges NREN is facing while incorporating new technologies into HPCC and other NASA applications. The workshop focused on three technologies - Quality of Service (QoS), advanced multicast, and security-and five major NGI application areas - telemedicine, digital earth, digital video, distributed data-intensive applications, and computational infrastructure applications. Network technology experts, application developers, and NGI testbed representatives came together at the workshop to promote cross-fertilization between the groups. Presentations on the first day, including an overview of the three technologies, application case studies and testbed status reports, laid the foundation for discussions on the second day. The objective of these latter discussions, held within smaller breakout groups, was to establish a coherent picture of the current status of the various pieces of each of the three technologies, to create a roadmap outlining future technology development, and to offer technological guidance to application developers. In this paper we first present a brief overview of the NGI applications that were represented at the workshop, focusing on the identification of technological advances that have successfully been incorporated in each application and technological challenges that remain. Next we present the technology roadmaps that were created at the workshop, summarizing the status of various mechanisms that are currently under development and forecasting when various advances are likely to occur within the next one-to-three-year time span. Then we identify issues that were raised at the workshop that might hinder technology development or that might impede integration into NGI applications. We also report some specific guidelines that were offered at the workshop to enable application developers to integrate and effectively use emerging NGI technology building blocks. Finally, we describe NREN activities to incorporate emerging technologies into NASA applications. These activities include support for other NASA High-Performance Computing and Communications Program areas such as IPG (Information Power Grid), support for NASA science enterprises such as Earth science and Mars program prototyping activities, support for satellite/terrestrial networking applications such as the TransAtlantic and TransPacific demonstrations and the Interplanetary Internet, support for NASA telemedicine applications such as the Virtual Collaborative Clinic, and participation in NGI advanced technology testbed initia-

tives such as the QBone and the NTON/Supernet. For each activity we highlight the primary technological challenge that is associated with it.
Author
Internets; Software Engineering; Technology Utilization; Internet Resources

20000064587 Indiana Univ.-Purdue Univ., School of Engineering and Technology, Indianapolis, IN USA
Dynamic Load-Balancing for Distributed Heterogeneous Computing of Parallel CFD Problems
Ecer, A., Indiana Univ.-Purdue Univ., USA; Chien, Y. P., Indiana Univ.-Purdue Univ., USA; Chen, J. D., Indiana Univ.-Purdue Univ., USA; Akay, H. U., Indiana Univ.-Purdue Univ., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The main objective of this effort is to run parallel codes on all available computer resources at a given time, including clusters of parallel supercomputers and networked workstations communicating through complex networks. Load balancing techniques commonly assume a single user environment for parallel jobs. This assumption is valid only when a user has access to a dedicated set of computers. When the computers by different owners need to be accessed and many parallel jobs need to be executed, the reservation of dedicated time becomes difficult. A dynamic load-balancing scheme is developed for improving the efficiency of parallel computing in such an environment. The basic assumptions are as follows: (1) There are large numbers of computers available indifferent locations,which are managed by different owners. (2) Each of the multi-user computers is operating under UNIX or Windows NT. (3) Each user can access all or any subset of these computers. The dynamic load balancing capability includes the following tools: (1) Software assigned to each computer to measure computer and network speed. (2) A load-balancing tool assigned to each parallel job to optimize the load distribution. (3) A master coordinator is not needed while each cluster or computer maybe running under a different job scheduler. Block-structured solution schemes are supported. It is assumed that the problem is divided into a number of blocks, which is greater than the number of available processors. Either greedy or genetic algorithms are utilized for calculating the number of blocks among available processors. The division of the grid is performed only once. Various optimization algorithms are studied for the load balancing of multiple parallel processes belonging to different users, competing for the same resources. It is assumed that (1) a parallel process does not have detailed knowledge of other parallel processes, (2) each parallel process has its own load-balancer, and (3) each parallel process can share its load distribution on any computer with other parallel processes that use the same computer. There is a load balancing coordinator on each computer for sharing information between the users. It monitors the computer load, the network load, and communicate with all parallel processes executing on that computer. Additional information contained in the original.
Author
Computational Fluid Dynamics; Computer Networks; Parallel Processing (Computers); Multiprocessing (Computers); Multiprogramming

20000064589 Northwestern Univ., ECE Dept., Evanston, IL USA
Efficient Use of Distributed Systems for Scientific Applications
Taylor, Valerie, Northwestern Univ., USA; Chen, Jian, Northwestern Univ., USA; Canfield, Thomas, Argonne National Lab., USA; Richard, Jacques, Chicago State Univ., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Distributed computing has been regarded as the future of high performance computing. Nationwide high speed networks such as vBNS are becoming widely available to interconnect high-speed computers, virtual environments, scientific instruments and large data sets. One of the major issues to be addressed with distributed systems is the development of computational tools that facilitate the efficient execution of parallel applications on such systems. These tools must exploit the heterogeneous resources (networks and compute nodes) in distributed systems. This paper presents a tool, called PART, which addresses this issue for mesh partitioning. PART takes advantage of the following heterogeneous system features: (1) processor speed; (2) number of processors; (3) local network performance; and (4) wide area network performance. Further, different finite element applications under consideration may have different computational complexities, different communication patterns, and different element types, which also must be taken into consideration when partitioning. PART uses parallel simulated annealing to partition the domain, taking into consideration network and processor heterogeneity. The results of using PART for an explicit finite element application executing on two IBM SPs (located at Argonne National Laboratory and the San Diego Supercomputer Center) indicate an increase in efficiency by up to 36% as compared to METIS, a widely used mesh partitioning tool. The input to METIS was modified to take into consideration heterogeneous processor performance; METIS does not take into consideration heterogeneous networks. The execution times for these applications were reduced by up to 30% as compared to METIS. These results are given in Figure 1 for four irregular meshes with number of elements ranging from 30,269 elements for the Barth5 mesh to 11,451 elements for the Barth4 mesh. Future work with PART entails using the tool with an integrated application requiring distributed sys-

tems. In particular this application, illustrated in the document entails an integration of finite element and fluid dynamic simulations to address the cooling of turbine blades of a gas turbine engine design. It is not uncommon to encounter high-temperature, film-cooled turbine airfoils with 1,000,000s of degrees of freedom. This results because of the complexity of the various components of the airfoils, requiring fine-grain meshing for accuracy. Additional information is contained in the original.
Author
Distributed Processing; Computer Systems Design; Computational Grids; Concurrent Processing; Software Engineering

20000064595 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Highly Parallel Computing Architectures by using Arrays of Quantum-dot Cellular Automata (QCA): Opportunities, Challenges, and Recent Results
Fijany, Amir, Jet Propulsion Lab., California Inst. of Tech., USA; Toomarian, Benny N., Jet Propulsion Lab., California Inst. of Tech., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

There has been significant improvement in the performance of VLSI devices, in terms of size, power consumption, and speed, in recent years and this trend may also continue for some near future. However, it is a well known fact that there are major obstacles, i.e., physical limitation of feature size reduction and ever increasing cost of foundry, that would prevent the long term continuation of this trend. This has motivated the exploration of some fundamentally new technologies that are not dependent on the conventional feature size approach. Such technologies are expected to enable scaling to continue to the ultimate level, i.e., molecular and atomistic size. Quantum computing, quantum dot-based computing, DNA based computing, biologically inspired computing, etc., are examples of such new technologies. In particular, quantum-dots based computing by using Quantum-dot Cellular Automata (QCA) has recently been intensely investigated as a promising new technology capable of offering significant improvement over conventional VLSI in terms of reduction of feature size (and hence increase in integration level), reduction of power consumption, and increase of switching speed. Quantum dot-based computing and memory in general and QCA specifically, are intriguing to NASA due to their high packing density (10(exp 11) - 10(exp 12) per square cm) and low power consumption (no transfer of current) and potentially higher radiation tolerant. Under Revolutionary Computing Technology (RTC) Program at the NASA/JPL Center for Integrated Space Microelectronics (CISM), we have been investigating the potential applications of QCA for the space program. to this end, exploiting the intrinsic features of QCA, we have designed novel QCA-based circuits for co-planner (i.e., single layer) and compact implementation of a class of data permutation matrices, a class of interconnection networks, and a bit-serial processor. Building upon these circuits, we have developed novel algorithms and QCA-based architectures for highly parallel and systolic computation of signal/image processing applications, such as FFT and Wavelet and Wlash-Hadamard Transforms.
Author
Automata Theory; Microelectronics; Parallel Processing (Computers); Quantum Dots; Very Large Scale Integration; Nanotechnology; Parallel Computers

20000064596 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
HTMT-class Latency Tolerant Parallel Architecture for Petaflops Scale Computation
Sterling, Thomas, Jet Propulsion Lab., California Inst. of Tech., USA; Bergman, Larry, Jet Propulsion Lab., California Inst. of Tech., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Computational Aero Sciences and other numeric intensive computation disciplines demand computing throughputs substantially greater than the Teraflops scale systems only now becoming available. The related fields of fluids, structures, thermal, combustion, and dynamic controls are among the interdisciplinary areas that in combination with sufficient resolution and advanced adaptive techniques may force performance requirements towards Petaflops. This will be especially true for compute intensive models such as Navier-Stokes are or when such system models are only part of a larger design optimization computation involving many design points. Yet recent experience with conventional MPP configurations comprising commodity processing and memory components has shown that larger scale frequently results in higher programming difficulty and lower system efficiency. While important advances in system software and algorithms techniques have had some impact on efficiency and programmability for certain classes of problems, in general it is unlikely that software alone will resolve the challenges to higher scalability. As in the past, future generations of high-end computers may require a combination of hardware architecture and system software advances to enable efficient operation at a Petaflops level. The NASA led HTMT project has engaged the talents of a broad interdisciplinary team to develop a new strategy in high-end system architecture to deliver petaflops scale computing in the 2004/5 timeframe. The Hybrid-Technology, MultiThreaded parallel computer architecture incorporates several advanced technologies in combination with an innovative dynamic adaptive scheduling mechanism to provide unprecedented performance and efficiency within practi-

cal constraints of cost, complexity, and power consumption. The emerging superconductor Rapid Single Flux Quantum electronics can operate at 100 GHz (the record is 770 GHz) and one percent of the power required by convention semiconductor logic. Wave Division Multiplexing optical communications can approach a peak per fiber bandwidth of 1 Tbps and the new Data Vortex network topology employing this technology can connect tens of thousands of ports providing a bi-section bandwidth on the order of a Petabyte per second with latencies well below 100 nanoseconds, even under heavy loads. Processor-in-Memory (PIM) technology combines logic and memory on the same chip exposing the internal bandwidth of the memory row buffers at low latency. And holographic storage photorefractive storage technologies provide high-density memory with access a thousand times faster than conventional disk technologies. Together these technologies enable a new class of shared memory system architecture with a peak performance in the range of a Petaflops but size and power requirements comparable to today's largest Teraflops scale systems. To achieve high-sustained performance, HTMT combines an advanced multithreading processor architecture with a memory-driven coarse-grained latency management strategy called "percolation", yielding high efficiency while reducing the much of the parallel programming burden. This paper will present the basic system architecture characteristics made possible through this series of advanced technologies and then give a detailed description of the new percolation approach to runtime latency management.
Author
Architecture (Computers); Computer Networks; Computer Programs; Holography; Parallel Computers; Parallel Processing (Computers); Parallel Programming; Quantum Electronics; Supercomputers

20000064606 MRJ Technology Solutions, Moffett Field, CA USA
Multithreaded Implementation of a Dynamic Irregular Application
Biswas, Rupak, MRJ Technology Solutions, USA; Oliker, Leonid, California Univ., Lawrence Berkeley Lab., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The success of parallel computing in solving realistic computational applications relies on their efficient mapping and execution on large-scale multiprocessor architectures. When the algorithms and data structures corresponding to these problems are unstructured or dynamic in nature, efficient implementation on parallel machines offers considerable challenges. Unstructured applications are characterized by irregular data access patterns while dynamic mesh adaptation causes computational workloads to grow or shrink at runtime. For such applications, dynamic load balancing is required to achieve algorithmic scaling on parallel machines. This talk describes a multithreaded implementation of a dynamic unstructured mesh adaptation algorithm on the Tera Multithreaded Architecture (MTA). Multithreaded machines can tolerate memory latency and utilize substantially more of their computing power by processing several threads of computation. For example, the MTA processors each have hardware support for up to 128 threads, and are therefore especially well suited for irregular and dynamic applications. Unlike traditional parallel machines, the MTA has a large uniform shared memory, no data cache, and is insensitive to data placement. Parallel programmability is significantly simplified since users have a global view of the memory, and need not be concerned with partitioning and load balancing issues. Performance is compared with an MPI implementation on the T3E and the Origin2000, and a shared-memory directives-based implementation on the Origin2000. A standard computational mesh simulating flow over an airfoil was used for our experiments to compare the three parallel architectures. The initial mesh, consisting of more than 28,000 triangles, was refined a total of five times to generate a mesh 45 times larger. Performance by platform and programming paradigm is presented in Table 1. It is important to note that different parallel versions use different dynamic load balancing strategies. The multithreaded implementation of the adaptation algorithm required adding a trivial amount of code to the original serial version and had little memory overhead. In contrast, the MPI version doubled the size of the code and required significant additional memory for the communication buffers. The simulation on the 8-processor MTA at SDSC using 100 threads per processor was almost 10 times faster than that obtained on 160 processors of a T3E and more than 100 times faster than that on a 64-processor Origin2000 running a directives-based version. Results indicate that multithreaded systems offer tremendous potential for quickly and efficiently solving some of the most challenging real-life problems on parallel computers.
Author
Multiprocessing (Computers); Parallel Computers; Parallel Processing (Computers); Computerized Simulation

20000064623 NASA Ames Research Center, Moffett Field, CA USA
Testing New Programming Paradigms with NAS Parallel Benchmarks
Jin, H., NASA Ames Research Center, USA; Frumkin, M., NASA Ames Research Center, USA; Schultz, M., NASA Ames Research Center, USA; Yan, J., NASA Ames Research Center, USA; February 2000; In English; See also 20000064579
Contract(s)/Grant(s): NAS2-14303; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Over the past decade, high performance computing has evolved rapidly, not only in hardware architectures but also with increasing complexity of real applications. Technologies have been developing to aim at scaling up to thousands of processors on both distributed and shared memory systems. Development of parallel programs on these computers is always a challenging task. Today, writing parallel programs with message passing (e.g. MPI) is the most popular way of achieving scalability and high performance. However, writing message passing programs is difficult and error prone. Recent years new effort has been made in defining new parallel programming paradigms. The best examples are: HPF (based on data parallelism) and OpenMP (based on shared memory parallelism). Both provide simple and clear extensions to sequential programs, thus greatly simplify the tedious tasks encountered in writing message passing programs. HPF is independent of memory hierarchy, however, due to the immaturity of compiler technology its performance is still questionable. Although use of parallel compiler directives is not new, OpenMP offers a portable solution in the shared-memory domain. Another important development involves the tremendous progress in the internet and its associated technology. Although still in its infancy, Java promisses portability in a heterogeneous environment and offers possibility to ”compile once and run anywhere.” In light of testing these new technologies, we implemented new parallel versions of the NAS Parallel Benchmarks (NPBs) with HPF and OpenMP directives, and extended the work with Java and Java-threads. The purpose of this study is to examine the effectiveness of alternative programming paradigms. NPBs consist of five kernels and three simulated applications that mimic the computation and data movement of large scale computational fluid dynamics (CFD) applications. We started with the serial version included in NPB2.3. Optimization of memory and cache usage was applied to several benchmarks, noticeably BT and SP, resulting in better sequential performance. In order to overcome the lack of an HPF performance model and guide the development of the HPF codes, we employed an empirical performance model for several primitives found in the benchmarks. We encountered a few limitations of HPF, such as lack of supporting the ”REDISTRIBUTION” directive and no easy way to handle irregular computation. The parallelization with OpenMP directives was done at the outer-most loop level to achieve the largest granularity. The performance of six HPF and OpenMP benchmarks is compared with their MPI counterparts for the Class-A problem size in the figure in next page. These results were obtained on an SGI Origin2000 (195MHz) with MIPSpro-f77 compiler 7.2.1 for OpenMP and MPI codes and PGI pghpf-2.4.3 compiler with MPI interface for HPF programs.
Author

Parallel Programming; Performance Prediction; Java (Programming Language); Computer Systems Performance; Interprocessor Communication

20000064727 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Evaluation of Task Assignment Policies for Supercomputing Servers: The Case for Load Unbalancing and Fairness
Schroeder, Bianca; Harchol-Balter, Mor; Mar. 2000; 18p; In English
Report No.(s): AD-A377091; CMU-CS-00-118; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

While the MPP is still the most common architecture in supercomputer centers today, a simpler and cheaper machine configuration is growing increasingly common. This alternative setup may be described simply as a collection of multiprocessors or a distributed server system. This collection of multiprocessors is fed by a single common stream of jobs, where each job is dispatched to exactly one of the multiprocessor machines for processing. The biggest question which arises in such distributed server systems is what is a good policy for assigning jobs to host machines. Many task assignment policies have been proposed, but not systematically evaluated under supercomputing workloads. In this paper we start by comparing existing task assignment policies using a trace-driven simulation under supercomputing workloads. We use analysis to validate our results and to provide intuition. We find that while the performance of supercomputing servers varies widely with the task assignment policy, none of the above policies perform as well as we would like. We observe that all task assignment policies proposed thus far aim to balance load among the hosts. We propose a policy which purposely unbalances load among the hosts, yet, counter-to-intuition, is also fair in that it achieves the same expected slowdown for all jobs - thus no jobs are biased against. We evaluate this policy again using both trace-driven simulation and analysis. We find that the performance of the load unbalancing policy is significantly better than the best of those policies which balance load.
DTIC
Distributed Processing; Client Server Systems; Multiprocessing (Computers)

20000065619 Institute for Human Factors TNO, Soesterberg, Netherlands

Effects of Asymmetric Delays on Task Performance in Networked Simulators ***Interim Report Effecten van Asymmetrische Vertragingen op de Taakprestatie in Genetwerkte Simulatoren***

deVries, S. C., Institute for Human Factors TNO, Netherlands; Kappe, B., Institute for Human Factors TNO, Netherlands; Aug. 19, 1999; 42p; In English

Contract(s)/Grant(s): A96/KL/354; TNO Proj. 730.3

Report No.(s): TD-99-0333; TM-99-A056; Copyright; Avail: Issuing Activity

Distributed Interactive Simulation (DIS) is a collection of protocols used to connect various simulators. DIS is not free of complications because those simulators may be quite heterogeneous and geographically dispersed. Important are the effects of delays, which are encountered in several ways in the context of DIS. Also notable are the effects of the low update rate. A preceding experiment examined how the effects of delays within and between simulators influenced the group performance resulting in guidelines which specified maximum allowable delays. The current experiment was performed to answer questions around non-linear interactions between internal and external delays found in the preceding experiment. A consequence of these interactions might be that the performance of combinations of fast and slow simulators could be disproportionally determined by the level of the slower simulators. Additionally, using an improved version of the experiment, the implications of a mathematical model were studied. This study suggested that a certain amount of internal delay may be beneficial in the presence of external delays. The results of the experiment showed that the performance of a heterogeneous ensemble of simulators is not worse than the performance of a homogeneous ensemble with comparable internal delays. All performance measures depended linearly on the delay values and no interaction between the factors internal and external delay was found. The report concludes with a few modified guidelines.

Author

Distributed Interactive Simulation; Computer Networks; Protocol (Computers); Simulators

20000065624 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA

A Programmable Router Architecture Supporting Control Plane Extensibility

Gao, Jun; Steenkiste, Peter; Takahashi, Eduardo; Fisher, Allan; Mar. 2000; 22p; In English

Contract(s)/Grant(s): N66001-96-C-8528; F30602-99-1-0518

Report No.(s): AD-A377107; CMU-CS-00-109; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Internet is evolving from an infrastructure that provides basic communication services into a more sophisticated infrastructure that supports a wide range of electronic services such as virtual reality games and rich multimedia retrieval services. However, this evolution is happening only slowly, in part because the communication infrastructure is too rigid. In this report, we present a programmable router architecture, in which the control plane functionality of the router can be extended dynamically through the use of delegates. Delegates can control the behavior of the router through a well defined router control interface, allowing service providers and third-party software vendors to implement customized traffic control policies or protocols. We describe Darwin, a system that implements such an architecture. We emphasize the runtime environment the system provides for delegate execution and the programming interface the system exports to support delegates. We demonstrate the advantages of using this system by presenting several delegate examples.

DTIC

Communication Networks; Protocol (Computers); Network Control; Access Control

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CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also 54 Man/System Technology and Life Support.

20000061435 Liege Univ., Aerodynamics Group, Belgium

An Optimal Control Theory Based Algorithm to Solve 2D Aerodynamic Shape Optimisation Problems for Inviscid and Viscous Flows

Hiernaux, S., Belgian National Foundation for Scientific Research, Belgium; Essers, J.-A., Liege Univ., Belgium; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 18-1 - 18-12; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

With the capacity of today's computers, one can envisage the resolution of shape optimization problems in aerodynamics. Nevertheless, optimization methods require many evaluations of different aero-dynamic configurations, and so are much more

expensive than a single analysis. It is therefore mandatory to find methods that evaluate aerodynamic functions and their gradient at the lowest possible computational cost, as well as fast and robust optimization methods. Classical optimization techniques (descent methods) not only require the value of the function to optimize, but also of its gradient. The classical way to compute the gradient is to use a finite-difference formula; the main drawback of this method is due to the fact that n + 1 evaluations of aerodynamic functions are necessary at each iteration, n being the number of parameters defining the geometry to optimize. So, such methods are completely un-suited to aerodynamic shape optimization, because of the high computational cost of the single analysis. Alternative methods (stochastic optimization, genetic algorithms) that don#t require gradient information are also highly costly in term of CPU time. For a few years, techniques for sensitivity analysis based on the optimal control theory have been developed. These techniques derive from the state equations another set of equations called ”adjoint” or ”costate” equations. The solution of these adjoint equations is used to compute the gradient at very low cost; since solving the adjoint equations is equivalent to solve the state equations, the cost of sensitivity analysis is greatly reduced. Some authors use adjoint equations derived from the discretized Euler equations. In this paper, we focus on adjoint equations derived from analytical state equations.
Author
Control Theory; Optimal Control; Two Dimensional Models; Aerodynamic Configurations; Viscous Flow; Shapes; Genetic Algorithms

20000063535 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Biomorphic Explorers Leading Towards a Robotic Ecology
Thakoor, Sarita, Jet Propulsion Lab., California Inst. of Tech., USA; Miralles, Carlos, AeroVironment, Inc., USA; Chao, Tien-Hsin, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 23p; In English; DARPA/ISAT Study Meeting: Towards a Robotic Ecology, 26-27 Apr. 1999, Cambridge, MA, USA; Sponsored by Defense Advanced Research Projects Agency, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents viewgraphs of biomorphic explorers as they provide extended survival and useful life of robots in ecology. The topics include: 1) Biomorphic Explorers; 2) Advanced Mobility for Biomorphic Explorers; 3) Biomorphic Explorers: Size Based Classification; 4) Biomorphic Explorers: Classification (Based on Mobility and Ambient Environment); 5) Biomorphic Flight Systems: Vision; 6) Biomorphic Glider Deployment Concept: Larger Glider Deploy/Local Relay; 7) Biomorphic Glider Deployment Concept: Balloon Deploy/Dual Relay; 8) Biomorphic Exlplorer: Conceptual Design; 9) Biomorphic Gliders; and 10) Applications.
CASI
Ecology; Robotics; Biology

20000063536 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Biomorphic Explorers
Thakoor, Sarita, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 19p; In English; Biologically Inspired Approaches for MAV’s, 21-22 Apr. 1999, Alexandria, VA, USA; Sponsored by Defense Advanced Research Projects Agency, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents, in viewgraph form, the first NASA/JPL workshop on Biomorphic Explorers for future missions. The topics include: 1) Biomorphic Explorers: Classification (Based on Mobility and Ambient Environment); 2) Biomorphic Flight Systems: Vision; 3) Biomorphic Explorer: Conceptual Design; 4) Biomorphic Gliders; 5) Summary and Roadmap; 6) Coordinated/Cooperative Exploration Scenario; and 7) Applications. This paper also presents illustrations of the various biomorphic explorers.
CASI
Biology; Animals; Classifications; Wildlife; Aerodynamics

20000064074 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Mars Rover Navigation Results Using Sun Sensor Heading Determination
Volpe, Richard, Jet Propulsion Lab., California Inst. of Tech., USA; [1998]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Upcoming missions to the surface of Mars will use mobile robots to traverse long distances from the landing site. to prepare for these missions, the prototype rover, Rocky 7, has been tested in desert field trials conducted with a team of planetary scientists. While several new capabilities have been demonstrated, foremost among these was sun-sensor based traversal of natural terrain totaling a distance of one kilometer. This paper describes navigation results obtained in the field tests, where cross-track error was

only 6% of distance traveled. Comparison with previous results of other planetary rover systems shows this to be a significant improvement.
Author
Mars Surface; Roving Vehicles; Surface Navigation; Robots; Solar Sensors

20000064075 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Evolution of Autonomous Self-Righting Behaviors for Articulated Nanorovers
Tunstel, Edward, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 7p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Miniature rovers with articulated mobility mechanisms are being developed for planetary surface exploration on Mars and small solar system bodies. These vehicles are designed to be capable of autonomous recovery from overturning during surface operations. This paper describes a computational means of developing motion behaviors that achieve the autonomous recovery function. It proposes a control software design approach aimed at reducing the effort involved in developing self-righting behaviors. The approach is based on the integration of evolutionary computing with a dynamics simulation environment for evolving and evaluating motion behaviors. The automated behavior design approach is outlined and its underlying genetic programming infrastructure is described.
Author
Autonomy; Automatic Control; Roving Vehicles

20000065663 Los Alamos National Lab., NM USA
Enhanced lower entropy bounds with application to constructive learning
Beiu, V.; Dec. 31, 1997; 12p; In English; Computational intelligence
Report No.(s): DE97-004791; LA-UR-97-516; No Copyright; Avail: Department of Energy Information Bridge

In this paper, the authors prove two new lower bounds for the number-of-bits required by neural networks for classification problems defined by m examples from R(sup n). Because they are obtained in a constructive way, they can be used for designing a constructive algorithm. These results rely on techniques used for determining tight upper bounds, which start by upper bounding the space with an n-dimensional ball. Very recently, a better upper bound has been detailed by showing that the volume of the ball can always be replaced by the volume of the intersection of two balls. A first lower bound for the case of integer weights in the range (-p,p) has been detailed: it is based on computing the logarithm of the quotient between the volume of the ball containing all the examples (rough approximation) and the maximum volume of a polyhedron. A first improvement over that bound will come from a tighter upper bound of the maximum volume of the polyhedron by two n-dimensional cones. An even tighter bound will be obtained by upper bounding the space by the intersection of two balls.
NTIS
Entropy; Boundaries

65
STATISTICS AND PROBABILITY

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

20000062851 Technische Univ., Dept. of Mathematics and Computing Science, Eindhoven Netherlands
Selecting the Best of Two Normal Populations Using a Loss Function
vanderLaan, P.; vanEeden, C.; Jun. 1997; 28p; In English
Report No.(s): PB2000-104939; MEMO-COSOR-97-13-Rev; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The problem of selecting the best of two normal populations is considered. In selection problems the usual loss function is the 0-1 one, i.e. the selection goal is to bound, from below, probabilities of making 'correct' selections. In the present paper a selection goal based on a general loss function is presented. The two population have unknown location parameters and 'good' populations are the ones with large values of this parameter. The selection rule is given and its performance is investigated. An application is presented. The selection rule is given and its performance is investigated. An application is presented. Similar results for the scale parameters of two gamma populations can be found in Van Der Laan and Van Eeden (1996).
NTIS
Populations; Selection; Probability Theory

20000064726 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Mix-nets: Factored Mixtures of Gaussians in Bayesian Networks With Mixed Continuous and Discrete Variables
Davies, Scott; Moore, Andrew; Apr. 2000; 32p; In English
Report No.(s): AD-A377089; CMU-CS-00-119; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recently developed techniques have made it possible to quickly learn accurate probability density functions from data in low-dimensional continuous spaces. In particular. mixtures of Gaussians can be fitted to data very quickly using an accelerated EM algorithm that employs multiresolution kd-trees (Moore 1999). In this paper, we propose a kind of Bayesian network in which low-dimensional mixtures of Gaussians over different subsets of the domain's variables are combined into a coherent joint probability model over the entire domain. The network is also capable of modelling complex dependencies between discrete variables and continuous variables without requiring discretization of the continuous variables. We present efficient heuristic algorithms for automatically learning these networks from data and perform comparative experiments illustrating how well these networks model real scientific data and synthetic data. We also briefly discuss some possible improvements to the networks. as well as their possible application to anomaly detection, classification probabilistic inference, and compression.
DTIC
Bayes Theorem; Machine Learning; Heuristic Methods; Probability Density Functions

20000064913 Technische Univ., Dept. of Mathematics and Computing Science, Eindhoven Netherlands
Response-Time Distribution in a Real-Time Database with Optimistic Concurrency Control and Constant Execution Times
Sassen, S. A. E.; van der Wal, J.; Mar. 1997; 30p
Report No.(s): PB2000-104847; MEMO-COSOR-97-07; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

For a real-time shared-memory database with optimistic concurrency control, an approximation for the transaction response-time distribution is obtained. The model assumes that transactions arrive at the database according to a Poisson process, that every transaction uses an equal number of data-items uniformly chosen, and that the multiprogramming level is bounded. The execution time of all transactions is constant. The behavior of the system is approximated by an M/D/c queue with feedback. The probability that a transaction must be fed back for a rerun depends on the number of transactions that has committed during its execution. Numerical experiments, which compare the approximate analysis with a simulation of the database, show that the approximation of the response-time distribution is quite accurate, even for high system loads.
NTIS
Data Bases; Real Time Operation; Response Time (Computers)

20000064994 George Washington Univ., School of Engineering and Applied Science, Washington, DC USA
Bayesian Aspects of Material Failure, Engineering Reliability, and Software Integrity ***Final Report, 1 Jan. 1995 - 30 Sep. 1998***
Singpurwalla, Nozer D.; Nov. 01, 1998; 5p; In English
Contract(s)/Grant(s): F49620-95-1-0107
Report No.(s): AD-A366897; AFRL-SR-BL-TR-99A-0185; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

Research on using Bayesian statistical methods and on probabilistic modeling of failure processes is described. Emphasis is on developing mathematical models for describing the growth of surface and penny shaped cracks in structural materials and on assessing the integrity of software via a new model for software. Initial work on a paradigm for information fusion is discussed and issues such as sensor reliability, sensor sabotage, adversarial sensors and sensor parleying are introduced.
DTIC
Failure; Reliability Engineering; Software Engineering

20000066600 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Spatial Join Selectivity Using Power Laws
Faloutsos, Christos; Seeger, Bernhard; Traina, Agma; Traina, Caetano, Jr; Apr. 2000; 19p; In English; Prepared in cooperation with Sao Paulo Univ., Dept. of Computer Science, Sao Carlos, Brazil and Universitaet Marburg, Fachbereich Mathematik und Informatik, Germany. Also referenced as contract no. NSF-DMS98-73442, NSF-IIS98-17496, and NSF-IIS99-1060
Contract(s)/Grant(s): N66001-97-C-8517; NSF-IRI96-25428
Report No.(s): AD-A377144; CMU-CS-00-124; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We discovered a surprising law governing the spatial join selectivity across two sets of points. An example of such a spatial join is "find the libraries that are within 10 miles of schools". Our law dictates that the number of such qualifying pairs follows a power law, whose exponent we call "pair-count exponent" (PC). We show that this law also holds for self-spatial-joins ("find

schools within 5 miles of other schools") in addition to the general case that the two point-sets are distinct. Our law holds for many real datasets, including diverse environments (geographic datasets, feature vectors from biology data, galaxy data from astronomy). In addition, we introduce the concept of the Box-Occupancy-Product-Sum (BOPS) plot, and we show that it can compute the pair-count exponent in a timely manner, reducing the run time by orders of magnitude, from quadratic to linear. Due to the pair-count exponent and our analysis (Law 1), we can achieve accurate selectivity estimates in constant time (0(1)) without the need for sampling or other expensive operations. The relative error in selectivity is about 30% with our fast BOPS method, and even better (about 10%), if we use the slower, quadratic method.
DTIC
Spatial Distribution; Probability Distribution Functions; Information Retrieval; Data Mining

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20000063528 Army Engineer Research and Development Center, Environmental Lab., Vicksburg, MS USA
Simulating Population Dynamics in an Ecosystem Context Using Coupled Eulerian-Lagrangian Hybrid Models (CEL HYBRID Models) ***Final Report***
Nestler, John M.; Goodwin, R. A.; Apr. 2000; 44p; In English
Report No.(s): AD-A377014; ERDC/EL-TR-00-4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Management and modification of water resources (e.g., construction of instream structures, regulatory actions, operating strategies, etc.) have a profound effect on the physico-chemical environment of aquatic ecosystems and on the living resources that depend on this environment. CEL HYBRID models are a new method for coupling Eulerian and Lagrangian reference frames so that the higher trophic levels of an aquatic ecosystem, such as fish and shellfish, can be systematically and realistically simulated. The Eulerian-Lagrangian couple works as follows: the influence of aquatic organisms on water quality is evaluated by spatially averaging relevant characteristics of the organisms within a cell (an Eulerian concept), such as biomass, while the population dynamics of individual species (e.g., reproduction, recruitment, feeding, migration, and/or mortality) are modeled by treating organisms as individuals or groups of individuals (a Lagrangian concept). Water quality is often analyzed using spatially averaged cells, where each cell represents one uniform environment, with no variation in attributes within the cell. On the other hand, the population dynamics of species are often analyzed by tracking individuals, or groups of individuals, all of which are considered to reside within one spatially averaged environment. Spatially averaging characteristics, such as mass, of a group of organisms' participation in the chemical processes of the aquatic environment, such as dissolved oxygen uptake and excretion, to be evaluated. However, species population dynamics, which determine the number of organisms in each cell, are usually modeled with a Lagrangian reference frame. CEL HYBRID models allow for the analysis of higher trophic level processes with minimal distortion and loss of information by coupling the two frames of reference and, thereby, exploiting the advantages and minimizing the disadvantages associated with each.
DTIC
Populations; Population Theory; Probability Theory; Ecosystems; Marine Environments; Water Management; Water Resources; Water Quality

20000064091 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Science Application Teams
[2000]; 22p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper discusses the science application team activities. Science Application team are: (1) Represent the diversity of NASA onboard computing of the future. (2) Drive architecture and system software requirements. (3) Demonstrate the benefit of highly capable computing onboard. (4) Study the birth of the first galaxies. (5) Study formation of stars. (6) Discusses the next generation space telescope hardware/software requirement: image processing and on-board optical calibration. Also discusses gamma ray large area space telescope; orbital thermal imaging spectrometer; solar terrestrial probe program; autonomous Mars rover;fault tolerance and errors.
CASI
Computer Programs; Galaxies; Gamma Rays; Imaging Spectrometers; Thermal Mapping; Architecture (Computers)

20000064099 Teledyne Brown Engineering, Huntsville, AL USA

ISS Payload Operations: The Need for and Benefit of Responsive Planning

Nahay, Ed, Teledyne Brown Engineering, USA; Boster, Mandee, Teledyne Brown Engineering, USA; [2000]; 7p; In English; Space OPS 2000 Symposium, 19-23 Jun. 2000, Toulouse, France

Contract(s)/Grant(s): NAS8-50000; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

International Space Station (ISS) payload operations are controlled through implementation of a payload operations plan. This plan, which represents the defined approach to payload operations in general, can vary in terms of level of definition. The detailed plan provides the specific sequence and timing of each component of a payload's operations. Such an approach to planning was implemented in the Spacelab program. The responsive plan provides a flexible approach to payload operations through generalization. A responsive approach to planning was implemented in the NASA/Mir Phase 1 program, and was identified as a need during the Skylab program. The current approach to ISS payload operations planning and control tends toward detailed planning, rather than responsive planning. The use of detailed plans provides for the efficient use of limited resources onboard the ISS. It restricts flexibility in payload operations, which is inconsistent with the dynamic nature of the ISS science program, and it restricts crew desires for flexibility and autonomy. Also, detailed planning is manpower intensive. The development and implementation of a responsive plan provides for a more dynamic, more accommodating, and less manpower intensive approach to planning. The science program becomes more dynamic and responsive as the plan provides flexibility to accommodate real-time science accomplishments. Communications limitations and the crew desire for flexibility and autonomy in plan implementation are readily accommodated with responsive planning. Manpower efficiencies are accomplished through a reduction in requirements collection and coordination, plan development, and maintenance. Through examples and assessments, this paper identifies the need to transition from detailed to responsive plans for ISS payload operations. Examples depict specific characteristics of the plans. Assessments identify the following: the means by which responsive plans accommodate the dynamic nature of science programs and the crew desire for flexibility; the means by which responsive plans readily accommodate ISS communications constraints; manpower efficiencies to be achieved through use of responsive plans; and the implications of responsive planning relative to resource utilization efficiency.

Author

International Space Station; Skylab Program; Spacelab; Payload Control; Autonomy; Flexibility

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology set theory, group theory and and number theory.

20000061916 Leiden Univ., Div. of Applied Mathematics, Netherlands

About the Sharpness of the Stability Estimates in the Kreiss Matrix Theorem

Spijker, M. N.; Tracogna, S.; Welfert, B. D.; May 06, 1998; 30p; In English

Report No.(s): PB2000-104879; TW-98-02; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available.

NTIS

Matrices (Mathematics); Estimating; Theorems; Numerical Stability

20000064060 Joint Inst. for Nuclear Research, Lab. of Computing Techniques and Automation, Dubna, USSR

Numerical solution of the nonstationary Schroedinger equation with increased accuracy

Vinitskij, S. I.; Puzynin, I. V.; Selin, A.; Dec. 31, 1998; 19p; In Russian; In English

Report No.(s): DE99-607985; JINR-R-11-98-44; No Copyright; Avail: Department of Energy Information Bridge

The method of Crank-Nicolson difference scheme generalization based on Magnus expansion for evolution operator of nonstationary Schroedinger equation is proposed for increasing the time approximation accuracy. The stability of received schemes is shown. Comparison between numerical and analytical solutions of the model problem (variable frequency oscillator) has been done for scheme O ((tau)(sup 4)) to demonstrate the accuracy, efficiency and adequate convergence of the scheme.

NTIS

Schroedinger Equation; Accuracy

20000064063 Geophysical Observatory, Helsinki, Finland

On the Connectivity Properties of the Rho-Boundary of the Unit Ball

Tossavainen, Timo, Geophysical Observatory, Finland; 2000; ISSN 1239-6303; 45p; In English; Sponsored in part by Yrjo Foundation

Report No.(s): Rept-123; ISBN 951-41-0868-X; Copyright; Avail: Issuing Activity

In recent years, conformal mappings of subdomains of the plane have been studied from many perspectives. In the case of f : B squared (right arrow) R squared conformal, one approach is to think of the absolute value of f' as a given 'density' rho on B squared and then characterize properties of f by giving conditions on rho. A little surprisingly, only two simple axioms on rho are needed to recover a remarkable part of geometric function theory.

Derived from text

Boundaries; Conformal Mapping; Euclidean Geometry; Analysis (Mathematics)

20000064581 NASA Ames Research Center, Moffett Field, CA USA

A Posteriori Error Estimation for Finite Volume and Finite Element Approximations Using Broken Space Approximation

Barth, Timothy J., NASA Ames Research Center, USA; Larson, Mats G., Chalmers Univ. of Technology, Sweden; Welcome to the NASA High Performance Computing and Communications Computational Aerosciences (CAS) Workshop 2000; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We consider a posteriori error estimates for finite volume and finite element methods on arbitrary meshes subject to prescribed error functionals. Error estimates of this type are useful in a number of computational settings: (1) quantitative prediction of the numerical solution error, (2) adaptive meshing, and (3) load balancing of work on parallel computing architectures. Our analysis recasts the class of Godunov finite volumes schemes as a particular form of discontinuous Galerkin method utilizing broken space approximation obtained via reconstruction of cell-averaged data. In this general framework, weighted residual error bounds are readily obtained using duality arguments and Galerkin orthogonality. Additional consideration is given to issues such as nonlinearity, efficiency, and the relationship to other existing methods. Numerical examples are given throughout the talk to demonstrate the sharpness of the estimates and efficiency of the techniques. Additional information is contained in the original.

Author

Error Analysis; Errors; Estimates; Finite Element Method; Finite Volume Method; Parallel Processing (Computers)

20000064692 College of William and Mary, Dept. of Mathematics, Williamsburg, VA USA

Bell-Curve Based Evolutionary Strategies for Structural Optimization*, 1 Aug. 1999 - 31 Jul. 2000*

Kincaid, Rex K., College of William and Mary, USA; [2000]; 4p; In English

Contract(s)/Grant(s): NAG1-2077; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Evolutionary methods are exceedingly popular with practitioners of many fields; more so than perhaps any optimization tool in existence. Historically Genetic Algorithms (GAs) led the way in practitioner popularity (Reeves 1997). However, in the last ten years Evolutionary Strategies (ESs) and Evolutionary Programs (EPS) have gained a significant foothold (Glover 1998). One partial explanation for this shift is the interest in using GAs to solve continuous optimization problems. The typical GA relies upon a cumber-some binary representation of the design variables. An ES or EP, however, works directly with the real-valued design variables. For detailed references on evolutionary methods in general and ES or EP in specific see Back (1996) and Dasgupta and Michalesicz (1997). We call our evolutionary algorithm BCB (bell curve based) since it is based upon two normal distributions.

Derived from text

Design Analysis; Genetic Algorithms; Strategy

20000065674 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR

Solution of the N=(0/2) superconformal f-Toda lattice

Deryagin, V. B.; Leznov, A. N.; Sorin, A. S.; Dec. 31, 1998; 20p; In English

Report No.(s): DE99-607978; JINR-E-2-98-49; No Copyright; Avail: Department of Energy Information Bridge

The general solution of the two-dimensional integrable generalization of the f-Toda chain with fixed ends is explicitly presented in terms of matrix elements of various fundamental representations of the SL (n/n-1) supergroup. The dominant role of the representation theory of graded Lie algebras in the problem of constructing integrable mappings and lattices is demonstrated.

NTIS

Lattices (Mathematics); Solution

20000066597 Geophysical Observatory, Helsinki, Finland

On Complex Differential Equations in the Unit Disc

Heittokangas, Janne, Geophysical Observatory, Finland; 2000; ISSN 1239-6303; 62p; In English; Sponsored in part by Emil Aaltonen Foundation

Report No.(s): Rept-122; ISBN 951-41-0867-1; Copyright; Avail: Issuing Activity

This paper presents a dissertation on complex differential equations in the unit disc. The topics include: 1) Notations and background; 2) Linear first order equations; 3) Linear second order equations; 4) The equation f (sup k) + A (z)f=0; 5) Upper bounds for the absolute value of f (sup k) (z)/f (sup j)(z) in the unit disc; 6) Linear equations of arbitrary order; 7) Linear non-homogeneous equations of arbitrary order; and 8) Algebraic differential equations.

CASI

Differential Equations; Complex Variables; Meromorphic Functions; Analysis (Mathematics)

70
PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see categories 71 through 77. For related instrumentation see 35 Instrumentation and Photography; for geophysics, astrophysics or solar physics see 46 Geophysics, 90 Astrophysics, or 92 Solar Physics.

20000065659 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Clock Technology Development in the Laser Cooling and Atomic Physics (LCAP) Program

Seidel, Dave, Jet Propulsion Lab., California Inst. of Tech., USA; Thompson, R. J., Jet Propulsion Lab., California Inst. of Tech., USA; Klipstein, W. M., Jet Propulsion Lab., California Inst. of Tech., USA; Kohel, J., Jet Propulsion Lab., California Inst. of Tech., USA; Maleki, L., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 15p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents the Laser Cooling and Atomic Physics (LCAP) program. It focuses on clock technology development. The topics include: 1) Overview of LCAP Flight Projects; 2) Space Clock 101; 3) Physics with Clocks in microgravity; 4) Space Clock Challenges; 5) LCAP Timeline; 6) International Space Station (ISS) Science Platforms; 7) ISS Express Rack; 8) Space Qualification of Components; 9) Laser Configuration; 10) Clock Rate Comparisons: GPS Carrier Phase Frequency Transfer; and 11) ISS Model Views. This paper is presented in viewgraph form.

CASI

Atomic Physics; Clocks; Laser Cooling; Technology Utilization

71
ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see 45 Environment Pollution. For aircraft noise see also 02 Aerodynamics and 07 Aircraft Propulsion Propulsion and Power.

20000062459 DYNACS Engineering Co., Inc., Cleveland, OH USA

Influence of Mean-Density Gradient on Small-Scale Turbulence Noise

Khavaran, Abbas, DYNACS Engineering Co., Inc., USA; June 2000; 18p; In English; 6th; Aeroacoustics, 12-14 Jun. 2000, Lahaina, HI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS3-98008; RTOP 523-90-43

Report No.(s): NASA/CR-2000-210226; E-12346; NAS 1.26:210226; AIAA Paper 2000-2059; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A physics-based methodology is described to predict jet-mixing noise due to small-scale turbulence. Both self- and shear-noise source teens of Lilley's equation are modeled and the far-field aerodynamic noise is expressed as an integral over the jet volume of the source multiplied by an appropriate Green's function which accounts for source convection and mean-flow refraction. Our primary interest here is to include transverse gradients of the mean density in the source modeling. It is shown that, in addition to the usual quadrupole type sources which scale to the fourth-power of the acoustic wave number, additional dipole and monopole sources are present that scale to lower powers of wave number. Various two-point correlations are modeled and an approximate solution to noise spectra due to multipole sources of various orders is developed. Mean flow and turbulence information is provided through RANS-k(epsilon) solution. Numerical results are presented for a subsonic jet at a range of temperatures

and Mach numbers. Predictions indicated a decrease in high frequency noise with added heat, while changes in the low frequency noise depend on jet velocity and observer angle.
Author
Turbulence; Sound Waves; Procedures; Noise Spectra; Aerodynamic Noise; Jet Mixing Flow

20000063507 NASA Glenn Research Center, Cleveland, OH USA
A Comparison of Measured Tone Modes for Two Low Noise Propulsion Fans
Heidelberg, Laurence J., NASA Glenn Research Center, USA; Elliott, David M., NASA Glenn Research Center, USA; June 2000; 18p; In English; 6th; Aeroacoustics, 12-14 Jun. 2000, Lahaina, HI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 522-81-11
Report No.(s): NASA/TM-2000-210231; E-12351; NAS 1.15:210231; AIAA Paper 2000-1989; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The acoustic modes for two low tip speed propulsion fans were measured to examine the effects of fan tip speed, at constant pressure ratio. A continuously rotating microphone method was used that provided the complete modal structure (circumferential and radial order) at the fundamental and second harmonic of the blade passing tone as well as most of the third harmonic modes. The fans are compared in terms of their rotor/stator interaction modal power, and total tone power. It was hoped that the lower tip speed might produce less noise. This was not the case. The higher tip speed fan, at both takeoff and cutback speeds, had lower tone and interaction levels. This could be an indication that the higher aerodynamic loading required to produce the same pressure ratio for the lower tip speed fan resulted in a greater velocity deficit in the blade wakes and thus more noise. Results consistent with expected rotor transmission effects were noted in the inlet modal structures of both fans.
Author
Acoustic Properties; Tip Speed; Engine Noise; Ducted Fans; Propeller Noise; Aeroacoustics; Rotor Stator Interactions

20000064585 NASA Glenn Research Center, Cleveland, OH USA
CAPRI: Computational Analysis PRogramming Interface. ”A CAD infra-structure for Aerospace Analysis and Design Simulations”
Claus, Russ, NASA Glenn Research Center, USA; Follen, Gregory J., NASA Glenn Research Center, USA; Haimes, Robert, Massachusetts Inst. of Tech., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The NASA Glenn Research Center is currently building the foundation for the software analysis suite NPSS (Numerical Propulsion System Simulation) within the High Performance Computing and Communication program. NPSS has a vision of creating a ”numerical test cell” that enables full engine simulations overnight on cost effective computing platforms. This vision is accomplished through numerical zooming and the integration of multiple disciplines such as aerodynamics, structures and heat transfer with computing and communication technologies to capture complex physical processes in a timely and cost effective manner. In order to conduct complex multi-discipline simulations overnight, solving the problem of providing common geometry representations or common access across all pieces of the simulation or design space is required. CAPRI offers a solution to this real world dilemma by providing a native connection to all major CAD systems. This allows NPSS applications access to the geometry, which preserves all the inherent features of that physical model, while allowing each discipline the ability to register its effect on the model. CAPRI provides a structured method that any discipline can then ”see” the results from other subject disciplines. CAPRI is a CAD-vendor neutral application programming infrastructure designed for the construction of Aerospace analysis and design systems. by allowing access directly into the CAD system from within grid generators, solvers and post-processors such tasks as meshing on the actual surfaces, node enrichment by solvers and defining which mesh faces are boundaries strategically supports a fundamental requirement for multi-disciplinary applications-”common view of the geometry”. This ’Geometry Centric’ approach makes multi-physics (multi-disciplinary) analysis codes much easier to build. by using the shared (coupled) surface as the foundation, CAPRI provides a single call to interpolate grid-node based data from the surface discretization in one volume to another. Finally, multi-disciplinary analysis and design applications are possible due to the fact that the results can be brought back into the CAD system (and therefore manufactured) because all geometry construction and modification are performed using the CAD system’s geometry kernel. This paper discussed the current implementation of CAPRI over Unigraphics, I-DEAS, Pro/Engineer and CATIA. Initial applications of CAPRI will be discussed and ongoing standards efforts that use CAPRI to define a common CAD to Computer Aided Engineering interface.
Author
Computer Aided Design; Computerized Simulation

20000065633 Institute TNO of Applied Physics, Delft, Netherlands

Modelling Tip Vortex Induced Noise

Geerlings, A. C., Institute TNO of Applied Physics, Netherlands; Dec. 20, 1999; 21p; In English

Contract(s)/Grant(s): A99/KM/150; TNO Proj. 008.00065/01.01

Report No.(s): TD-99-0063; HAG-RPT-990239; Copyright; Avail: Issuing Activity

Sound generated by objects in a flow, such as hydrofoils or propellers, is caused by a number of mechanisms. One mechanism is due to the tip vortex, a phenomenon caused by the finite length of airfoils and propeller blades. Noise due to the tip vortex can be considered complementary to other previously studied noise mechanisms such as non-uniform stationary inflow, inflow turbulence and trailing edge noise. In this literature study a first step is made to come to a design for a parameterized model for tip vortex noise. The tip vortex induced partial source contribution completes the existing noise emission model for ship propellers. The proposed model consists of available techniques by which the noise radiation is based on wall pressure fluctuations described by their temporal and spatial spectra. This requires first the availability of the parameters that describe the turbulent layer. Secondly, in order to apply these techniques to tip vortex related noise, the time-varying equilibrium position of the tip vortex is required. For simplified geometries parameter models are available. In case of a complex geometry a numerical solution may be sought by means of Reynolds-Averaged Navier-Stokes (RANS) calculations.

Author

Vortices; Aeroacoustics; Aerodynamic Noise; Propeller Noise; Propeller Blades; Trailing Edges

20000065657 Georgia Inst. of Tech., Acoustics and Aerospace Technologies Branch, Atlanta, GA USA

High Amplitude Acoustic Behavior of a Slit-Orifice Backed by a Cavity

Ahuja, K. K., Georgia Inst. of Tech., USA; Gaeta, R. J., Jr., Georgia Inst. of Tech., USA; DAgostino, M., Georgia Inst. of Tech., USA; 20000331; 53p; In English

Contract(s)/Grant(s): NAG1-1734

Report No.(s): GTRI-A5004/2000-3; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The objective of the study reported here was to acquire detailed acoustic data and limited and flow visualization data for numerical validation a new model of sound absorption by a very narrow rectangular slit backed by a cavity. The sound absorption model is being developed by Dr. C. K. W. Tam of Florida State University. This report documents normal incidence impedance measurements of a singular rectangular slit orifice with no mean flow. All impedance measurements are made within a 1.12 inch (28.5 mm) diameter impedance tube using the two-microphone method for several frequencies in the range 1000-6000Hz and incident sound pressure levels in the range 130 - 150 dB. In the interest of leaving the analysis of the data to the developers of more advanced analytical and computational models of sound absorption by narrow slits, we have refrained from giving our own explanations of the observed results, although many of the observed results can be explained using the classical explanations of sound absorption by orifices.

Derived from text

Cavities; Orifices; Slits; Amplitudes; Acoustic Attenuation

20000065658 Georgia Inst. of Tech., Acoustics and Aerospace Technologies Branch, Atlanta, GA USA

Sound Absorption of a 2DOF Resonant Liner with Negative Bias Flow

Ahuja, K. K., Georgia Inst. of Tech., USA; Cataldi, P., Georgia Inst. of Tech., USA; Gaeta, R. J., Jr., Georgia Inst. of Tech., USA; Mar. 31, 2000; 35p; In English

Contract(s)/Grant(s): NAG1-1734

Report No.(s): GTRI-A5004/2000-5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes an experimental study conducted to determine the effect of negative bias flow on the sound absorption of a two degree-of-freedom liner. The backwall for the liner was designed to act as a double-Helmholtz resonator so as to act as a hard wall at all frequencies except at its resonant frequencies. All normal incident impedance data presented herein was acquired in an impedance tube. The effect of bias flow is investigated for a buried septum porosity of 2% and 19.5% for bias flow orifice mach numbers up to 03 11. As a porous backwall is needed for the flow to pass through, the effect of bias flow on this backwall all had to be evaluated first. The bias flow appears to modify the resistance and reactance of the backwall alone at lower frequencies up to about 2 kHz, with marginal effects at higher frequencies. Absorption coefficients close to unity are achieved for a frequency range of 500-4000 Hz for the overall liner for a septum porosity of 2% and orifice mach number of 0.128. Insertion loss tests performed in a flow duct facility for grazing flow Mach numbers up to 0.2 and septum mach numbers up to 0.15 showed that negative

bias flow can increase insertion loss by as much as 10 dB at frequencies in the range of 500 - 1400 Hz compared to no grazing flow. The effectiveness of the negative bias flow is diminished as the grazing flow velocity is increased.
Derived from text
Degrees of Freedom; Linings; Sound Transmission; Response Bias; Flow Characteristics

20000066584 Institute TNO of Applied Physics, Delft, Netherlands
Acoustic Radiation from Beam-Plate Systems
Petersson, B. A. T., Institute TNO of Applied Physics, Netherlands; Oct. 07, 1999; 27p; In English
Contract(s)/Grant(s): A97/KM/131; TNO Proj. 008.00653/01.01
Report No.(s): TD-99-0056; TPD-HAG-RPT-990159; Copyright; Avail: Issuing Activity

Based on a recently developed theoretical description for combinations of arbitrary deep beams and thin plates, numerical results for the acoustic radiation are presented. Fluid loading of the radiating beam-plate configuration is rigorously taken into account. For most configurations studied, the radiation principally follows that of a point excited plate. With respect to thin plates, fluid loading is confirmed to be influential for the radiation characteristics whereas the actual configuration of the structural system enables the radiation for Helmholtz numbers at and above the dilatational resonance of the beam to exceed that of the directly excited plate. It is thus demonstrated that owing to the waveguide behaviour of the beam, enhanced radiation results from the dilatational resonance and above in comparison with what would have been predicted based on Euler-Bernoulli theory. In the range below the dilatational resonance, the analysis further indicates that marked structural alterations do not affect the radiation correspondingly.
Author
Sound Waves; Waveguides; Numerical Analysis; Thin Plates

20000066603 Physics and Electronics Lab. TNO, The Hague, Netherlands
Environmentally Adaptive Sonar Techniques: A Literature Survey and Recommendations for Further Research *Final Report*
Eecen, P. J., Physics and Electronics Lab. TNO, Netherlands; Lam, F.-P. A., Physics and Electronics Lab. TNO, Netherlands; Simons, D. G., Physics and Electronics Lab. TNO, Netherlands; September 1999; 33p; In English
Contract(s)/Grant(s): A99/KM/651; TNO Proj. 28804
Report No.(s): TD-99-0246; FEL-99-A207; Copyright; Avail: Issuing Activity

This report describes a literature survey on environmentally adaptive sonar technology. Many papers are summarized and reported in a literature list. The international projects on environmentally adaptive sonar technology are described. Many techniques are summarized and the report concludes with a list of recommendations for a succeeding project on environmentally adaptive sonar technology. Also, a comprehensive list of methods and equipment concerning environmental parameter estimation is included.
Author
Sonar; Underwater Acoustics; Real Time Operation; Frequencies; Marine Technology; Tracking (Position)

20000066615 Southampton Univ., Signal Processing and Control Group, UK
Model for the Control of the Sound Radiated by an Aircraft Panel Excited by a Turbulent Boundary Layer
Maury, C., Southampton Univ., UK; Gardonio, P., Southampton Univ., UK; Elliott, S. J., Southampton Univ., UK; June 2000; 90p; In English
Report No.(s): ISVR-TR-287; Copyright; Avail: Issuing Activity

This aim of this report is to present a simplified but relevant model for predicting the vibro-acoustic response of an aircraft panel excited by a turbulent boundary layer. This analytical model provides an insight into tile physical properties of the TBL-excited panel and enables the performance limitations to be derived for various idealized active control systems. This report is divided into three main parts. The first part justifies the simplifying assumptions of the flat plate model for an aircraft panel. Furthermore, it describes how the spectral densities of the panel response can be obtained from an analysis of the system response to a harmonic deterministic excitation and a statistical model for the turbulent boundary layer. The second part focuses on the modal formulation used to solve the flow-structure interaction problem in the frequency domain; criteria are discussed under which the cross-modal coupling of the structural modes call be neglected when excited by a turbulent boundary layer. The modelling of the pressure field induced by the turbulent boundary layer which acts as a distributed random excitation field on the structure is described. The third part presents simulation results in which the verification of the approximations and the influence of the main physical parameters art discussed, together with a comparison between experimental and predicted results. The way in which the structural modes and the radiation modes of the plate contribute to the vibro-acoustic response are also examined. One

important conclusion is that for subsonic turbulent flows, each structural mode radiates sound independently. A suitable strategy for the active structural acoustic control of the sound power transmitted through the panel would thus be independent feedback control of each structural mode in the low-frequency domain. It is also shown, however, that independent control of the panel's radiation modes is also possible, and that this could provide a more efficient control strategy, since a smaller number of radiation modes than structural modes needs to be controlled for a given level of performance.
Author
Active Control; Mathematical Models; Panels; Turbulent Boundary Layer; Aircraft Noise; Harmonic Excitation; Harmonic Radiation

20000066625 Department of the Navy, Washington, DC USA
Phase Fluctuation Enhanced Adaptive Processor
Wagstaff, Ronald A., Inventor; Mobbs, Jackson A., Inventor; Feb. 04, 2000; 31p; In English
Patent Info.: Filed 4 Feb. 2000; US-Patent-Appl-SN-09,498,348
Report No.(s): AD-D019714; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
The invention uses phase fluctuations in each frequency bin to modify the exponents of pressure amplitudes (or power magnitudes) for each successive realization of a signal. As the magnitudes of the phase fluctuations decrease (i.e., signal has small magnitudes and the noise has large ones), the exponents increase. The modified pressures are summed and averaged. The resulting average is then raised to an exponent that is the average of the exponents of the individual pressures (or power magnitudes). All individual exponents and the averaged exponent in each bin are preferably bounded between optimal values of 2 and -4. The exponents will be negative for noise (attenuation), and in between for clutter signals.
DTIC
Signal Processing; Sonar; Noise Reduction; Underwater Acoustics; Random Noise

20000067667 Georgia Inst. of Tech., Acoustics and Aerospace Technologies Branch, Atlanta, GA USA
Active Control of Liner Impedance by Varying Perforate Orifice Geometry
Ahuji, K. K., Georgia Inst. of Tech., USA; Gaeta, R. J., Jr., Georgia Inst. of Tech., USA; Mar. 31, 2000; 206p; In English
Contract(s)/Grant(s): NAG1-1734
Report No.(s): GTRI-A5004/2000-1; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
The present work explored the feasibility of controlling the acoustic impedance of a resonant type acoustic liner. This was accomplished by translating one perforate over another of the same porosity creating a totally new perforate that had an intermediate porosity. This type of adjustable perforate created a variable orifice perforate whose orifices were non-circular. The key objective of the present study was to quantify, the degree of attenuation control that can be achieved by applying such a concept to the buried septum in a two-degree-of-freedom (2DOF) acoustic liner. An additional objective was to examine the adequacy of the existing impedance models to explain the behavior of the unique orifice shapes that result from the proposed silding perforate concept. Different orifice shapes with equivalent area were also examined to determine if highly non-circular orifices had a significant impact on the impedance.
Derived from text
Active Control; Orifices; Geometry; Acoustic Impedance; Linings; Resonance

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see 73 Nuclear Physics.

20000062712 Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany
Examination of the e(sup +) and e(sup +)e(sup -) pair emission from heavy ion collisions at the EPoS II spectrometer
Baumann, J.; Dec. 31, 1996; 150p; In German; In English
Report No.(s): DE99-715815; GSI-96-05; No Copyright; Avail: Department of Energy Information Bridge
In the course of examination of the positron and positron-electron pair emission from heavy ion collisions at the Coulomb barrier, the research groups EPOS I and ORANGE have found a number of line structures in the measured positron energy and cumulative pair energy spectra which up to present could not be fully explained, as theoretical interpretations so far remain incon-

sistent in some respects. For clarification, further measurements have been made at the completely new designed EPoS II spectrometer. Reproducibility of the lines is possible at a high level of statistical significance.
NTIS
Ionic Collisions; Pair Production; Atomic Physics

20000062713 Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany
Quest for narrow e(sup +)e(sup -) cumulative energy distributions heavy ion collisions. The GSI e(sup +)e(sup -) puzzle
Ganz, R.; Dec. 31, 1995; 136p; In German; In English
Report No.(s): DE99-715793; GSI-95-11; No Copyright; Avail: Department of Energy Information Bridge
The examination of electron-positron pairs which are emitted in heavy-ion collisions at the Coulomb barrier was continued with the newly designed EPoS II spectrometer at the UNILAC accelerator. The objective of the experiments was to further analyse the narrow line structures in the positron-electron cumulative energy distributions, which were observed in preceding measurements examining the collision systems U 238 + Th 232 and U 238 + Ta181 with the EPOS I spectrometer. by means of a reproduction experiment, the existence of the lines was statistically verified relying on a large data pool.
NTIS
Ionic Collisions; Energy Distribution; Atomic Physics

20000062716 Joint Inst. for Nuclear Research, Lab. of Particle Physics, Dubna, USSR
Resonance Bremsstrahlung of a fast charged particle in a medium
Beshtoev, K.; Dec. 31, 1998; 15p; In English
Report No.(s): DE99-607973; JINR-E-2-98-23; No Copyright; Avail: Department of Energy Information Bridge
The Bremsstrahlung of the fast charged particle in the medium with dielectric permittivity (epsilon) at velocities (upsilon) (>=) c/n n(sup 2) =Re(epsilon) is considered. The Bremsstrahlung has singularity at (beta) = 1/ncos(theta) (beta) = (upsilon)/c, (theta) is an angle of the Bremsstrahlung. This Bremsstrahlung is interpreted as resonance Bremsstrahlung with the width characterized by Im(epsilon)=(epsilon)(sub 2), and the less (epsilon)(sub 2) is, the higher the peak of this resonance rises. The angular distribution of the Bremsstrahlung is determined by cos (theta)=1/n(beta) and this angle coincides with the angle of the Cherenkov radiation. At (beta)=1/n this resonance Bremsstrahlung goes in the forward direction and depends on frequency (omega) (epsilon)=(epsilon) (omega).
NTIS
Bremsstrahlung; Charged Particles; Resonance

20000062722 Joint Inst. for Nuclear Research, Flerov Lab. of Nuclear Reactions, Dubna, USSR
Considerations of nuclear objects stability
Shchegolev, V.; Dec. 31, 1998; 19p; In Russian; In English
Report No.(s): DE99-607964; JINR-D-4-98-34; No Copyright; Avail: Department of Energy Information Bridge
A new concept of the stability of nuclear objects based on the geometrical representation of states of identical particles forming shells is given. This representation is based on the following principle: the whole is stable, if it is made of the greatest possible number of elements, each being different from another. As a result, the known magic numbers are calculated by a simple method.
NTIS
Stability; Matter (Physics); Atomic Physics

20000064056 Joint Inst. for Nuclear Research, Lab. of High Energies, Dubna, USSR
Description of (pi)(sup -) -meson and proton characteristics in np- interactions at P(sub n) = 1.25 - 5.1 GeV/c within the framework of FRITIOF model
Gankhuyag, B.; Dec. 31, 1998; 20p; In Russian; In English
Report No.(s): DE99-607990; JINR-R-2-98-26; No Copyright; Avail: Department of Energy Information Bridge
Rapidity and transverse momentum distributions of (pi)(sup -) - mesons and protons in np-interactions at 1.25 - 5.1 GeV/c in the framework of FRITIOF model are analyzed. Due to fitting of the model parameters a complex description of np-interactions has been reached. In the modified model the charge-exchange between colliding nucleons is taken into account: the transverse momentum which the colliding nucleons are exchanged by is chosen and the minimum mass of excited hadrons is supposed to be 1.2 GeV; in case of two- particle decays, a string with a mass less than 1.7 GeV, an isotropic particle decay is simulated in the

rest frame of the string. The modified model can be used both for a description of different processes and for an analysis of nucleus-nucleus interactions at intermediate energies.
NTIS
Mesons; Protons; Nuclear Interactions; Transverse Momentum

20000064067 NASA Ames Research Center, Moffett Field, CA USA
Structure of Co(H2)n + Clusters, for n = 1-6
Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; Maitre, Philippe, California Univ., USA; Journal of Physical Chemistry; 1995; ISSN 0022-3654; Volume 99, pp. 3444-3447; In English; Copyright; Avail: Issuing Activity

The geometries and H2 binding energies have been determined for Co(H2)n (sup +), for n = 1-6. The binding energies are in good agreement with experiment. The shape of the clusters is used to explain the pairwise decrease in the binding energies. The bonding in CoH2 (sup +) and Co(H2)2 (sup +) is very similar and is enhanced by sd (sigma) hybridization. The next two H2 molecules add to the side of Co(H2)2 (sup +). These two additional H2 molecules cannot benefit from sd (sigma) hybridization and are less strongly bound. The addition of the fifth and sixth H2 molecules eliminates sd (sigma) hybridization as a mechanism for reducing Co-H2 repulsion. This coupled with the smaller Co to H2 (sigma *) donation results in another decrease in the binding energies.
Author
Hydrogen; Cobalt; Chemical Bonds; Molecular Clusters; Hybrid Structures

20000064084 NASA Ames Research Center, Moffett Field, CA USA
Theoretical Study of Electron Scattering by Small Clusters and Adsorbates
Huo, Winifred M., NASA Ames Research Center, USA; Sheehy, J. A., Eloret Corp., USA; Electron Collisions with Molecules, Clusters, and Surfaces; [1994], pp. 171-182; In English; Copyright; Avail: Issuing Activity

Current interest in clusters stems from their role as novel materials as well as a possible extension of cluster results to bulk systems. Experimental investigations on clusters have been carried out using laser spectroscopy, microwave spectroscopy, heavy-particle collisions, as well as electron collisions with earlier experimental work on electron attachment and ionization having been reviewed previously. Recently, Mark and coworkers studied the decay channels of cluster ions following electron impact ionization. Rauth et al. reported the formation of the superhalogen ion SF7(-) and other nonstoichiometric cluster ions in their study of electron attachment to SF6 clusters. Kresin et al. measured the absolute electron-impact depletion cross section of metal clusters Na8, Na(20), and Na(40). They found that the inelastic scattering cross section increased with cluster size and was considerably greater than the hard sphere collision cross sections. They hypothesized that electron attachment and collision-induced fragmentation were the dominant physical processes responsible for this effect. For the two smaller clusters, they also found a sharp increase in the cross section near threshold. Most theoretical studies of clusters have been devoted to their electronic structures, vibrational relaxation, and predissociation while investigations of electron scattering from clusters has been lacking. In view of this, we recently undertook an ab initio study of electron scattering from small Be clusters and BeCO. Beryllium was chosen because it is readily amenable to ab t'nitio calculations. Moreover, the electronic structure of Be clusters has been studied extensively, showing that the Be-Be bond is relatively weak in comparison with a normal chemical bond. Our investigation focuses on how the cross sections change with cluster size and geometry. The range of energy studied, 0.05 - 5.0 eV, is chosen because of the ubiquitous resonance in the low-energy scattering of Be. Hence it can be determined if it is possible, as a consequence of the weaker bonds in the Be clusters, to identify the atomic origin of the cluster resonance.
Derived from text
Numerical Analysis; Electron Scattering; Adsorption; Atomic Clusters; Electronic Structure; Inelastic Scattering; Ionization; Scattering Cross Sections

20000065647 Joint Inst. for Nuclear Research, Frank Lab. of Neutron Physics, Dubna, USSR
Search for low-energy upscattering of ultracold neutrons from a beryllium surface
Muzychka, A.; Pokotilovskij, Y.; Geltenbort, P.; Dec. 31, 1998; 20p; In English
Report No.(s): DE99-607982; JINR-E-3-98-41; No Copyright; Avail: Department of Energy Information Bridge

The results are presented of the search for the anomalous low energy upscattering of ultracold neutrons from beryllium surface. This upscatterring is considered as one of the possible reasons of UCN 'disappearance' from very cold beryllium bottles, observed in experiments. The Indium foil activation method was used to measure a very low intensity flux of upscattered UCN. The (15-250) m/s velocity interval of upscattered UCN is excluded in these measurements with CL 90%.
NTIS
Inelastic Scattering; Cold Neutrons; Nuclear Physics

73
NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see 93 Space Radiation. For atomic and molecular physics see 72 Atomic and Molecular Physics. For elementary particle physics see 77 Physics of Elementary Particles and Fields. For nuclear astrophysics see 90 Astrophysics.

20000062721 Joint Inst. for Nuclear Research, Lab. of High Energies, Dubna, USSR
Different experimental behaviour of fast secondary particles produced in (sup 12)C interactions at relativistic energies as studied with radiochemistry and in a propane chamber
Kulakov, B. A.; Karachuk, J.; Gelovani, L. K.; Gridnev, T. G.; Sosnin, A. N.; Dec. 31, 1998; 15p; In English
Report No.(s): DE99-607967; JINR-E-1-98-51; No Copyright; Avail: Department of Energy Information Bridge

Energetic secondary fragments produced in the interaction of (41-44) GeV (sup 12)C ions with copper exhibit experimentally a broader angular distribution as compared to energetic secondary fragments produced in the interactions at a lower (sup 12)C-energy (15-25) GeV when studied with radiochemical techniques. Such a different experimental behaviour of secondary fragments produced by (sup 12)C ions of the same two energy groups is not observed, when these secondary fragments are investigated with a propane bubble chamber. Separation of secondary particles is described.
NTIS
Particle Production; Angular Distribution; Nuclear Physics

20000062723 International Atomic Energy Agency, International Nuclear Data Committee, Vienna, Austria
Summary report of the third research coordination meeting on development of reference charged-particle cross section database for medical radioisotope production
Oblozinsky, P.; Nov. 30, 1998; 69p; In English; 3rd; Development of reference charged-particle cross section database for medical radioisotope production
Report No.(s): DE99-607946; INDC(NDS)-388; No Copyright; Avail: Department of Energy Information Bridge

The report summarizes results of the final coordination meeting of the IAEA research project on ''Development of Reference Charged-Particle Cross Section Database for Medical Radioisotopes Production''. Details are given on the status of the Database and preparation of the TECDOC, two major results of the project. Actions and deadlines are specified towards finalizing these results in the near future.
NTIS
Charged Particles; Data Bases; Nuclear Physics

20000063366 International Atomic Energy Agency, International Nuclear Data Committee, Vienna, Austria
Summary report of the 2. research coordination meeting on compilation and evaluation of photonuclear data for applications
Oblozinsky, P.; Sep. 30, 1998; 51p; In English; 2nd; Compilation and evaluation of photonuclear data for applications
Report No.(s): DE99-607944; INDC(NDS)-384; No Copyright; Avail: Department of Energy Information Bridge

The report contains the summary of the 2. research coordination meeting on compilation and evaluation of photonuclear data for applications hosted by the Los Alamos National Laboratory. The project aims to produce an IAEA Photonuclear Data library and a TECDOC ''Handbook on Photonuclear Data''. Summarized is the status of the project along with future tasks towards its completion in 1999. An Appendix includes nine extended abstract of presented papers. A separate indexing was provided for each abstract.
NTIS
Photonuclear Reactions; Data Acquisition; Nuclear Physics

20000063367 International Atomic Energy Agency, International Nuclear Data Committee, Vienna, Austria
Method and program CABEI for adjusting consistency between the cross section data of natural element and its isotopes
Liu Tingjin,; Sun Zhengjun,; Nov. 30, 1998; 19p; In English
Report No.(s): DE99-607943; INDC(CPR)-046; No Copyright; Avail: Department of Energy Information Bridge

The method and program CABEI have been developed to make the complete data of natural element and its isotopes satisfy at the same time the two kinds of consistent relationships, one for each nuclide, and another between the natural element and its

isotopes. The method and program were successfully used to adjust the data of natural Fe and Fe-54,56,57,58 of CENDL-2.1, as well as to adjust the data of natural Ni and its isotopes Ni-58,60,61,62,64.
NTIS
Nuclear Physics; Consistency; Cross Sections

20000063368 International Atomic Energy Agency, International Nuclear Data Committee, Vienna, Austria
Neutron activation cross section measurements and evaluations in CIAE
Huang Xiaolong,; Lu Hanlin,; Zhao Wenrong,; Yu Weixiang,; Han Xiaogang,; Oct. 31, 1998; 51p; In English
Report No.(s): DE99-607942; INDC(CPR)-045; No Copyright; Avail: Department of Energy Information Bridge
The cross sections of 28 reactions have been measured by the activation method since 1995 in CIAE. At the same time the cross sections of 40 reactions which we have measured since 1989 have been compiled and evaluated. A brief description of experimental measurement of activation cross sections is given. The data measured after 1995 by ourselves are listed in Table 4 and our evaluations for 40 reactions are listed in Table 5, respectively. A graphical intercomparison with available experimental data is given in appendix.
NTIS
Neutron Activation Analysis; Nuclear Physics

20000063369 International Atomic Energy Agency, International Nuclear Data Committee, Vienna, Austria
Benchmarking of evaluated neutron data for vanadium by a 14 MeV spherical shell transmission experiment
Simakov, S. P.; Devkin, B. V.; Fursov, B. I.; Kobozev, M. G.; Talalaev, V. A.; Oct. 31, 1998; 34p; In English
Report No.(s): DE99-607941; INDC(CCP)-417; No Copyright; Avail: Department of Energy Information Bridge
Measurements of neutron leakage spectra from two shells of pure vanadium having wall thicknesses of 3.5 cm and 10.5 cm with a 14 MeV neutron source at the center are reported. The neutron leakage spectra were measured by the time-of-flight method from 15 MeV down to 50 keV. Descriptions of the experimental arrangement, the time-of-flight spectrometer, the measurements and data reduction procedures are given. Corrections connected with neutron multiple scattering in the neutron source, deviations from spherical symmetry and others were estimated by the Monte-Carlo technique. Also, the response function of the spectrometer was determined and folded with the calculated spectra to allow meaningful calculation-experiment comparisons even near the 14 MeV peak. Three-dimensional Monte-Carlo calculations were made with the MCNP code, using the EFF-3, FENDL-1 and JENDL-FF nuclear data libraries. The total leakage fluence is correctly predicted or slightly overestimated by all these evaluated data. However, its breakdown into energy bins shows considerable over estimations near 0.1 MeV for FENDL-1 and JENDL-FF and near 10 MeV for JENDL-FF, while EFF-3 on the whole reproduces the leakage spectra best. An analysis of existing differential experimental V(n,xn) data at 14 MeV incident energy agrees with these findings.
NTIS
Nuclear Physics; Neutron Sources; Neutron Spectra; Leakage

20000063370 International Atomic Energy Agency, International Nuclear Data Committee, Vienna, Austria
Status of experimental and evaluated discrete (gamma)-ray production at E(sub n)=14.5 MeV. Performed under the CRP on measurement, calculation and evaluation of photon production data *Final Report*
Simakov, S. P.; Pavlik, A.; Vonach, H.; Hlavac, S.; Sep. 30, 1998; 60p; In English
Contract(s)/Grant(s): IAEA-7809/RB
Report No.(s): DE99-607938; INDC(CCP)-413; No Copyright; Avail: Department of Energy Information Bridge
The aim of the paper is to collect and examine the status of the experimental data on discrete (gamma)-ray production cross sections via (n, x(gamma)) reaction for practically important nuclei at 14 MeV incident neutron energy. From this point of view, the available experimental cross sections for all reliable (gamma)-ray transitions, measured by high energy resolution in- beam technique, were compiled in the report. This experimental base was critically checked from the point of view of influence of different experimental factors and evaluated experimental cross sections and uncertainties were received. The present status of experimental data against practical demands was established. The FENDL-1, ENDF/B6 and BROND-2 libraries were checked as well to search whether the discrete photon production cross sections were presented there and how they agree with available experimental data.
NTIS
Nuclear Physics; Photons; Gamma Rays

20000063371 International Atomic Energy Agency, International Nuclear Data Committee, Vienna, Austria
Fission level density and barrier parameters for actinide neutron-induced cross section calculations ***Final Report, 15 Dec. 1995 - 14 Jun. 1998***
Maslov, V. M.; Oct. 31, 1998; 126p; In English
Contract(s)/Grant(s): IAEA-8832/RB
Report No.(s): DE99-607937; INDC(BLR)-013; No Copyright; Avail: Department of Energy Information Bridge

Fission and total level densities modelling approach was developed. Neutron-induced fission cross section data for incident energies from 10 keV up to emissive fission threshold were employed to extract level density and fission barrier parameters. In particular, fission barrier parameters (inner barrier height, outer barrier height, curvatures) were extracted for altogether 49 isotopes of Th, Pa, U, Np, Pu, Am, Cm, Bk, and Cf. The adopted level density modelling approach and fission barrier parametrization was supported by calculations of fission cross section data above the emissive fission threshold, up to 20 MeV neutron incident energy.
NTIS
Fission; Neutron Cross Sections; Nuclear Physics

20000064054 Joint Inst. for Nuclear Research, Frank Lab. of Neutron Physics, Dubna, USSR
Application of correlation technique to delayed neutrons measurements on thermal neutron induced fission of (sup 237)Np
Zejnalov, S.; Zejnalova, O. B.; Smirnov, V.; Dec. 31, 1998; 24p; In Russian; In English
Report No.(s): DE99-607992; JINR-R-3-98-17; No Copyright; Avail: Department of Energy Information Bridge

A method of measurements of weak effects in the presence of background on the neutron-activation experiments is proposed. The method is based on measurements of cross-correlation function between neutron flux and measured effect intensity. A detailed theoretical analysis of the method is given. The method was used for a measurement of average number of delayed neutrons on thermal neutrons induced fission of (sup 237)Np.
NTIS
Thermal Neutrons; Cross Correlation; Nuclear Physics

20000064057 Joint Inst. for Nuclear Research, Flerov Lab. of Nuclear Reactions, Dubna, USSR
Isomeric ratios in the reaction ((gamma), p) at the energies of the giant dipole resonance
Gangrskij, Y.; Tonchev, A. P.; Zuzaan, P.; Kolesnikov, N. N.; Lukashek, V. G.; Dec. 31, 1998; 19p; In Russian; In English
Report No.(s): DE99-607988; JINR-R-15-98-37; No Copyright; Avail: Department of Energy Information Bridge

The isomeric ratios in the photonuclear reactions ((gamma), p) at the energies in the region of the Giant Dipole Resonance were measured. The isotopes (sup 98)Mo, (sup 100)Ru, (sup 118)Sn, (sup 120)Sn, (sup 122)Sn were irradiated by the Bremsstrahlung of microtron. The activation method was used for measurements of reaction yields. The obtained data were compared with the ones calculated on the basis of the statistical model.
NTIS
Photonuclear Reactions; Isomers; Resonance; Nuclear Physics

20000064058 Joint Inst. for Nuclear Research, Flerov Lab. of Nuclear Reactions, Dubna, USSR
Revealing the structure peculiarities of the two-dimensional distributions of experimental observables
Pyatkov, Y.; Klyuev, I. V.; Tishchenko, V. G.; Pashkevich, V. V.; Maslov, V. A.; Dec. 31, 1998; 43p; In Russian; In English
Report No.(s): DE99-607987; JINR-R-13-98-32; No Copyright; Avail: Department of Energy Information Bridge

The methods and results of revealing the structure peculiarities of different scales in the two-dimensional distributions of experimental observables are discussed. The mass-energy distributions of fission fragments in the (sup 252)Cf and (sup 234)U nuclei are considered as an example. The approach elaborated opens up new possibilities for investigating the mechanism of nuclear fission and, in particular, the manifestation of fission modes.
NTIS
Nuclear Physics; Fine Structure

20000064118 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Expansions of Fermi and symmetrized Fermi integrals and applications in nuclear physics
Grypeos, M.; Koutroulos, C.; Luk'yanov, V.; Shebeko, A.; Dec. 31, 1998; 23p; In English
Report No.(s): DE99-608001; JINR-E-4-98-76; No Copyright; Avail: Department of Energy Information Bridge

A detailed study is undertaken, using various techniques, in deriving expansions of integrals containing the Fermi or the symmetrized Fermi distributions. The results are presented in a mathematically compact form and consist of generalizations and extensions of previously known expansions. The relevance of the results to quantities of interest in nuclear physics is recalled and particular attention is paid to the so-called exponentially small terms which may play an essential role in certain cases.
NTIS
Integrals; Integral Calculus; Series Expansion

20000064119 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Caloric curve and multifragmentation in heavy ion collisions at intermediate energies
Parvan, A. S.; Gudima, K. K.; Toneev, V. D.; Dec. 31, 1998; 27p; In Russian; In English
Report No.(s): DE99-607993; JINR-R-7-98-33; No Copyright; Avail: Department of Energy Information Bridge
Based on a canonical ensemble treatment, a unique description of multifragmentation and equation of state for isospin non-degenerated nuclear matter is constructed within a statistical model for fragmenting nuclear system. The free energy of primary fragments is defined by a liquid-drop approximation of the statistical multifragmentation model. Exact solutions for the canonical partition function of the decaying nuclear system are obtained by means of recurrent relations. For certain thermodynamic parameters this model exhibits a phase transition of the liquid-gas type. Fragment multiplicity distributions as well as temperature and volume dependence of thermodynamic quantities are calculated. The caloric curve characterizing the phase transition under question is discussed. The effective parameter (tau) of the fragment charge distributions and the average multiplicity of intermediate mass fragments are compared with appropriate experimental data from heavy ion collisions.
NTIS
Nuclear Physics; Fragmentation; Ionic Collisions; Equations of State

20000064706 Saclay Research Centre, Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee, Gif-sur-Yvette, France
Study of the effect of (sup 11)Be halo on the sub-coulombian fusion
Felou Youmbi, V.; Dec. 11, 1996; 148p; In French; In English
Report No.(s): DE99-609718; CEA-DAPNIA-SPHN-96-04T; No Copyright; Avail: Department of Energy Information Bridge
Fission cross sections of (sup 9,11)Be + (sup 238)U systems are measured in the energy range of the coulomb barrier. These measures allow the study of neutron halo effect on sub coulombian fusion. (sup 9,11)Be beams are obtained by fragmentation at the GANIL facilities. The fusion between incident particle and the target nucleus leads to a compound nucleus which disappears by fission. The FUSION detector is used to detect the fission fragments by coincidence. We present some calculations of potential barriers by using Wong formula. The nucleus-nucleus interaction is simulated by a double convolution between the nucleus density and the effective M3Y interaction. In a more realistic framework ECIS94 code calculates the fusion cross section by using a coupling formalism. Theoretical values and experimental results are compared. We get a good agreement for (sup 9)Be + (sup 238)U system and an unusual behaviour appears for (sup 11)Be + (sup 238)U system.
NTIS
Halos; Nuclear Physics; Beryllium Isotopes; Fission

20000066582 Grand Accelerator National d'Ions Lourds, Caen, France
Study of the (sup 7)Be(p, (gamma))(sup 8)B and (sup 7)Li(n, (gamma))(sup 8)Li capture reactions using the shell model embedded in the continuum
Bennaceur, K.; Ploszajczak, M.; Nowacki, F.; Okolowicz, J.; Feb. 28, 1999; 49p; In English
Report No.(s): DE99-633343; GANIL-P-99-02; No Copyright; Avail: Department of Energy Information Bridge
The realistic shell model which includes the coupling between many-particle (quasi-)bound states and the continuum of one-particle scattering states is applied to the spectroscopy of mirror nuclei: (sup 8)B and (sup 8)Li, as well as to the description of low energy cross sections (the astrophysical S factors) in the capture reactions: (sup 7)Be(p,(gamma))(sup 8)B and (sup 7)Li(n,(gamma)) (sup 8)Li.
NTIS
Lithium Isotopes; Beryllium Isotopes; Boron Isotopes; Nuclear Physics

20000066626 Grand Accelerator National d'Ions Lourds, Caen, France
Multiscale fluctuations in nuclear response
Lacroix, D.; Chomaz, P.; Jan. 31, 1999; 43p; In English
Report No.(s): DE99-633342; GANIL-P-99-01; No Copyright; Avail: Department of Energy Information Bridge

The nuclear collective response is investigated in the framework of a door way picture in which the spreading width of the collective emotion is described as a coupling to more and more complex configurations. It is shown that this coupling induces fluctuations of the observed strength. In the case of a hierarchy of overlapping decay channels, Ericson fluctuations are observed at different scales. Methods for extracting these scales and the related lifetimes are discussed. Finally, it is shown that the coupling of different states at one level of complexity to some common decay channels at the next level, may produce interference-like patterns in the nuclear response. This quantum effect leads to a new type of fluctuations with a typical width related to the level spacing.
NTIS
Nuclear Physics; Responses; Variations

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OPTICS

Includes light phenomena and the theory of optical devices. For lasers see 36 Lasers and Masers.

20000062729 NASA Goddard Space Flight Center, Greenbelt, MD USA
Overcoming Dynamic Disturbances in Imaging Systems
Young, Eric W., NASA Goddard Space Flight Center, USA; Dente, Gregory C., GCD Associates, USA; Lyon, Richard G., NASA Goddard Space Flight Center, USA; Chesters, Dennis, NASA Goddard Space Flight Center, USA; Gong, Qian, Swales Aerospace, USA; [2000]; 11p; In English; Computational Optics and Imaging, 10-12 May 2000, Greenbelt, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We develop and discuss a methodology with the potential to yield a significant reduction in complexity, cost, and risk of spaceborne optical systems in the presence of dynamic disturbances. More robust systems almost certainly will be a result as well. Many future space-based and ground-based optical systems will employ optical control systems to enhance imaging performance. The goal of the optical control subsystem is to determine the wavefront aberrations and remove them. Ideally reducing an aberrated image of the object under investigation to a sufficiently clear (usually diffraction-limited) image. Control will likely be distributed over several elements. These elements may include telescope primary segments, telescope secondary, telescope tertiary, deformable mirror(s), fine steering mirror(s), etc. The last two elements, in particular, may have to provide dynamic control. These control subsystems may become elaborate indeed. But robust system performance will require evaluation of the image quality over a substantial range and in a dynamic environment. Candidate systems for improvement in the Earth Sciences Enterprise could include next generation LANDSAT systems or atmospheric sensors for dynamic imaging of individual, severe storms. The technology developed here could have a substantial impact on the development of new systems in the Space Science Enterprise; such as the Next Generation Space Telescope(NGST) and its follow-on the Next NGST. Large Interferometric Systems of non-zero field, such as Planet Finder and Submillimeter Probe of the Evolution of Cosmic Structure, could benefit. These systems most likely will contain large, flexible optormechanical structures subject to dynamic disturbance. Furthermore, large systems for high resolution imaging of planets or the sun from space may also benefit. Tactical and Strategic Defense systems will need to image very small targets as well and could benefit from the technology developed here. We discuss a novel speckle imaging technique with the potential to separate dynamic aberrations from static aberrations. Post-processing of a set of image data, using an algorithm based on this technique, should work for all but the lowest light levels and highest frequency dynamic environments. This technique may serve to reduce the complexity of the control system and provide for robust, fault-tolerant, reduced risk operation. For a given object, a short exposure image is ”frozen” on the focal plane in the presence of the environmental disturbance (turbulence, jitter, etc.). A key factor is that this imaging data exhibits frame-to-frame linear shift invariance. Therefore, although the Point Spread Function is varying from frame to frame, the source is fixed; and each short exposure contains object spectrum data out to the diffraction limit of the imaging system. This novel speckle imaging technique uses the Knox-Thompson method. The magnitude of the complex object spectrum is straightforward to determine by well-established approaches. The phase of the complex object spectrum is decomposed into two parts. One is a single-valued function determined by the divergence of the optical phase gradient. The other is a multi-valued function determined by, the circulation of the optical phase gradient-”hidden phase.” Finite difference equations are developed for the phase. The novelty of this approach is captured in the inclusion of this ”hidden phase.” This technique allows the diffraction-limited reconstruction of the object from the ensemble of short exposure frames while simultaneously estimating the phase as a function of time from a set of exposures.
Author
Aberration; Image Resolution; Imaging Techniques; Dynamic Control; Optical Control; Spaceborne Photography; Wave Fronts

20000063497 Kaiser Electro-Optics, Inc., West Carlsbad, CA USA
Environmental Test Screening Procedure
Zeidler, Janet, Kaiser Electro-Optics, Inc., USA; Mar. 30, 2000; 10p; In English
Contract(s)/Grant(s): NAS8-98236; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This procedure describes the methods to be used for environmental stress screening (ESS) of the Lightning Mapper Sensor (LMS) lens assembly. Unless otherwise specified, the procedures shall be completed in the order listed, prior to performance of the Acceptance Test Procedure (ATP). The first unit, S/N 001, will be subjected to the Qualification Vibration Levels, while the remainder will be tested at the Operational Level. Prior to ESS, all units will undergo Pre-ESS Functional Testing that includes measuring the on-axis and plus or minus 0.95 full field Modulation Transfer Function and Back Focal Length. Next, all units will undergo ESS testing, and then Acceptance testing per PR 460.
Derived from text
Environmental Tests; Stresses; Lightning; Mapping; Detection; Lenses

20000064062 NASA Goddard Space Flight Center, Greenbelt, MD USA
Fracture Probability of MEMS Optical Devices for Space Flight Applications
Fettig, Rainer K., Raytheon ITSS, USA; Kuhn, Jonathan L., NASA Goddard Space Flight Center, USA; Moseley, S. Harvey, NASA Goddard Space Flight Center, USA; Kutyrev, Alexander S., Raytheon ITSS, USA; Orloff, Jon, Maryland Univ., USA; Jul. 14, 1999; 6p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A bending fracture test specimen design is presented for thin elements used in optical devices for space flight applications. The specimen design is insensitive to load position, avoids end effect complications, and can be used to measure strength of membranes less than 2 microns thick. The theoretical equations predicting stress at failure are presented, and a detailed finite element model is developed to validate the equations for this application. An experimental procedure using a focused ion beam machine is outlined, and results from preliminary tests of 1.9 microns thick single crystal silicon are presented. These tests are placed in the context of a methodology for the design and evaluation of mission critical devices comprised of large arrays of cells.
Author
Bending; Failure; Fracturing; Loads (Forces); Mathematical Models; Membranes; Performance Tests

20000064659 Washington State Univ., Dept. of Physics, Pullman, WA USA
Polymer Processing for All-Optical Device Fabrication ***Final Report, 1 May 1996 - 31 Aug. 1999***
Kuzyk, Mark G.; Mar. 21, 2000; 7p; In English
Contract(s)/Grant(s): F49620-96-1-0188; AF Proj. 1651
Report No.(s): AD-A376188; 11F-2464-0265; AFRL-SR-BL-TR-00-2126; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

We have achieved our research goal to study the effect of polymer processing and composition on fabricability and performance of all-optical switching devices and optical amplifier devices. In the process, we have developed a deeper understanding of the linear and nonlinear properties of materials and how they affect device performance. The 6 major efforts completed in this program include: (1) interferometric measurements of the intensity dependent refractive index in single-mode polymer optical fibers that demonstrates switching, (2) loss, scattering, fluorescence and two photon absorption measurements based on a new transverse excitation technique that was invented in our lab, (3) refractive index profiling measurement techniques developed in our lab to characterized preforms and fibers, (4) third-order susceptibility studies aimed at understanding the nonlinearity mechanisms in dye-doped polymers, (5) demonstration of dual-core single-mode fiber with nonlinear coupling (switching), and (6) demonstration of fibers with electrodes.
DTIC
Fabrication; Optical Equipment; Light Amplifiers; Optical Switching

20000066586 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Observations and Calculations of Light Scattering from Clusters of Spheres ***Final Report, Dec. 1998-Jan. 1999***
Holler, Stephen; Auger, Jean-Claude; Stout, Brian; Fan, Yongle; Bottiger, Jerold R.; Mar. 2000; 38p; In English; Prepared in cooperation with Yale Univ., New Haven, CT, New Mexico State Univ., Las Cruces, NM and Universite Pierre et Marie Curie, Paris, France.
Contract(s)/Grant(s): Proj-B53A
Report No.(s): AD-A377281; ARL-TR-2136; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two-dimensional angular optical scattering (TAOS) from clusters of polystyrene latex spheres is measured in the near-forward and near-backward directions. In both cases, the scattering pattern contains a rich and complicated structure due to the inter-

action and interference of the light among the primary particles. Calculations are made for aggregates similar to those generated experimentally that demonstrate the rich structure in the scattering pattern. A comparison of the experimental and theoretical TAOS gives good qualitative agreement.
DTIC
Light Scattering; Optical Properties; Physical Optics

20000066601 NASA Marshall Space Flight Center, Huntsville, AL USA
Multi-Use Space Optics Test Facility
Reily, Jack C., NASA Marshall Space Flight Center, USA; Kegley, Jeff, NASA Marshall Space Flight Center, USA; Keidel, John, NASA Marshall Space Flight Center, USA; Siler, Richard, NASA Marshall Space Flight Center, USA; Wright, Ernie, NASA Marshall Space Flight Center, USA; Jacobson, David, NASA Marshall Space Flight Center, USA; Smith, Scott, NASA Marshall Space Flight Center, USA; Eng, Ron, NASA Marshall Space Flight Center, USA; Stahl, Phil, NASA Marshall Space Flight Center, USA; [2000]; 2p; In English; Optical, 18-23 Jun. 2000, Quebec, Canada; Sponsored by Optical Society of America, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Marshall Space Flight Center has modified the X-ray Calibration Facility to test Next Generation Space Telescope developmental mirrors at cryogenic temperatures (35 degrees Kelvin) while maintaining capability for performance testing of x-ray optics and detectors. Marshall Space Flight Center (MSFC) has maintained and operated a world-class x-ray optics and detector testing facility since mid 1970. The ground test and calibration of the Chandra (previously AXAF) X-ray Observatory required extensive modifications to the X-ray Calibration Facility (XRCF). X-ray optical performance testing of the Chandra optics and detectors was successfully completed at the XRCF in 1997. The development phase for the Next Generation Space Telescope (NGST) program and the establishment of the Space Optics Manufacturing Technology Center at MSFC led to additional modifications to the XRCF to accommodate optical testing at cryogenic temperatures. NGST supported efforts include the Sub-Scale Beryllium Mirror Demonstrator (SBMD) and the NGST Mirror System Demonstrator (NMSD) programs. In addition, the Advanced Mirror System Demonstrator (AMSD) program will use the cryogenic test facility for mirror performance testing in 2001. In 1999 the facility was upgraded to perform cryogenic testing of lightweight visible optics, without compromising the existing x-ray testing capability. A thermal enclosure capable of 20 degrees Kelvin and a vibration isolated instrumentation mount were added. A vacuum-compatible five-axis motion table was modified to operate under cryogenic conditions in order to provide mirror steering under test conditions. This new cryogenic test facility will accommodate optics up to two meters in diameter, with radii of curvature of up to twenty meters. Several facility characterization tests and three NGST program mirror tests have been conducted at cryogenic temperatures to date. Data from these cryogenic tests will allow the development teams to perform final polishing operations on the mirrors, based on optical figure data collected at a temperature of 35 degrees Kelvin. Optical wavefront measurements were made at 35 degrees Kelvin with several instruments located at the radius of curvature of the mirror. The current wavefront measuring instruments include a Shack-Hartman wavefront sensor as the main instrument, a Point Diffraction Interferometer (PDI), a Point Spread Function (PSF) imager, and a radius of curvature measuring instrument. Planned enhancements to this system include the addition of a vibration insensitive phase shifting interferometer.
Author
Performance Tests; Test Facilities; X Ray Optics; Space Manufacturing; Calibrating; Next Generation Space Telescope Project; Optical Equipment

20000067645 NASA Marshall Space Flight Center, Huntsville, AL USA
Characterization of X-Ray Diffraction System with a Microfocus X-Ray Source and a Polycapillary Optic
Gubarev, Mikhail, NASA Marshall Space Flight Center, USA; Marshall, Joy K., NASA Marshall Space Flight Center, USA; Ciszak, Ewa, NASA Marshall Space Flight Center, USA; Ponomarev, Igor, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 49th; 49th Annual Denver X-Ray Conference, 31 Jul. - 4 Aug. 2000, Denver, CO, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We present here an optimized microfocus x-ray source and polycapillary optic system designed for diffraction of small protein crystals. The x-ray beam is formed by a 5.5mm focal length capillary collimator coupled with a 40 micron x-ray source operating at 46Watts. Measurements of the x-ray flux, the divergence and the spectral characteristics of the beam are presented, This optimized system provides a seven fold greater flux than our recently reported configuration [M. Gubarev, et al., J. of Applied Crystallography (2000) 33, in press]. We now make a comparison with a 5kWatts rotating anode generator (Rigaku) coupled with confocal multilayer focusing mirrors (Osmic, CMF12- 38Cu6). The microfocus x-ray source and polycapillary collimator system

delivers 60% of the x-ray flux from the rotating anode system. Additional ways to improve our microfocus x-ray system, and thus increase the x-ray flux will be discussed.
Author
X Ray Diffraction; X Ray Sources; X Rays; Crystals; Proteins

20000067679 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Recent Trends in the Analysis of Quasioptical Systems
Hoppe, D. J., Jet Propulsion Lab., California Inst. of Tech., USA; Imbriale, W. A., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The recent trend in microwave instruments is the use of multiple millimeter and submillimeter wavelength bands. These systems are typically analyzed by using physical optics, Gaussian beams or ray tracing techniques. Physical optics offers high accuracy at the expense of computation time. This trade-off becomes particularly apparent in the analysis of multiple reflector antennas, such as beam waveguide antennas, where physical optics is used to compute the current on each reflector from the current on the previous reflector. At the other end of the spectrum is ray tracing approaches that ignore diffraction effects entirely. These methods are fast but sacrifice the ability to predict some effects accurately. An intermediate approach is to use an appropriate set of expansion functions to model the field between the reflectors. If the set is chosen wisely only a few coefficients need to be determined from each reflector current. The field is then computed at the next reflector through the use of the expansion functions and their coefficients rather than by using the previous reflector current. For a beam waveguide system with no enclosing tubes an excellent set of expansion functions is the Gaussian beam mode set. In many cases a preliminary design which includes the effects on diffraction may be obtained by considering only the fundamental mode and a thin lens model for the reflectors. Higher-order modes are included to model the effects of the curved reflector, which include asymmetric distortion of the beam, cross polarization, and beam truncation. This paper describes a computer code implementing higher-order Gaussian beam scattering by multiple reflector systems. There are four essential steps in the algorithm. (1) Compute the current on the first reflector using physical optics using either a feed model or by an incident set of Gaussian beam modes. (2) Find the direction of propagation for the reflected Gaussian beam-set using ray tracing. (3) Determine the waist size and location for the output beam set by examining the amplitude and phase distribution of the current on the reflector. (4) Compute the amplitudes of the individual modes in the output mode set. These steps are then repeated for each addition reflector in the chain. In each of these cases the previous Gaussian beam set provides the input field for the current calculation. Details of the four steps discussed above will be discussed. Examples will compare results from the Gaussian beam approach to pure physical optics, illustrating both its merits and limitations. Hybrid approaches capable of eliminating some of the limitations will also be discussed.
Author
Microwave Sensors; Submillimeter Waves; Beam Waveguides; Ray Tracing; Physical Optics

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PLASMA PHYSICS

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

20000062453 Wisconsin Univ., Dept. of Physics, Madison, WI USA
Dynamo and anomalous transport in the reversed field pinch
Prager, S. C.; Aug. 31, 1998; 31p; In English; 25th; controlled fusion and plasma physics; Sponsored by European Physical Society, Switzerland
Report No.(s): DE99-000800; No Copyright; Avail: Department of Energy Information Bridge

The reversed field pinch is an effective tool to study the macroscopic consequences of magnetic fluctuations, such as the dynamo effect and anomalous transport. Several explanations exist for the dynamo (the self-generation of plasma current)--the MHD dynamo, the kinetic dynamo, and the diamagnetic dynamo. There is some experimental evidence for each, particularly from measurements of ion velocity and electron pressure fluctuations. Magnetic fluctuations are known to produce energy and particle flux in the RFP core. Current profile control is able to decrease fluctuation-induced transport by a factor of five. Improved confinement regimes are also obtained at deep reversal and, possibly, with flow shear.
NTIS
Plasma Physics; Reverse Field Pinch; Radiation Transport

20000063524 Compton Research and Development Labs., Inc., Staten Island, NY USA

Self-Field-Dominated Plasma ***Final Report, 1 Apr. 1995 - 31 Mar. 1998***

Nardi, V.; Brzosko, J. S.; Powell, C.; Mar. 31, 1998; 20p; In English

Contract(s)/Grant(s): F49620-95-1-0271; AF Proj. 2301

Report No.(s): AD-A376917; AFRL-SR-BL-TR-00-0167; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This research effort addresses the production process of ion clusters with binding energy per ion as low as = 2.78 eV from a plasma source characterized by high energy density (kJ/cu cm, i.e., 0.2 keV/particle) and electron temperatures T(e) 0.4 keV. Particle-flow and magnetic structure of the plasma current sheath affect the emission of ion clusters and superclusters in plasma focus discharges. Part of the tests summarized here address methods and means for achieving controlled variations of the current sheath (CS) structure via electrode geometry modifications. CS parameters are monitored with multiple magnetic probes in the case of cylindrical - and open-funnel electrode geometry.

DTIC

Electron Energy; Ions; Magnetic Probes; Plasma Currents; Plasma Focus; Plasmas (Physics)

20000064707 Risoe National Lab., Optics and Fluid Dynamics Dept., Roskilde, Denmark

Flow speed measurement using two-point collective light scattering

Heinemeier, N.; Sep. 30, 1998; 144p; In English

Report No.(s): DE99-609083; RISO-R-1064(EN); ISBN 87-550-2413-0; No Copyright; Avail: Department of Energy Information Bridge

Measurements of turbulence in plasmas and fluids using the technique of collective light scattering have always been plagued by very poor spatial resolution. In 1994, a novel two-point collective light scattering system for the measurement of transport in a fusion plasma was proposed. This diagnostic method was design for a great improvement of the spatial resolution, without sacrificing accuracy in the velocity measurement. The system was installed at the W7-AS steallartor in Garching, Germany, in 1996, and has been operating since. This master thesis is an investigation of the possible application of this new method to the measurement of flow speeds in normal fluids, in particular air, although the results presented in this work have significance for the plasma measurements as well. The main goal of the project was the experimental verification of previous theoretical predictions. However, the theoretical considerations presented in the thesis show that the method can only be hoped to work for flows that are almost laminar and shearless, which makes it of very small practical interest. Furthermore, this result also implies that the diagnostic at W7-AS cannot be expected to give the results originally hoped for.

NTIS

Flow Measurement; Velocity Measurement

20000065670 Texas Univ., Inst. for Fusion Studies, Austin, TX USA

Nonlinear theory of kinetic instabilities near threshold

Berk, H. L.; Pekker, M. S.; Breizman, B. N.; May 31, 1997; 31p; In English

Report No.(s): DE97-008140; DOE/ER/54346-787; IFSR-787; No Copyright; Avail: Department of Energy Information Bridge

A new nonlinear equation has been derived and solved for the evolution of an unstable collective mode in a kinetic system close to the threshold of linear instability. The resonant particle response produces the dominant nonlinearity, which can be calculated iteratively in the near-threshold regime as long as the mode does not trap resonant particles. With sources and classical relaxation processes included, the theory describes both soft nonlinear regimes, where the mode saturation level is proportional to an increment above threshold, and explosive nonlinear regimes, where the mode grows to a level that is independent of the closeness to threshold. The explosive solutions exhibit mode frequency shifting. For modes that exist in the absence of energetic particles, the frequency shift is both upward and downward. For modes that require energetic particles for their existence, there is a preferred direction of the frequency shift. The frequency shift continues even after the mode traps resonant particles.

NTIS

Nonlinear Equations; Kinetics

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SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

20000061972 NASA Lewis Research Center, Cleveland, OH USA
Evanescent Microwave Probes Using Coplanar Waveguide and Stripline for Super-Resolution Imaging of Materials
Ponchak, G. E., NASA Lewis Research Center, USA; Akinwande, D., Case Western Reserve Univ., USA; Ciocan, R., Case Western Reserve Univ., USA; LeClair, S. R., Air Force Research Lab., USA; Tabib-Azar, M., Case Western Reserve Univ., USA; [2000]; 4p; In English; Microwave, 13-19 Jun. 1999, Anaheim, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): RTOP 632-68-51; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

An evanescent field microwave imaging probe based on half-wavelength, microwave transmission line resonators is described. Optimization of the probe tip design, the coupling gap, and the data analysis has resulted in images of metal lines on semiconductor substrates with 2.6 microns spatial resolution and a minimum detectable line width of 0.4 microns at 1 GHz.
Author
Microwave Probes; Evanescence; Microwave Imagery; Imaging Techniques

20000062718 Joint Inst. for Nuclear Research, Frank Lab. of Neutron Physics, Dubna, USSR
DMSO-induced dehydration of DPPC membranes studied by x-ray diffraction, small angle neutron scattering and calorimetry
Kiselev, M. A.; Kiselev, A. M.; Lesieur, P.; Grabielle-Madelmond, C.; Ollivon, M.; Dec. 31, 1998; 15p; In English
Report No.(s): DE99-607970; JINR-E-14-98-91; No Copyright; Avail: Department of Energy Information Bridge

The properties of dimethyl sulfoxide (DMSO), a cryoprotector well known for its biological and therapeutic applications, were investigated on lipid membranes by x-ray diffraction, differential scanning calorimetry (DSC) and small angle neutron scattering (SANS). The DSC study of water freezing and melting of ice was performed in the ternary system which consists of 1,2-dipalmitoyl-sn-glycero- 3-phosphatidylcholine (DPPC)/DMSO/water system. The influence of DMSO on the DPPC membrane structure was established in the excess of solvent in the region of DMSO mole fraction from 0.0 to 1.0. The methods applied demonstrated the differences in the membrane structure in three sub- regions of DMSO mole fraction (X(sub DMSO)) from 0.0 to 0.3 for the first, from 0.3 to 0.9 for the second, and from 0.9 to 1.0 for the third sub-region. The results for 0.0 (<=) X(sub DMSO) (<=) 0.3 can be explained in the framework of DMSO-induced dehydration of intermembrane space.
NTIS
Sulfur Oxides; Dehydration; Membrane Structures; Methyl Compounds

20000062719 Joint Inst. for Nuclear Research, Frank Lab. of Neutron Physics, Dubna, USSR
Microscopic phase separation in La2CuO(4+x) induced by the superconducting transition
Pomyakushin, V.; Balagurov, A. M.; Zakharov, A. A.; Dec. 31, 1998; 11p; In English
Report No.(s): DE99-607969; JINR-E-14-98-10; No Copyright; Avail: Department of Energy Information Bridge

The phase separation (PS) effect in superconducting La2CuO(4+x) (x (<=) 0.04) single crystals with low oxygen mobility was studied via (mu) SR spectroscopy, high resolution neutron diffraction and magnetic susceptibility. Despite the fact that all crystals are inside the miscibility gap (0.01 < x < 0.06), only crystals with a sufficiently large excess oxygen concentration x (>=) 0.04 show a macroscopic phase separation according to the neutron diffraction data. However, in all samples a phase transition to an ordered magnetic state was observed by (mu)SR spectroscopy concomitantly with the onset of superconductivity. This unexpected behaviour suggests that the underlying microscopic PS is driven by superconductivity.
NTIS
Phase Separation (Materials); Lanthanum Oxides; Cuprates

20000062854 NASA Glenn Research Center, Cleveland, OH USA
Device Physics Analysis of Parasitic Conduction Band Barrier Formation in SiGe HBTs
Roenker, K. P., Cincinnati Univ., USA; Alterovitz, S. A., NASA Glenn Research Center, USA; [2000]; 4p; In English; 2; Silicon Monolithic Integrated Circuits in RF Systems, 26-28 Apr. 2000, Garmisch, Germany; Sponsored by Massachusetts Inst. of Tech., USA
Contract(s)/Grant(s): RTOP 632-50-5D; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper presents a physics-based model describing the current-induced formation of a parasitic barrier in the conduction band at the base collector heterojunction in npn SiGe heterojunction bipolar transistors (HBTs). Due to the valence band discontinuity DELTA E(sub v), hole injection into the collector at the onset of base pushout is impeded, which gives rise to formation of a barrier to electron transport which degrades the device's high frequency performance. In this paper, we present results from an analytical model for the height of the barrier calculated from the device's structure as a function of the collector junction bias and collector current density.
Author
Bipolar Transistors; Conduction Bands; Heterojunctions; Silicon; Germanium; Electrophysics; Semiconductor Devices; Barrier Layers

20000063515 National Inst. of Standards and Technology, Electronics and Electrical Engineering Lab., Gaithersburg, MD USA
NIST Electronics and Electrical Engineering Laboratory and the Development of Its Semiconductor Program: A Presentation to the Standards Alumni Association
French, J. C.; Feb. 1999; 58p
Report No.(s): PB2000-105433; NISTIR-6507; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The report is a Presentation to the Standards Alumni Association by Judson C. French, Director, Electronics and Electrical Engineering Laboratory (EEEL). EEEL's formal mission is to promote U.S. economic growth through improved competitiveness, by providing measurement capability of high economic impact focused primarily on the needs of U.S. electronics and electrical equipment industries. EEEL does this by providing measurement research and services, principally in the authors' five technical divisions. It covers in the Electricity Division the provision of the Nation's basic, primary electrical standards, and support for electronic instrumentation, the electrical utilities, video technologies and electronic product data exchange, and, covers in the other divisions, semiconductor electronics, radio-frequency and microwave and millimeter wave signals and interference, superconductors, magnetics, and optoelectronics.
NTIS
Electrical Engineering; Semiconductors (Materials); Superconductors (Materials); Product Development

20000064047 Georgia Inst. of Tech., Atlanta, GA USA
Process Characterization of Non-Stoichiometric Material Growth ***Final Report, 1 Jun. 1996 - 31 May 1999***
Brown, April S.; May, Gary; May 1999; 12p; In English
Contract(s)/Grant(s): F49620-96-1-0197
Report No.(s): AD-A376202; FR-3; AFRL-SR-BL-TR-00-0119; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
This project addresses characterization of the Molecular Beam Epitaxy (MBE) process utilizing a Statistical Experiment Design (SED) approach and then building models. This approach is applied to GaAs-based materials, InP-based materials, and GaN-based materials, and to non-stoichiometric Be-doping InGaAs materials. The model responses are related to known physical effects for the growth of these materials. In addition, new phenomena are uncovered.
DTIC
Molecular Beam Epitaxy; Experiment Design

20000064117 Joint Inst. for Nuclear Research, Frank Lab. of Neutron Physics, Dubna, USSR
Twinned structure of La2CuO4 crystals
Balagurov, A. M.; Beskrovnyj, A. I.; Pomyakushin, V.; Simkin, V. G.; Bagautdinov, B.; Dec. 31, 1998; 19p; In Russian; In English
Report No.(s): DE99-608002; JINR-R-14-98-9; No Copyright; Avail: Department of Energy Information Bridge
The twin microstructure of La2CuO(4+(delta)) superconducting crystals with (delta) from 0.02 to 0.04 has been studied by neutron and x-ray scanning of reciprocal space as well as by high resolution neutron diffraction. The studied crystals belonged to two different types with respect to the oxygen mobility: with and without macroscopic phase separation. It has been shown that for both types of crystals the twinning is accompanied by arising of practically the same systems of domains (transformational twins). Configuration of the domains is so, that the boundaries between them are mainly coherent. In the macroscopically phase separated La2CuO(4+(delta)) crystals the volume of distorted and tense areas is most probably small, that would be the factor, which furthers to oxygen diffusion.
NTIS
Twinning; Crystal Lattices; Microstructure; Crystal Structure

20000064660 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Acoustic phonon generation in a superlattice under the hopping perpendicular transport
Glavin, B. A.; Linnik, T. L.; Kochelap, V. A.; Sep. 30, 1998; 20p; In English
Report No.(s): DE99-609736; IC-98/135; No Copyright; Avail: Department of Energy Information Bridge

In this work we consider the theory of sound amplification under the hopping perpendicular transport in a semiconductor superlattice. It is shown that phonons propagating close to the axis of superlattice demonstrate high values of the increment, exceeding the rates of phonon scattering on natural isotopes. Effects, restricting the value of increment, including the current induced heating of electrons, are discussed. Influence of the phonon spectrum modification in superlattice on the value of increment is examined.
NTIS
Phonons; Superlattices

20000064724 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA
Solid State Research *Quarterly Report, 1 Aug.-31 Oct. 1999*
Shaver, David C.; Apr. 20, 2000; 69p; In English
Contract(s)/Grant(s): F19628-95-C-0002
Report No.(s): AD-A377032; 1999:4; ESC*-TR-99-060; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report covers in detail the research work of the Solid State Division at Lincoln Laboratory for the period 1 August through 31 October 1999. The topics covered are Quantum Electronics, Electro-optical Materials and Devices, Submicrometer Technology, Biosensor and Molecular Technologies, Advanced Imaging Technology, Analog Device Technology, and Advanced Silicon Technology. Funding is provided by several DoD organizations-including the Air Force, Army, BMDO, DARPA, Navy, NSA, and OSD-and also by the DOE, NASA, and NIST.
DTIC
Solid State Devices; Quantum Electronics; Optoelectronic Devices; Bioinstrumentation

20000065621 Universities Space Research Association, Huntsville, AL USA
Protein Crystals Grow Purer in Space: Physics of Phenomena
Chernov, Alex A., Universities Space Research Association, USA; [2000]; 3p; In English; 1st; Microgravity Research and Applications in Physical Science and Biotechnology, 10 Sep. 2000, Sorrento, Italy; Original contains color illustrations
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This presentation will summarize the quantitative experimental and theoretical results obtained by B.R. Thomas, P.G. Vekilov, D.C. Carter, A.M. Holmes, W.K. Widierow and the Author, the team with expertise in physics, biochemistry, crystallography and engineering. Impurities inhomogeneously trapped by a growing crystal - e.g., producing sectorial structure and/or striations - may induce macroscopic internal stress in it if an impurity molecule has slightly (less than 10%) different shape or volume than the regular one(s) they replace. We tested for the first time plasticity and measured Young modulus E of the triclinic, not cross-linked lysozyme by triple point bending technique. Triclinic lysozyme crystals are purely elastic with E similar or equal to 1/5 (raised dot) 10 (exp 9) partial derivative yn/sq cm. The strength limit, sigma (sub c) similar or equal to 10 (exp -3)E similar or equal to Epsilon (sub c), where sigma (sub c) and epsilon (sub c) are critical stress and strain, respectively. Scaling E and sigma (sub c) with the lattice spacing suggests similar binding stiffness in inorganic and biomolecular crystals. The inhomogeneous internal stress may be resolved in these brittle crystals either by cracking or by creation of misoriented mosaic blocks during, not after growth. If each impurity molecule induces in the lattice elementary strain epsilon (sub 0) similar or equal to 3 (raised dot) 10 (exp -2) (this is maximal elementary strain that can arise at the supersaturation DELTA mu/kT similar or equal to 2 and macroscopic molecular concentration difference between subsequent macrolayers or growth sectors is partial derivativeC similar or equal to 5 (raised dot) 10 (exp -3), the internal strain epsilon similar or equal to epsilon (sub 0) partial derivative C similar or equal to 10 (exp -4). Mosaic misorientation resolving such strain is approximately 30 arcsec. Tenfold increase of impurity concentration may cause cracking. Estimates of stress in an isometric sectorial crystal show that lysozyme crystals can tolerate the stress till the size of 0.5mm. Dissolving mosaic lysozyme crystal shows that the mosaicity, indeed, is absent below that size.
Derived from text
Crystallography; Proteins; Crystal Growth; Mathematical Models; Physics

20000067636 NASA Marshall Space Flight Center, Huntsville, AL USA
Macromolecule Crystal Quality Improvement in Microgravity: The Role of Impurities
Judge, Russell A., NASA Marshall Space Flight Center, USA; Snell, Edward H., NASA Marshall Space Flight Center, USA; Pusey, Marc L., NASA Marshall Space Flight Center, USA; Sportiello, Michael G., Colorado Univ., USA; Todd, Paul, Colorado

Univ., USA; Bellamy, Henry, Stanford Synchrotron Radiation Lab., USA; Borgstahl, Gloria E., Toledo Univ., USA; Pokros, Matt, Toledo Univ., USA; Cassanto, John M., Instrumentation Technology Associates, Inc., USA; [2000]; 1p; In English; ACA Annual Meeting, 23 Jul. 2000, Saint Paul, MN, USA; No Copyright; Avail: Issuing Activity; Abstract Only

While macromolecule impurities may affect crystal size and morphology the over-riding question is; ”How do macromolecule impurities effect crystal X-ray quality and diffraction resolution?” In the case of chicken egg white lysozyme, crystals can be grown in the presence of a number of impurities without affecting diffraction resolution. One impurity however, the lysozyme dimer, does negatively impact the X-ray crystal properties. Crystal quality improvement as a result of better partitioning of this impurity during crystallization in microgravity has been reported’. In our recent experimental work dimer partitioning was found to be not significantly different between the two environments. Mosaicity analysis of pure crystals showed a reduced mosaicity and increased signal to noise for the microgravity grown crystals. Dimer incorporation however, did greatly reduce the resolution limit in both ground and microgravity grown crystals. These results indicate that impurity effects in microgravity are complex and may rely on the conditions or techniques employed.
Author

Macromolecules; Impurities; Microgravity; Crystallization; Impact Strength

20000067642 Universities Space Research Association, Huntsville, AL USA

Direct Visualization of an Impurity Depletion Zone

Chernov, Alex A., Universities Space Research Association, USA; Garcia-Ruiz, Juan Ma, Granada Univ., Spain; Thomas, Bill R., Universities Space Research Association, USA; [2000]; 1p; In English, 26 Aug. 2000, Nancy, France; Original contains color illustration

Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

When a crystal incorporates more impurity per unit of its volume than the impurity concentration in solution, the solution in vicinity of the growing crystal is depleted with respect to the impurity I,2. With a stagnant solution, e. g. in microgravity or gels, an impurity depletion zone expands as the crystal grows and results in greater purity in most of the outer portion of the crystal than in the core. Crystallization in gel provides an opportunity to mimic microgravity conditions and visualize the impurity depletion zone. Colorless, transparent apoferritin (M congruent to 450 KDa) crystals were grown in the presence of red holoferritin dimer as a microheterogeneous impurity (M congruent to 900 KDa) within agarose gel by counterdiffusion with Cd(2+) precipitant. Preferential trapping of dimers, (distribution coefficient K = 4 (exp 1,2)) results in weaker red color around the crystals grown in the left tube in the figure as compared to the control middle tube without crystals. The left and the middle tubes contain colored ferritin dimers, the right tube contains colored trimers. The meniscus in the left tube separate gel (below) and liquid solution containing Cd(2+) (above). Similar solutions, though without precipitants, were present on top of the middle and right tube allowing diffusion of dimers and trimers. The area of weaker color intensity around crystals directly demonstrates overlapped impurity depletion zones.
Author

Depletion; Impurities; Crystallization; Microgravity

20000067647 NASA Marshall Space Flight Center, Huntsville, AL USA

Substrate Preparations in Epitaxial ZnO Film Growth

Zhu, Shen, Universities Space Research Association, USA; Su, C.-H., NASA Marshall Space Flight Center, USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; Harris, M. T., Air Force Research Lab., USA; Callahan, M. J., Air Force Research Lab., USA; George, M. A., Alabama Univ., USA; [2000]; 1p; In English; 12th; Crystal Growth and Epitaxy, 13-18 Aug. 2000, Vail, CO, USA

Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

Epitaxial ZnO films were grown on the two polar surfaces (O-face and Zn-face) of (0001) ZnO single crystal substrates using off-axis magnetron sputtering deposition. Annealing-temperature dependence of ZnO substrates was studied. ZnO films grown on sapphire substrates have also been investigated for comparison purposes and the annealing temperature of A1203 substrates is 1000 C. Substrates and films were characterized using photoluminescence (PL) spectrum, x-ray diffraction, atomic force microscope, energy dispersive spectrum, and electric transport measurements. It has been found that the ZnO film properties were different when films were grown on the two polarity surfaces of ZnO substrates and the A1203 substrates. An interesting result shows that high temperature annealing of ZnO single crystals will improve the surface structure on the O-face surface rather than the opposite surface. The measurements of homoepitaxial ZnO films indicate that the O-terminated surface is better for ZnO epitaxial film growth.
Author

Epitaxy; Substrates; Zinc Oxides; Metal Films; Single Crystals

20000067648 NASA Marshall Space Flight Center, Huntsville, AL USA

Mechanisms for the Crystallization of ZBLAN

Ethridge, Edwin C., NASA Marshall Space Flight Center, USA; Tucker, Dennis S., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Microgravity Materials, 8 Jun. 2000, Huntsville, AL, USA; Sponsored by NASA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A number of research teams have observed that glass forming melts that are solidified in low-g exhibit enhanced glass formation. This project will examine one of these glasses, the heavy metal fluoride glass ZBLAN. A four year ground based research program has been approved to examine the crystallization of ZBLAN glasses with the purpose of testing a theory for the crystallization of ZBLAN glass. The theory could explain the general observations of enhanced glass formation of other glasses melted and solidified in low-g. Fluid flow in 1-g results from buoyancy forces and surface tension driven convection. This fluid flow can introduce shear in undercooled liquids in 1-g. In low-g it is known that fluid flows are greatly reduced so that the shear rate in fluids in low-g are extremely low. It is believed that fluids may have some weak structure in the absence of flow. Even very small shear rates could cause this structure to collapse in response to the shear. A general result would be shear thinning of the fluid. The hypothesis of this research is that: Shear thinning in undercooled liquids increases the rate of nucleation and crystallization of glass forming melts. Shear of the melt can be reduced in low-g enhancing undercooling and glass formation. Samples will be melted and quenched in 1-g under quiescent conditions at a number of controlled cooling rates to determine times and temperatures of crystallization and heated at controlled heating rates to determine kinetic crystallization parameters. Experiments will also be performed on the materials while under controlled vibration conditions and compared with the quiescent experiments in order to evaluate the effect of shear in the liquid on crystallization kinetics. After the experimental parameters are well known, experiments will be repeated under low-g (and 2-g) conditions on the KC-135 aircraft during low-g parabolic maneuvers. The results will determine the effects of shear on crystallization. Our experimental setups will be designed with low-g experiments in mind and will be tested as breadboard low-g experiments. It is very likely that the thermal analysis instrumentation can be adapted to be run in the microgravity glovebox facilities. Critical space experiments may result to test the theory at longer low-g time experiments in space.

Author

Crystallization; Glass; Metal Fluorides; Melts (Crystal Growth)

77
PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also 72 Atomic and Molecular Physics, 73 Nuclear Physics, and 25 Inorganic, Organic and Physical Chemistry.

20000062449 Forschungszentrum Rossendorf e.V., Dresden, Germany

Kaons in nuclear matter

Kolomeitsev, E. E.; Feb. 28, 1997; 170p; In German; In English

Report No.(s): DE99-715823; FZR-167; No Copyright; Avail: Department of Energy Information Bridge

The subject of the doctoral thesis is examination of the properties of kaons in nuclear matter. A specific method is explained that has been developed for the scientific objectives of the thesis and permits description of the kaon- nucleon interactions and kaon-nucleon scattering in a vacuum. The main challenge involved was to find approaches that would enable application of the derived relations out of the kaon mass shell, connected with the second objective, namely to possibly find methods which are independent of models. The way chosen to achieve this goal relied on application of reduction formulas as well as current algebra relations and the PCAC hypothesis.

NTIS

Kaons; Matter (Physics); Nucleons

20000062715 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR

Is the Casimir effect relevant to sonoluminescence

Nesterenko, V. V.; Pirozhenko, I.; Dec. 31, 1998; 12p; In English

Report No.(s): DE99-607974; JINR-E-2-98-40; No Copyright; Avail: Department of Energy Information Bridge

The Casimir energy of a solid ball (or cavity in an infinite medium) is calculated by a direct frequency summation using the contour integration. The dispersion is taken into account, and the divergences are removed by making use of the zeta function technique. The Casimir energy of a dielectric ball (or cavity) turns out to be positive, it being increased when the radius of the ball decreases. The latter eliminates completely the possibility of explaining, via the Casimir effect, the sonoluminescence for

bubbles in a liquid. Besides, the Casimir energy of the air bubbles in water proves to be immensely smaller than the amount of the energy emitted in a sonoluminescent flash. The dispersive effect is shown to be inessential for the final result.
NTIS
Sonoluminescence; Cavities

20000064055 Joint Inst. for Nuclear Research, Lab. of Particle Physics, Dubna, USSR
Superposition of neutrino eigenstates and Dirac-Majorana oscillation
Zajmidoroga, O.; Dec. 31, 1998; 15p; In Russian; In English
Report No.(s): DE99-607991; JINR-R-2-98-36; No Copyright; Avail: Department of Energy Information Bridge
The mixing matrix structure and evolution of eigenstates of neutrino provide the evidence in the existence of the superposition states of left- handed neutrino and right-handed antineutrino. These new states of neutrino have the properties of Majorana neutrino and have no well-defined lepton number. The physical perspectives to measure the Dirac-Majorana oscillation and the comparison with experimental data are presented.
NTIS
Neutrinos; Eigenvectors; Oscillations; Dirac Equation

20000064662 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Supersymmetric sine algebra and degeneracy of Landau levels
Jellal, A.; Daoud, M.; Hassouni, Y.; Sep. 30, 1998; 11p; In English
Report No.(s): DE99-609738; IC-98/143; No Copyright; Avail: Department of Energy Information Bridge
Two different realizations of the supersymmetric sine algebra (SSA) are given. We show that the quantum superalgebra sl(sub q)(2/1) is derived from the SSA. We discuss the relevance of the latter result to the study of spin-1/2 Bloch electron in a constant magnetic field. The relation between the deformation parameter q and the degeneracy of Landau levels is established.
NTIS
Supersymmetry; Sine Series; Landau Factor

20000064701 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Discrete symmetry breaking and restoration at finite temperature in 3D Gross-Neveu model
Zhou Bang-rong,; Aug. 31, 1998; 9p; In English
Report No.(s): DE99-609735; IC-98/114; No Copyright; Avail: Department of Energy Information Bridge
Dynamical spontaneous breaking of some discrete symmetries including special parities and time reversal and their restoration at finite temperature T are researched by means of the real-time thermal field theory in 3D Gross- Neveu model. When (Lambda)/m(0), the ratio between the momentum cut-off and the dynamical fermion mass at T=0 is very large, the equation of critical chemical potential (mu)(sub c) and critical temperature T(sub c) will be (Lambda)- independent and identical to the one obtained by auxiliary scalar field approach in 1/N expansion. The dynamical fermion mass m(identical-to)m(T,(mu)), as the order parameter of symmetry breakings, is indicated to have the same (T(sub c)-T)(sup 1/2) behavior at T is less than or approx. T(sub c) as the one in 4D NJL-model and it shows the second-order phase transition feature of the symmetry restoration at T>T(sub c). It is also proven that no scalar bound state could exist in this model.
NTIS
Discrete Functions; Broken Symmetry; Restoration

20000064702 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Nambu-Goldstone mechanism in real-time thermal field theory
Zhou Bangrong,; Aug. 31, 1998; 13p; In English
Report No.(s): DE99-609734; IC-98/113; No Copyright; Avail: Department of Energy Information Bridge
In a one-generation fermion condensate scheme of electroweak symmetry breaking, it is proven that at finite temperature T below the symmetry restoration temperature T(sub c), a massive Higgs boson and three massless Nambu-Goldstone bosons could emerge from the spontaneous breaking of electroweak group SU(sub L)(2)xU(sub Y)(1)(yields)U(sub Q)(1) if the two fermion flavors in the one generation are mass-degenerate, thus the Goldstone Theorem is rigorously valid in this case. However, if the two fermion flavors have unequal masses, owing to 'thermal fluctuation', the Goldstone Theorem will be true only approximately for a very large momentum cut-off (Lambda) in zero temperature fermion loop or for low energy scales. All possible pinch singularities are proven to cancel each other, as is expected in a real-time thermal field theory.
NTIS
Real Time Operation; Field Theory (Physics)

20000064703 Institute of Atomic Energy, Otwock-Swierk, Poland

Thermodynamic functions for a model antiferromagnet with identical coupling between all spins

Al-Wahsh, H.; Urban, M.; Czachor, A.; Dec. 31, 1997; 26p; In English

Report No.(s): DE99-609732; IAE-27/A; No Copyright; Avail: Department of Energy Information Bridge

A model antiferromagnet consisting of N spins S=1/2, all interacting among themselves with equal strength, and with the external magnetic field H, was analysed, both for Ising spins and vector spins. Starting from the Hamiltonian, the partition function, specific heat and magnetic susceptibility vs temperature T have been calculated for both systems, for finite N (with the inter-spin coupling I < 0) and for N (yields)(infinity) (with the coupling I/N < 0). For finite N one finds several relations between the features of the energy levels and the calculated plots, related especially to the number of spins being odd or even. The 1/(NT) behavior of the susceptibility at T(yields) 0 for odd N has been interpreted as due to the occurrence of a single frustrated spin pushing the whole system to behave like the free spin in the external magnetic field. For N(yields)(infinity) (thermodynamic limit) the Kac procedure has been extended to include the effect of magnetic field, both for Ising spins and the vector spins. As compared with the ferromagnetic case, the evaluation of the partition function and related functions is in the case of antiferromagnetic coupling (I < 0) relatively straightforward. We have found the specific heat (per one spin) vs T at finite magnetic field to be proportional to the squared field, turning to zero at the absence of the field. The magnetic susceptibility (per one spin) shows a regular behavior of the paramagnetic type at all temperatures.

NTIS

Thermodynamics; Antiferromagnetism

20000064705 Saclay Research Centre, Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee, Gif-sur-Yvette, France

Measurement of the branching ratio of the long lived neutral kaon decay into a muon pair and a photon, and development of a trigger system in the NA48 experiment at CERN

Schanne, S.; Oct. 24, 1997; 234p; In French; In English

Report No.(s): DE99-609719; CEA-DAPNIA-SPP-97-1006; No Copyright; Avail: Department of Energy Information Bridge

The study of direct CP violation in the neutral K meson system is the primary goal of the high precision NA 48 experiment at CERN, based on a spectrometer and a liquid krypton calorimeter. This experiment is also sensitive to rare kaon decays, in particular the one of the K(sub L) into a muon pair and a photon, discussed on the first part of he dissertation. The second part presents a detailed description on the second level 'charged' trigger system of the experiment, operating at a 100 kHz event input rate. Its aim is to select the decays of K(sub L) or K(sub S) into a pair of charged pions, based on a high speed digital signal processor farm performing the online reconstruction of the invariant mass of an event in less than 100 microseconds, using the spectrometer data for an efficient rejection of the physical backgrounds. The reconstruction algorithm, the realization of the farm and its performances are presented. The third part determines a measurement of the branching ratio of the K(sub L) decay into a pair of muons and a proton using the data taken in 1995. 59 signal events are found containing a background estimated to 14. The results is 3.4(+/-)0.6 (stat) (+/-) 0.4 (syst) x 10(exp -7) and allows the determination of the value of the ratio between the coupling constants of the weak non leptonic transitions through vector and pseudo-scalar intermediate states (alpha)(sub K) = 0.048680(sub .21)(sup +024). A search for decays of K(sub l) into two muons and two electrons has been performed. No candidate has been found. An upper limit for the branching fraction of the process of 3.8 x 10(exp -8) at a 90 % confidence level is obtained.

NTIS

Kaons; Muons; Protons; Invariance; Particle Decay; Branching (Physics)

20000064993 Chicago Univ., Chicago, IL USA

Coherent Control in Atoms, Molecules, and Semiconductors ***Final Report***

Poetz, Walter; Schroeder, W. Andreas; May 1998; 230p; In English; Coherent Control of Charge Carrier Dynamics in Semiconductors, 18-22 May 1998, Chicago, IL, USA

Contract(s)/Grant(s): DAAG55-98-1-0123

Report No.(s): AD-A366924; ARO-38551.1-EL-CF; ISBN 0-7923-5649-7; Copyright; Avail: Defense Technical Information Center (DTIC)

The International Workshop on Coherent Control of Charge Carrier Dynamics in Semiconductors was held May 18-22, 1998 at the University of Illinois at Chicago. An international and multidiciplinary group of scientists presented recent results on coherent control phenomena in atoms, molecules, and semiconductors. Pertinent open physical questions, as well as potential technological applications and the future of the field were discussed.

DTIC

Coherent Radiation; Charge Carriers

20000065668 Argonne National Lab., IL USA
Lattice formulation of chiral gauge theories
Bodwin, G. T.; Dec. 31, 1995; 69p; In English
Report No.(s): DE97-007882; ANL-HEP-PR-95-59-REV; No Copyright; Avail: Department of Energy Information Bridge

The authors present a method for formulating gauge theories of chiral fermions in lattice field theory. The method makes use of a Wilson mass to remove doublers. Gauge invariance is then restored by modifying the theory in two ways: the magnitude of the fermion determinant is replaced with the square root of the determinant for a fermion with vector-like couplings to the gauge field; a double limit is taken in which the lattice spacing associated with the fermion field is taken to zero before the lattice spacing associated with the gauge field. The method applies only to theories whose fermions are in an anomaly-free representation of the gauge group. They also present a related technique for computing matrix elements of operators involving fermion fields. Although the analyses of these methods are couched in weak-coupling perturbation theory, it is argued that computational prescriptions are gauge invariant in the presence of a nonperturbative gauge-field configuration.
NTIS
Gauge Theory; Lattices (Mathematics); Chirality

20000065671 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Renormalon chains contributions to non-singlet evolution kernels in QCD
Mikhajlov, S.; Dec. 31, 1998; 12p; In English
Report No.(s): DE99-607975; JINR-E-2-98-43; No Copyright; Avail: Department of Energy Information Bridge

Contributions to QCD non-singlet evolution kernels P (z) for the DGLAP equation and V (x,y) for the Brodsky-Lepage evolution equation are calculated for a certain class of diagrams which include renormalon chains. Closed expressions are presented for the sums of these contributions that dominate for a large number of flavors N(sub f);1. Calculations are performed in covariant (xi)-gauge, in the MS bar scheme. The assumption of 'naive nonabelianization' approximation for kernel calculations is discussed. The partial solution to the Brodsky-Lepage evolution equation is obtained.
NTIS
Chains; Kernel Functions; Quantum Chromodynamics

20000065672 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Hidden symmetry of the Yang-Coulomb monopole
Mardoyan, L. G.; Sisakyan, A. N.; Ter-Antonyan, V.; Dec. 31, 1998; 8p; In English
Report No.(s): DE99-607976; JINR-E-2-98-46; No Copyright; Avail: Department of Energy Information Bridge

The bound system composed of the Yang monopole coupled to a particle of the isospin by the SU (2) and Coulomb interaction is considered. The generalized Runge-Lenz vector and the SO(6) group of hidden symmetry are established. It is also shown that the group of hidden symmetry makes it possible to calculate the spectrum of the system by a pure algebraic method.
NTIS
Symmetry; Monopoles

20000065675 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Table of integrals. Asymptotical expressions for non-collinear kinematics
Arbuzov, A. B.; Belitskij, A. V.; Kuraev, E.; Shajkhatdenov, B. G.; Dec. 31, 1998; 27p; In English
Report No.(s): DE99-607979; JINR-E-2-98-53; No Copyright; Avail: Department of Energy Information Bridge

A set of Feynman integrals appearing in calculations of different QED processes to the one-loop accuracy is presented. Scalar, vector and tensor integrals with two, three, four and five denominators are considered. The cases of equal and different fermion masses are considered. Results obtained are valid in the region where all kinematical invariants are large compared to the masses squared. Mass corrections for some scalar integrals in the case of different fermion masses are also given.
NTIS
Integrals; Mathematical Tables; Feynman Diagrams

20000065676 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Description of the higher massless irreducible integer spins in the BRST approach
Pashnev, A.; Tsulaya, M.; Dec. 31, 1998; 15p; In English
Report No.(s): DE99-607980; JINR-E-2-98-56; No Copyright; Avail: Department of Energy Information Bridge

The BRST approach is applied to the description of irreducible massless higher spins representations of the Poincare group in arbitrary dimensions. The total system of constraints in such theory includes both the first and the second class constraints. The corresponding nilpotent BRST charge contains terms up to the seventh degree in ghosts.
NTIS
Integers; Spin

20000065677 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Background harmonic superfields in N=2 supergravity
Zupnik, B. M.; Dec. 31, 1998; 19p; In English
Report No.(s): DE99-607981; JINR-E-2-98-67; No Copyright; Avail: Department of Energy Information Bridge
A modification of the harmonic superfield formalism in D=4, N=2 supergravity using a subsidiary condition of covariance under the background supersymmetry with a central charge (B-covariance) is considered. Conservation of analyticity together with the B-covariance leads to the appearance of linear gravitational superfields. Analytic prepotentials arise in a decomposition of the background linear superfields in terms of spinor coordinates and transform in a nonstandard way under the background supersymmetry. The linear gravitational superfields can be written via spinor derivatives of nonanalytic spinor prepotentials. The perturbative expansion of supergravity action in terms of the B-covariant superfields and the corresponding version of the differential-geometric formalism are considered. We discuss the dual harmonic representation of the linearized extended supergravity, which corresponds to the dynamical condition of Grassmann analyticity.
NTIS
Supergravity; Gravitational Fields

20000066581 Grand Accelerator National d'Ions Lourds, Caen, France
Symmetry and symmetry breaking in quantum mechanics
Chomaz, P.; Dec. 31, 1998; 55p; In French; In English
Report No.(s): DE99-633341; GANIL-P-98-30; No Copyright; Avail: Department of Energy Information Bridge
In the world of infinitely small, the world of atoms, nuclei and particles, the quantum mechanics enforces its laws. The discovery of Quanta, this unbelievable castration of the Possible in grains of matter and radiation, in discrete energy levels compels us of thinking the Single to comprehend the Universal. Quantum Numbers, magic Numbers and Numbers sign the wave. The matter is vibration. to describe the music of the world one needs keys, measures, notes, rules and partition: one needs quantum mechanics. The particles reduce themselves not in material points as the scholars of the past centuries thought, but they must be conceived throughout the space, in the accomplishment of shapes of volumes. When Einstein asked himself whether God plays dice, there was no doubt among its contemporaries that if He exists He is a geometer. In a Nature reduced to Geometry, the symmetries assume their role in servicing the Harmony. The symmetries allow ordering the energy levels to make them understandable. They impose there geometrical rules to the matter waves, giving them properties which sometimes astonish us. Hidden symmetries, internal symmetries and newly conceived symmetries have to be adopted subsequently to the observation of some order in this world of Quanta. In turn, the symmetries provide new observables which open new spaces of observation.
NTIS
Broken Symmetry; Quantum Mechanics

80
SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula.

20000065635 Institute for Human Factors TNO, Soesterberg, Netherlands
Innovation of the Training of the Deputy Weapon Engineer ***Final Report Innovatie van de Opleiding tot Systeem Verantwoordelijke Officier***
Schaafstal, A. M., Institute for Human Factors TNO, Netherlands; vanBerlo, M. P. W., Institute for Human Factors TNO, Netherlands; Oct. 12, 1999; 94p; In Dutch
Contract(s)/Grant(s): A96/KM/371; TNO Proj. 730.2
Report No.(s): TD-99-0343; TM-99-A065; Copyright; Avail: Issuing Activity
The TNO Human Factors Research institute has developed and evaluated a model for designing and conducting technical training (Structured Troubleshooting) aimed at enhancing the transfer of training to the situation on board. The question is whether this model is applicable to the innovation of two functions for officers in the Weapon Engineering Branch: the Weapon Engineer-

ing Officer (WEO) and the Deputy Weapon Engineering Officer (DWEO). This report describes this research in which we focussed upon the innovation of the function-course for the DWEO. Based upon an analysis of the current training practices and a task analysis, a new concept is developed for the function-course of the DWEO.
Author
Education; Procedures; Training Evaluation; Models

20000065636 Physics and Electronics Lab. TNO, The Hague, Netherlands
Boot: Decision Support for the Selection of Facilities for Education and Training ***Final Report***
vanderHulst, A., Physics and Electronics Lab. TNO, Netherlands; deHoog, R., Physics and Electronics Lab. TNO, Netherlands; Wielemaker, J., Physics and Electronics Lab. TNO, Netherlands; December 1999; 58p; In English; Original contains color illustrations
Contract(s)/Grant(s): A98/KM/749; TNO Proj. 27655
Report No.(s): TD99-0240; FEL-99-A188; Copyright; Avail: Issuing Activity

The present report describes a method and accompanying tool (BOOT) providing decision support for the selection of facilities for education and training. BOOT supports users to define a programme of requirements for future e&t facilities. As fidelity requirements turned out to be of major importance for the selection of facilities, knowledge based support for the definition of such requirements is provided. After having defined the programme of requirements, BOOT helps to match this programme against profiles for possible e&t facilities. Finally, the user is aided to define the relative importance of the various requirements and to perform a two step multi-criteria analysis. In the first step, an optimum choice on the basis of educational requirements is determined, in the second step organizational and financial constraints are taken into regard to reach an overall optimum choice.
Author
Education; Knowledge Based Systems

20000067651 NASA Marshall Space Flight Center, Huntsville, AL USA
Intelligent Tutoring Systems for Procedural Task Training of Remote Payload Operations at NASA
Ong, James, Henke Associates, Inc.; Noneman, Steven, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Interservice/Industry Training, Simulation and Education, Nov. 2000, Orlando, FL, USA
Contract(s)/Grant(s): NAS8-98071; No Copyright; Avail: Issuing Activity; Abstract Only

Intelligent Tutoring Systems (ITSs) encode and apply the subject matter and teaching expertise of experienced instructors to provide students with individualized instruction automatically. ITSs complement training simulators by providing automated instruction when it is not economical or feasible to dedicate an instructor to each student during training simulations. Despite their proven training effectiveness and favorable operating cost, however, relatively few ITSs are in use. This is largely because it is usually costly and difficult to encode the task knowledge used by the ITS to evaluate the student's actions and assess the student's performance. Procedural tasks are tasks for which there exist procedures, guidelines, and strategies that determine the correct set of steps to be taken within each situation. to lower the cost and difficulty of creating tutoring systems for procedural task training, Stottler Henke Associates, Inc. (SHAI) worked closely with the Operations Training Group at NASA's Marshall Space Flight Center to develop the Task Tutor Toolkit (T (exp 3)), a generic tutoring system shell and scenario authoring tool. The Task Tutor Toolkit employs a case-based reasoning approach where the instructor creates a procedure template that specifies the range of student actions that are "correct" within each scenario. Because each procedure template is specific to a single scenario, the system can employ relatively simple reasoning methods to represent a correct set of actions and assess student performance. This simplicity enables a non-programmer to specify task knowledge quickly and easily by via graphical user interface, using a "demonstrate, generalize, and annotate" paradigm, that recognizes the range of possible valid actions and infers principles understood (or misunderstood) by the student when those actions are carried out. The Task Tutor Toolkit was also designed to be modular and general, so that it can be interfaced with a wide range of training simulators and support a variety of training domains. SHAI and NASA applied the Task Tutor Toolkit to create the Remote Payload Operations Tutor (RPOT). RPOT is a specific tutoring system application which lets scientists who are new to space mission operations learn to monitor and control their experiments aboard the International Space Station according to NASA payload regulations, guidelines, and procedures. The RPOT simulator lets students practice these skills by monitoring the telemetry variable values of a simple, hypothetical experiment, sending commands to the experiment, coordinating with NASA personnel via voice communication loops, and submitting and retrieving information via documents and forms. At the end of each scenario, RPOT displays the principles correctly or incorrectly demonstrated by the student, along with explanations and background information. The effectiveness of RPOT and the Task Tutor Toolkit are currently under evaluation at NASA.
Author
Education; Payloads; Tasks; Training Simulators; Remote Control; Artificial Intelligence

20000067671 Hampton Univ., VA USA
American Indial Educational Opportunities Program at Hampton University ***Final Report, 1 Jan. - 31 Dec. 1999***
Molin, Paulette F., Hampton Univ., USA; [1999]; 3p; In English
Contract(s)/Grant(s): NGT1-52207; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The American Indian Educational Opportunities Program (AIEOP) at Hampton University was formed to provide scholarship and other support to eligible students from state and federally recognized tribal groups on campus. During the reporting period, AIEOP worked to enhance American Indian participation at Hampton through a variety of means, including recruitment and retention of students, outreach activities, curatorial efforts, course instruction, and sponsorship of educational programs. Dr. Paulette F. Molin, a member of the Minnesota Chippewa Tribe, served as the program's director.
Derived from text
American Indians; Education; Universities

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20000061486 Battelle Seattle Research Center, Seattle, WA USA
Simplified Crew Size Evaluation Method ***Final Report***
Lee, John D.; Forsythe, Alice M.; Rothblum, Anita M.; Jan. 2000; 62p; In English
Contract(s)/Grant(s): DTCG39-94-D-E00777
Report No.(s): AD-A377253; UDI-16(2); USCG-D-13-00; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report identifies a simplified method of crew size evaluation that can complement the relatively complex crew size evaluation method (CSEM). The simplified crew size evaluation method (S-CSEM) uses lookup tables that were generated via CSEM analyses and a task-based description of operating conditions to eliminate complex calculations, provide flexibility, and link operating conditions to the number of crew needed for vessel operation. Thus, S-CSEM is a simple and practical tool for crew size evaluation. This report is one of two reports on the use of CSEM to evaluate crew needs under different operational scenarios. The lookup tables in this report were generated by an in-depth analysis reported in, "The Use of the Crew Size Evaluation Method to Examine the Effect of Operational Factors on Crew Needs," CG-D-12-00. That report contains a detailed description of the analyses, the data sets used to perform the analyses, and criteria which can be applied in the evaluation of sufficient crew.
DTIC
Crew Size; Evaluation; Workloads (Psychophysiology)

20000064013 Institute for Human Factors TNO, Soesterberg, Netherlands
Analysis of Command Functions on Time, Volume, and Complexity Criteria ***Interim Report***
Rasker, P. C., Institute for Human Factors TNO, Netherlands; Post, W. M., Institute for Human Factors TNO, Netherlands; Treurniet, W., Physics and Electronics Lab. TNO, Netherlands; vanDelft, J. H., Institute for Human Factors TNO, Netherlands; Essens, P. J. M. D., Institute for Human Factors TNO, Netherlands; Dec. 30, 1999; 28p; In English
Contract(s)/Grant(s): A98/KM/342; TNO Proj. 731.1
Report No.(s): TD-99-0375; TM-99-A085; Copyright; Avail: Issuing Activity

This study is done in the context of the 'Future Command Study' assigned by the Royal Netherlands Navy to TNO. The objective of this study was to make an analysis of Command & Control functions on time, volume, and complexity criteria and validate the results of the committee. Based on three criteria (time, volume, and complexity) critical combinations of Command & Control functions and operational tasks ('hotspots') were identified by experts. Hotspots were in particularly found in operational situations with a pertinent rules of engagement component. The combination of high uncertainty in operational situations in littoral waters with complex rules of engagement and less-identifiable opponents provides a high workload situation. The results show that the experts expect high volumes and complexity of information for threat assessment (who is the opponent and what options does the opponent have) and decision-making (what will the consequences be of planned actions considering multiple threats).
Author
Command and Control; Decision Making; Time Functions; Volume; Complexity

20000064599 NASA Ames Research Center, Moffett Field, CA USA

It Takes More than Technology

Hultquist, Mary, NASA Ames Research Center, USA; Utley, Judith, MRJ Techology Solutions, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The technology required to develop and manage a production metacenter or grid environment is an important ingredient in such a project. However, this technology may neither be the most difficult piece of the puzzle nor the one demanding the most patience and perseverance. This paper touches on the technical underpinnings of the collaborative effort that resulted in a production metacenter joining two cooperating IBM SPs, one at NASA Ames Research Center (ARC) and the other at NASA Langley Research Center (LaRC). The discussion then focuses on the problems attributable to differing environments, both physical and cultural, even though both sites were part of the same agency. The approach for the Phase I NASA Metacenter was centralized with most decisions made by the NAS Division at Ames. Also discussed is the distributed approach to resolving the even greater difficulties encountered in the multi-agency effort to modify NASA's technology to build a similar metacenter in the Department of Defense. The DoD Metacenter joins two DoD Major Shared Resource Centers (MSRCs), the Aeronautical Systems Center (ASC) MSRC at Wright-Patterson Air Force Base and the U.S. Army Engineer Research and Development Center (ERDC) MSRC. The final discussion focuses on similar problems that have arisen at NASA with the NASA Information Power Grid.

Author

Distributed Processing; Information Resources Management; Information Systems; Systems Management

20000066583 NASA Kennedy Space Center, Cocoa Beach, FL USA

A/C 67 Investigation Board Final Report

May 11, 1987; In English; Videotape: 27 min., 41 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000078606; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

On March 26, 1987, after the launch of an Atlas/Centaur rocket with a payload of a Navy Communications Satellite, a problem developed and the rocket was lost. John Busse chaired the Accident Investigation Board that was convened to investigate the incident. This videotape is a press conference with Mr Busse, who reviews the findings of the investigation concerning the loss of the Atlas/Centaur-67 launch vehicle. The loss is primarily attributed to a hardover engine yaw command that was caused by an erroneous signal from the digital computer unit. The generation of the erroneous signal is blamed on unfavorable weather conditions which created a lightning hazard. Mr. Busse, also, reviews the investigation's recommendations for avoiding similar occurrences. The press then asks questions about the findings and recommendations.

CASI

Accident Investigation; Atlas Centaur Launch Vehicle; Lightning; Weather; Spacecraft Launching; Flight Hazards; Meteorological Parameters

20000066614 Physics and Electronics Lab. TNO, The Hague, Netherlands

BOOT: Evaluation of Studies *Final Report BOOT: Evaluatie Studies*

vanderHuslt, A., Physics and Electronics Lab. TNO, Netherlands; Wielemaker, J., Physics and Electronics Lab. TNO, Netherlands; Sabel, A. A., Physics and Electronics Lab. TNO, Netherlands; February 2000; 41p; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): A98/KM/749; TNO Proj. 27655

Report No.(s): TD-99-0238; FEL-99-A194; Copyright; Avail: Issuing Activity

The acceptance of a method depends to a large extent on the quality of the decision trajectory and the quality of the outcome. The study reported here aimed primarily at an assessment of both qualities of a method for staff-studies on facilities for education and training (named BOOT). Results of a comparison of unguided staff-studies and BOOT based studies revealed substantial differences in the decision trajectory. Unguided studies tended to be rather 'solution' oriented. That is, before having reached a conclusion on requirements, the discussion tended to focus on solutions. Only when comparing several alternatives, requirements relating to the differences between alternatives were made explicit. BOOT, on the other hand, supports a more analytical approach. It guides users to make requirements explicit before discussing the alternative e&t facilities. Problem with the solution oriented approach is that it cannot guarantee that all relevant requirements are made clear and that all possible solutions are taken into regard. Indeed, interviews revealed that potential users preferred the analytical BOOT approach. BOOT will affect the way the RNIN Organization deals with staff-studies on e&t. BOOT forces users to motivate each crucial decision, and supports the evaluation of those decisions by a third party. It opens up the process and gives users less control. This may negatively impact the acceptance when decision makers in turn will not accept the end result as realistic a need.

Author

Education; Training Evaluation; Decision Support Systems; Training Devices

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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.

20000061448 NASA Langley Research Center, Hampton, VA USA
Development of X-33/X-34 Aerothermodynamic Data Bases: Lessons Learned and Future Enhancements
Miller, C. G., NASA Langley Research Center, USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 32-1 - 32-12; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

A synoptic of programmatic and technical lessons learned in the development of aerothermodynamic data bases for the X-33 and X-34 programs is presented in general terms and from the perspective of the NASA Langley Research Center Aerothermodynamics Branch. The format used is that of the ”aerothermodynamic chain,” the links of which are personnel, facilities, models/test articles, instrumentation, test techniques, and computational fluid dynamics (CFD). Because the aerodynamic data bases upon which the X-33 and X-34 vehicles will fly are almost exclusively from wind tunnel testing, as opposed to CFD, the primary focus of the lessons learned is on ground-based testing. The period corresponding to the development of X-33 and X-34 aerothermodynamic data bases was challenging, since a number of other such programs (e.g., X-38, X-43) competed for resources at a time of downsizing of personnel, facilities, etc., outsourcing, and role changes as NASA Centers served as subcontractors to industry. The impact of this changing environment is embedded in the lessons learned. From a technical perspective, the relatively long times to design and fabricate metallic force and moment models, delays in delivery of models, and a lack of quality assurance to determine the fidelity of model outer mold lines (OML) prior to wind tunnel testing had a major negative impact on the programs. On the positive side, the application of phosphor thermography to obtain global, quantitative heating distributions on rapidly fabricated ceramic models revolutionized the aerothermodynamic optimization of vehicle OMLs, control surfaces, etc. Vehicle designers were provided with aeroheating information prior to, or in conjunction with, aerodynamic information early in the program, thereby allowing trades to be made with both sets of input; in the past only aerodynamic data were available as input. Programmatically, failure to include transonic aerodynamic wind tunnel tests early in the assessment phase led to delays in the optimization phase, as OMLs required modification to provide adequate transonic aerodynamic performance without sacrificing subsonic and hypersonic performance. Funding schedules for industry, based on technical milestones, also presented challenges to aerothermodynamics seeking optimum flying characteristics across the subsonic to hypersonic speed regimes and minimum aeroheating. This paper is concluded with a brief discussion of enhancements in ground-based testing/CFD capabilities necessary to partially/fully satisfy future requirements.
Author
Aerodynamic Characteristics; Aerothermodynamics; Data Bases; Fabrication; Ground Tests; X-33 Reusable Launch Vehicle; X-34 Reusable Launch Vehicle; X-38 Crew Return Vehicle

20000061485 Center for Army Analysis, Fort Belvoir, VA USA
Third Special Conference on Historical Data Analysis (SCOHDA 3) ***Final Report, Feb. - Mar. 2000***
Gory, Duane; Mar. 2000; 35p; In English; 3rd, 2-3 Mar. 2000, Fort Belvoir, VA, USA
Report No.(s): AD-A377305; CAA-R-00-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Center for Army Analysis hosted the Third Special Conference on Historical Data Analysis (SCOHDA III) from 2-3 March 2000. The purpose of the conference was to provide an exchange between the armies of the USA, UK, Australia, and France on techniques for examining and uses of data on historical combat operations to support defense planning and analysis.
DTIC
Conferences; Histories; Defense Program; Data Processing

20000062302 Information International Associates, Inc., Oak Ridge, TN USA
CENDI Metadata Initiatives: Beyond the Bibliographic Record
Hodge, Gail; Apr. 1998; 23p; In English
Report No.(s): AD-A377496; CENDI-1998-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

No Abstract Available.
DTIC
Information Retrieval; Information Transfer; Information Theory; Information Systems

20000062724 International Atomic Energy Agency, International Nuclear Data Committee, Vienna, Austria

Nuclear data libraries and online services. An introduction to the data types and services available from the IAEA Nuclear Data Section

Oblozinsky, P.; Schwerer, O.; Sep. 30, 1998; 15p; In English; Nuclear Reaction Data and Nuclear Reactors: Physics, Design and Safety, 23 Feb. - 17 Mar. 1998, Trieste, Italy

Report No.(s): DE99-607945; INDC(NDS)-387; No Copyright; Avail: Department of Energy Information Bridge

The IAEA Nuclear Data Section provides convenient, cost-free access to the world's most comprehensive collection of numerical nuclear physics data. These nuclear data libraries result from a worldwide cooperation of nuclear data centres coordinated by the IAEA. An introduction is given to the various nuclear data types and libraries with particular emphasis to online services via the Internet. This paper summarizes a presentation for the IAEA Workshop on ''Nuclear Reaction Data and Nuclear Reactors: Physics, Design and Safety'' held at ICTP Trieste, Italy, 23 February - 17 March 1998.

NTIS

On-Line Systems; Information Systems; Subroutine Libraries (Computers)

20000062887 College of William and Mary, Dept. of Computer Science, Williamsburg, VA USA

Robust Adaptive Data Encoding and Restoration

Park, Stephen K., College of William and Mary, USA; Rahman, Zia-ur, College of William and Mary, USA; Halyo, Nesim, College of William and Mary, USA; Jun. 09, 2000; 9p; In English

Contract(s)/Grant(s): NCC1-258; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This is the final report for NASA cooperative agreement and covers the period from 01 October, 1997 to 11 April, 2000. The research during this period was performed in three primary, but related, areas. 1. Evaluation of integrated information adaptive imaging. 2. Improvements in memory utilization and performance of the multiscale retinex with color restoration (MSRCR). 3. Commencement of a theoretical study to evaluate the non-linear retinex image enhancement technique. The research resulted in several publications, and an intellectual property disclosure to the NASA patent council in May, 1999.

Author

Imaging Techniques; Proving; Evaluation; Information Adaptive System; Memory (Computers); Numerical Analysis; Nonlinearity

20000063372 Los Alamos National Lab., NM USA

Human events reference for ATHEANA (HERA) database description and preliminary user's manual

Auflick, J. L.; Hahn, H. A.; Pond, D. J.; May 27, 1998; 103p; In English

Report No.(s): DE99-001170; LA-UR-98-2400; No Copyright; Avail: Department of Energy Information Bridge

The Technique for Human Error Analysis (ATHEANA) is a newly developed human reliability analysis (HRA) methodology that aims to facilitate better representation and integration of human performance into probabilistic risk assessment (PRA) modeling and quantification by analyzing risk-significant operating experience in the context of existing behavioral science models. The fundamental premise of ATHEANA is that error-forcing contexts (EFCs), which refer to combinations of equipment/material conditions and performance shaping factors (PSFs), set up or create the conditions under which unsafe actions (UAs) can occur. Because ATHEANA relies heavily on the analysis of operational events that have already occurred as a mechanism for generating creative thinking about possible EFCs, a database, called the Human Events Reference for ATHEANA (HERA), has been developed to support the methodology. This report documents the initial development efforts for HERA.

NTIS

User Manuals (Computer Programs); Data Bases; Human Performance; Error Analysis

20000063495 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Evaluation of DVD-R for Archival Applications

Martin, Michael D., Jet Propulsion Lab., California Inst. of Tech., USA; Hyon, Jason J., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 3p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

For more than a decade, CD-ROM and CD-R have provided an unprecedented level of reliability, low cost and cross-platform compatibility to support federal data archiving and distribution efforts. However, it should be remembered that years of effort were required to achieve the standardization that has supported the growth of the CD industry. Incompatibilities in the interpretation of the ISO-9660 standard on different operating systems had to be dealt with, and the imprecise specifications in the Orange Book Part n and Part Hi led to incompatibilities between CD-R media and CD-R recorders. Some of these issues were presented by the authors at Optical Data Storage '95. The major current problem with the use of CD technology is the growing volume of digital data that needs to be stored. CD-ROM collections of hundreds of volumes and CD-R collections of several thousand volumes are

becoming almost too cumbersome to be useful. The emergence of Digital Video Disks Recorder (DVD-R) technology promises to reduce the number of discs required for archive applications by a factor of seven while providing improved reliability. It is important to identify problem areas for DVD-R media and provide guidelines to manufacturers, file system developers and users in order to provide reliable data storage and interchange. The Data Distribution Laboratory (DDL) at NASA's Jet Propulsion Laboratory began its evaluation of DVD-R technology in early 1998. The initial plan was to obtain a DVD-Recorder for preliminary testing, deploy reader hardware to user sites for compatibility testing, evaluate the quality and longevity of DVD-R media and develop proof-of-concept archive collections to test the reliability and usability of DVD-R media and jukebox hardware.
Derived from text
Digital Data; Digital Television; Multimedia; Video Disks; Video Communication

20000063523 Lamont-Doherty Geological Observatory, Palisades, NY USA
Enhancement of the Release of Scientific Data in the Framework of Scientific Publishing ***Annual Report, 1 Mar. 1999 - 29 Feb. 2000***
Scholosser, Peter; Apr. 20, 2000; 4p; In English
Contract(s)/Grant(s): N00014-99-1-0461
Report No.(s): AD-A376915; LDEO-5-21802; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This proposal requested support for exploring a more rapid data release in the framework of the Journal of Geophysical Research (Oceans) Editorship. The goal is to develop a policy that would require data release at the same time as publication of the first scientific description of the research project that produced the data. Design and implementation of the policy should emphasize incentives and advantages of early data release in terms of possibilities of cooperation and the opportunity for the community to develop large integrated data sets to derive synthesized science products.
DTIC
Research Management; Documents; Geophysics; Data Processing

20000064523 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Review of the New AVIRIS Data Processing System
Aronsson, Mikael, Jet Propulsion Lab., California Inst. of Tech., USA; Summaries of the Seventh JPL Airborne Earth Science Workshop January 12-16, 1998; Dec. 19, 1998; Volume 1, pp. 15-21; In English; See also 20000064520; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The processing of AVIRIS data - from the Metrum Very Large Data Store (VLDS) flight tape to delivered data products - has traditionally been performed in essentially the same way, from the beginning of the AVIRIS project up to and including the 1996 flight season. Starting with the 1997 flight season, a drastically different paradigm has been used for the processing of AVIRIS data. This change was made possible by the recent development of and related availability of affordable data storage devices.
Derived from text
Data Processing Equipment; Data Storage; Data Processing; Magnetic Tapes; Magnetic Disks

20000064582 NASA Ames Research Center, Moffett Field, CA USA
Adaptivity in Agent-Based Routing for Data Networks
Wolpert, David H., NASA Ames Research Center, USA; Kirshner, Sergey, NASA Ames Research Center, USA; Merz, Chris J., NASA Ames Research Center, USA; Turner, Kagan, NASA Ames Research Center, USA; Welcome to the NASA High Performance Computing and Communications Computational Aerosciences (CAS) Workshop 2000; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This article introduces the concept of "COllective INtelligence" (COIN) and the crucial steps involved in COIN design. A COIN is a large multi-agent system where: (i) There is no centralized communication among agents; (ii) There is no centralized control among agents; (iii) There is a well-specified global objective, and we are confronted with the inverse problem of how to configure the system to achieve that objective. (iv) Agents are "greedy" in that they act to try to optimize their own utilities, without explicit regard to cooperation with other agents. Many conventional approaches to designing large distributed systems to optimize a world utility attempt to explicitly model the dynamics of the overall system. They then hand-tune the interactions between the agents to ensure that those agents "cooperate" as far as the world utility is concerned. This approach is labor-intensive, often results in highly nonrobust systems, and usually results in design techniques that have limited applicability. In contrast, in our approach we wish to solve the COIN design problems implicitly, via the "adaptive" character of Reinforcement Learning (RL) algorithms that each of the agents run. This approach introduces an entirely new, profound design problem: Assuming the RL algorithms are able to achieve high rewards, what reward functions for the individual agents will, when pursued by those agents, result in high world utility? How, without any detailed modeling of the overall system, can one set the utility functions for the RL algorithms

in a COIN to have the overall dynamics reliably and robustly achieve large values of the provided world utility? In this article we focus on applying COINs to the problem of internet packet routing. In a conventional approach to packet routing, each router runs what it believes (based on the information available to it) to be a shortest path algorithm (SPA), i.e., each router sends its packets in the way that it surmises will get those packets to their destinations most quickly. Unlike with an approach based on our COIN framework, with SPA-based routing the routers have no concern for the possible deleterious side-effects of their routing decisions on the global performance (e.g., they have no concern for whether they induce bottlenecks). In these experiments the COIN-based system achieved significantly better global throughput than did the 'full knowledge' Ideal SPA-based system (ISPA, i.e., an SPA endowed with full knowledge of the shortest paths, whose performance provides an upper bound on that of all SPAs). In particular, they automatically avoided the Braess'Paradox that was built-in to some of those systems. This is illustrated in the figure, where "FK-COIN" refers the best possible COIN performance, and "MB-COIN" refers to a practical COIN-based system, which has access to limited information about the state of the network. Although still very young, research specifically concentrating on the COIN design problem has already resulted in successes in artificial domains, in particular in the leader-follower problem, and in variants of Arthur's El Farol bar problem, in addition to packet-routing. It is expected that as it matures and draws upon other disciplines related to COINs the research will greatly expand the range of tasks addressable by human engineers. Further information is contained in the original.
Author
Algorithms; Knowledge Based Systems; Artificial Intelligence; Distributed Processing; Computer Systems Design

20000064597 NASA Ames Research Center, Moffett Field, CA USA
Information Power Grid: Distributed High-Performance Computing and Large-Scale Data Management for Science and Engineering
Johnston, William E., NASA Ames Research Center, USA; Gannon, Dennis, NASA Ames Research Center, USA; Nitzberg, Bill, NASA Ames Research Center, USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We use the term "Grid" to refer to distributed, high performance computing and data handling infrastructure that incorporates geographically and organizationally dispersed, heterogeneous resources that are persistent and supported. This infrastructure includes: (1) Tools for constructing collaborative, application oriented Problem Solving Environments / Frameworks (the primary user interfaces for Grids); (2) Programming environments, tools, and services providing various approaches for building applications that use aggregated computing and storage resources, and federated data sources; (3) Comprehensive and consistent set of location independent tools and services for accessing and managing dynamic collections of widely distributed resources: heterogeneous computing systems, storage systems, real-time data sources and instruments, human collaborators, and communications systems; (4) Operational infrastructure including management tools for distributed systems and distributed resources, user services, accounting and auditing, strong and location independent user authentication and authorization, and overall system security services The vision for NASA's Information Power Grid - a computing and data Grid - is that it will provide significant new capabilities to scientists and engineers by facilitating routine construction of information based problem solving environments / frameworks. Such Grids will knit together widely distributed computing, data, instrument, and human resources into just-in-time systems that can address complex and large-scale computing and data analysis problems. Examples of these problems include: (1) Coupled, multidisciplinary simulations too large for single systems (e.g., multi-component NPSS turbomachine simulation); (2) Use of widely distributed, federated data archives (e.g., simultaneous access to metrological, topological, aircraft performance, and flight path scheduling databases supporting a National Air Space Simulation systems}; (3) Coupling large-scale computing and data systems to scientific and engineering instruments (e.g., realtime interaction with experiments through real-time data analysis and interpretation presented to the experimentalist in ways that allow direct interaction with the experiment (instead of just with instrument control); (5) Highly interactive, augmented reality and virtual reality remote collaborations (e.g., Ames / Boeing Remote Help Desk providing field maintenance use of coupled video and NDI to a remote, on-line airframe structures expert who uses this data to index into detailed design databases, and returns 3D internal aircraft geometry to the field); (5) Single computational problems too large for any single system (e.g. the rotocraft reference calculation). Grids also have the potential to provide pools of resources that could be called on in extraordinary / rapid response situations (such as disaster response) because they can provide common interfaces and access mechanisms, standardized management, and uniform user authentication and authorization, for large collections of distributed resources (whether or not they normally function in concert). IPG development and deployment is addressing requirements obtained by analyzing a number of different application areas, in particular from the NASA Aero-Space Technology Enterprise. This analysis has focussed primarily on two types of users: the scientist / design engineer whose primary interest is problem solving (e.g. determining wing aerodynamic characteristics in many different operating environments), and whose primary interface to IPG will be through various sorts of problem solving frameworks. The second type of user is the tool designer: the computational scientists who convert physics and mathematics into code that can simulate the

physical world. These are the two primary users of IPG, and they have rather different requirements. The results of the analysis of the needs of these two types of users provides a broad set of requirements that gives rise to a general set of required capabilities. The IPG project is intended to address all of these requirements. In some cases the required computing technology exists, and in some cases it must be researched and developed. The project is using available technology to provide a prototype set of capabilities in a persistent distributed computing testbed. Beyond this, there are required capabilities that are not immediately available, and whose development spans the range from near-term engineering development (one to two years) to much longer term R&D (three to six years). Additional information is contained in the original.
Author
Computers; On-Line Systems; Programming Environments; Systems Engineering; Telecommunication; Computer Networks; Distributed Processing; Computer Systems Design; Parallel Processing (Computers)

20000064600 Florida International Univ., Dept. of Decision Science and Information Systems, Miami, FL USA
Knowledge Management Systems
Becerra-Fernandez, Irma, Florida International Univ., USA; February 2000; In English; See also 20000064579; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The development of knowledge management systems (KMS) demands that knowledge be obtained, produced, shared, regulated, and leveraged by a steady conglomeration of individuals, processes, information technology applications, and a knowledge-sharing organizational culture. It has been observed that KMS currently underway at most organizations fall into three categories: educational, problem-solving systems, and knowledge repositories - which constitute the majority of the KMS in place. Educational KMS are used to elicit and catalog tacit knowledge, and simultaneously serve as educational tools. Problem-solving KMS are used by organizations with significant intellectual capital that require eliciting and capturing knowledge for reuse in order to solve new problems as well as recurring problems, based on experience gained from solving previous problems. Knowledge repositories, include repositories of organizational knowledge that exists in explicit form (e.g. system to store marketing-oriented documents), less structured databases of employees' insights and observations (e.g. "discussion databases" or "lessons-learned systems") and repositories that attempt to manage organizational knowledge by holding pointers to experts who possess specific knowledge within an organization. The latter category of KMS has been referred to in the literature as Knowledge Yellow Pages or People-Finder systems. This paper discusses the development of two examples of such people-finder KMS, the Searchable Answer Generating Environment (SAGE) and the Expert Seeker KMS. SAGE is a KMS used to identify experts in the Florida State University System (SUS). Currently, each Florida State University maintains information concerning funded research, but these databases are disparate and disjoint. The SAGE application creates one single web-enabled repository, which can be searched in a number of ways including Research Topic, Investigator Name, Funding Agency, or University. The Expert Seeker KMS, currently under development, seeks to help locate intellectual capital within KSC at all educational levels. The application will store the competencies available within the organization, including items that are typically not captured by Human Resources applications, for example, past projects that have been completed, patents, and other relevant knowledge. This repository will be especially useful when organizing cross-functional teams. This application combines and unifies existing data from multiple sources into one user accessible interface. Expert Seeker allows the identification of a researcher's expertise within a discipline and facilitates communication or a point of contact. Insights and lessons-learned gained from the development of these two systems are discussed. The process of profile-generation, and maintenance is also discussed. Finally, the role of technology in automating the process of profile-maintenance in order to diminish the impact that self-assessment introduces in the profile generation, as well as future plans are presented. Additional information is contained in the original.
Author
Human Resources; Information Systems; Problem Solving; Technology Utilization; Knowledge Based Systems; Management Systems

20000066576 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The Application of Automatic Identification Technology for Intransit Visibility at Remote Locations
Patterson, Chris B.; Jun. 1999; 87p; In English
Report No.(s): AD-A372334; AFIT/GMO/LAL/99E-11; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Air Mobility Command (AMC) is responsible for collecting intransit visibility (ITV) data at remote and austere airfields. Automatic identification technology (AIT) is emerging as a system for quick and accurate data capture. This paper examines the application of AIT at remote locations to obtain ITV. Four areas are addressed: processes, training, manning, and equipment. Obtaining ITV at remote locations is currently a complicated combination of manpower and time intensive processes. AIT is capable of streamlining these processes by reducing cargo and passenger processing times. Additionally, it provides highly accurate data. Although AIT offers several significant benefits, the technical nature of AIT equipment requires skilled personnel for setup,

operation, and troubleshooting. Recent AIT exercise scenarios highlighted the need for training programs at all levels from aerial port personnel to commanders. Furthermore, it does not appear that the application of AIT will reduce manning requirements. Despite these disadvantages, AIT could improve ITV at remote locations. Given that past attempts to collect ITV data at remote or austere locations have been manpower and time intensive, AIT could eliminate these problems in the future. Consequently, AMC should plan to use AIT to improve ITV at remote locations.
DTIC
Visibility; Information Systems; Identifying

89
ASTRONOMY

Includes observations of celestial bodies, astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20000062311 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
High-Resolution Optical and Near-Infrared Imaging of Young Circumstellar Disks
McCaughrean, Mark, Astrophysikalisches Inst., Germany; Stapelfeldt, Karl, Jet Propulsion Lab., California Inst. of Tech., USA; Close, Laird, Hawaii Univ., USA; [2000]; 20p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the past five years, observations at optical and near-infrared wavelengths obtained with the Hubble Space Telescope and ground-based adaptive optics have provided the first well-resolved images of young circumstellar disks which may form planetary systems. We review these two observational techniques and highlight their results by presenting prototype examples of disks imaged in the Taurus-Auriga and Orion star-forming regions. As appropriate, we discuss the disk parameters that may be typically derived from the observations, as well as the implications that the observations may have on our understanding of, for example, the role of the ambient environment in shaping the disk evolution. We end with a brief summary of the prospects for future improvements in space- and ground-based optical/IR imaging techniques, and how they may impact disk studies.
Author
Adaptive Optics; Imaging Techniques; Image Resolution; Stellar Envelopes

20000062359 National Optical Astronomy Observatories, Tucson, AZ USA
A Spectroscopic Study of Field BHB Star Candidates
Kinman, T., Kitt Peak National Observatory, USA; Castelli, F., Osservatorio Astronomico, Italy; Cacciari, C., Osservatorio Astronomico, Italy; Bragaglia, A., Osservatorio Astronomico, Italy; Harmer, D., Kitt Peak National Observatory, USA; Valdes, F., Kitt Peak National Observatory, USA; June 2000; 48p; In English
Report No.(s): NOAO-Preprint-879; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

New spectroscopic observations are presented for a sample of thirty-one blue horizontal branch (BHB) star candidates that are sufficiently nearby to have reliable proper motions. Comments are given on a further twenty-five stars that have previously been suggested as BHB star candidates but which were not included in our sample. Moderately high-resolution spectra (lambda/Delta(lambda) approx. = 15 000) of twenty five of our program stars were taken with the coude feed spectrograph at Kitt Peak. Twelve of the program stars were also observed with the CAT spectrograph at ESO. Six of these program stars were observed from both hemispheres. IUE low-resolution spectra are available for most of our candidates and were used, in addition to other methods, in the determination of their T(sub ff) and reddening. A compilation of the visual photometry for these stars (including new photometry obtained at Kitt Peak) is also given. Abundances were obtained from these spectra using models computed by Castelli with an updated version of the ATLAS9 code.
Author
Spectroscopy; Research; Blue Stars; IUE; Spectra; Stellar Evolution

20000062461 National Optical Astronomy Observatories, Tucson, AZ USA
WFPC2 Stellar Photometry with HSTphot
Dolphin, Andrew E., National Optical Astronomy Observatories, USA; June 2000; 18p; In English
Contract(s)/Grant(s): GO-02227.06-A; GO-07696
Report No.(s): NOAO-Preprint-881; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

HSTphot, a photometry package designed to handle the undersampled PSFs found in WFPC2 images, is introduced and described, as well as some of the considerations that have to be made in order to obtain accurate PSF-fitting stellar photometry

with WFPC2 data. Tests of HSTphot's internal reliability are made using multiple observations of the same field, and tests of external reliability are made by comparing with DoPHOT reductions of the same data. Subject headz'ngs: techniques: photometric
Author
Design Analysis; Fabrication; Stellar Spectrophotometry

20000063503 National Optical Astronomy Observatories, Tucson, AZ USA
The Charge Transfer Efficiency and Calibration of WFPC2
Dolphin, Andrew E., National Optical Astronomy Observatories, USA; June 2000; 40p; In English
Contract(s)/Grant(s): GO-02227.06-A; GO-07496
Report No.(s): NOAO-Preprint-882; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new determination of WFPC2 photometric corrections is presented, using HSTphot reduction of the WFPC2 Omega Centauri and NGC 2419 observations from January 1994 through March 2000 and a comparison with ground-based photometry. No evidence is seen for any position-independent photometric offsets (the "long-short anomaly"); all systematic errors appear to be corrected with the CTE and zero point solution. The CTE loss time dependence is determined to be very significant in the Y direction, causing time-independent CTE solutions to be valid only for a small range of times. On average, the present solution produces corrections similar to Whitmore, Heyer, & Casertano, although with an improved functional form that produces less scatter in the residuals and determined with roughly a year of additional data. In addition to the CTE loss characterization, zero point corrections are also determined as functions of chip, gain, filter, and temperature. of interest, there are chip-to-chip differences of order 0.01 - 0.02 magnitudes relative to the Holtzman et al. calibrations, and the present study provides empirical zero point determinations for the non-standard filters such as the frequently-used F450W, F606W, and F702W.
Author
Calibrating; Photometry; Systematic Errors

20000064714 NASA Ames Research Center, Moffett Field, CA USA
Spectral Irradiance Calibration in the Infrared, 4, 1.2-35um Spectra of Six Standard Stars
Cohen, Martin, Jamieson Science and Engineering, Inc., USA; Witteborn, Fred C., NASA Ames Research Center, USA; Walker, Russell G., Jamieson Science and Engineering, Inc., USA; Bregman, Jesse D., NASA Ames Research Center, USA; Wooden, Diane H., NASA Ames Research Center, USA; Astronomical Journal; July 1995; ISSN 0004-6256; Volume 110, No. 1, pp. 275-289; In English
Contract(s)/Grant(s): F19628-92-C-0900; NCC2-142; Copyright; Avail: Issuing Activity

We present five new absolutely calibrated continuous stellar spectra from 1.2 to 35 microns, constructed as far as possible from actual observed spectral fragments taken from the ground, the Kuiper Airborne Observatory (KAO), and the IRAS Low Resolution Spectrometer (LRS). These stars, Beta Peg, Delta Boo, Beta And, Beta Gem, and Delta Hya, augment our already created complete absolutely calibrated spectrum for a Tau. All these spectra have a common calibration pedigree. The wavelength coverage is ideal for calibration of many existing and proposed ground-based, airborne, and satellite sensors.
Author
Calibrating; Infrared Radiation; Spectral Emission; Continuous Spectra; Light (Visible Radiation)

20000065627 NASA Ames Research Center, Moffett Field, CA USA
Far-Infrared Polarimetry of Galactic Clouds from the Kuiper Airborne Observatory
Dotson, Jessie L., NASA Ames Research Center, USA; Davidson, Jacqueline, NASA Ames Research Center, USA; Dowell, C. Darren, California Inst. of Tech., USA; Schleuning, David A., Chicago Univ., USA; Hildebrand, Roger H., Chicago Univ., USA; [1999]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

In this paper we present a complete summary of the data obtained with the far-infrared polarimeter, Stokes, in flights of the Kuiper Airborne Observatory. We have observed 12 Galactic clouds and have made over 1100 individual measurements at 100 micrometer and 60 micrometer. The median P for all of the 60 micrometer and 100 micrometer measurements is 3.6% and 2.6% respectively. We also present flux maps obtained simultaneously with the polarimetry.
Author
Polarization (Waves); H II Regions; Interstellar Gas; Magnetic Fields; Magnetic Clouds; Galactic Mass

20000065628 Chicago Univ., Enrico Fermi Inst., Chicago, IL USA
Probing the Magnetic Field Structure in the W3 Molecular Cloud
Schleuning, D. A., Chicago Univ., USA; Vaillancourt, J. E., Chicago Univ., USA; Hildebrand, R. H., Chicago Univ., USA; Dowell, C. D., California Inst. of Tech., USA; Novak, G., Dearborn Observatory, USA; Dotson, J. L., Search for Extraterrestrial

Intelligence Inst., USA; Davidson, J. A., Universities Space Research Association, USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

This paper presents polarization maps of the central 3' x 5' region of the W3 molecular cloud at far-infrared (60 micrometer and 100 micrometer) and submillimeter (350 micrometer) wavelengths. We use the multi-wavelength polarization measurements to differentiate between the emission in warm and cool dust components. We infer that the submillimeter observations trace a layer of cool dust with high column density, which we attribute to a large scale ridge of material. This ambient ridge has an orderly magnetic field with evidence for "hourglass" field structure; however, the field structure is qualitatively different in size and orientation compared to previous studies. The far-infrared measurements are dominated by warm dust surrounding evolved HII regions or embedded young stars. The warm dust, in contrast to the ridge, has a disrupted magnetic field that varies rapidly in the plane of the sky and along the line of sight, suggesting that the field has been distorted by the expansion of HII regions.
Author
Magnetic Field Configurations; Magnetic Clouds; Magnetic Fields; Molecular Clouds; Interstellar Gas; H II Regions

20000065649 Hawaii Univ., Inst. for Astronomy, Honolulu, HI USA
Operation of the University of Hawaii 2.2M Telescope on Mauna Kea ***Final Report, 1 Mar. 1997 - 28 Feb. 1999***
McLaren, Robert; Hall, Donald; Jan. 26, 2000; 7p; In English
Contract(s)/Grant(s): NAG5-4355
Report No.(s): AD-A375005; 654379; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

During this period the operation of the University of Hawaii's 2.2M telescope was partially funded by this grant. The original term of this grant was one year. Most of the grant funds were expended during this year. Subsequently a one year extension was approved. Over the resulting 2 year period, this grant provided approximately 6% of the operating budget of the telescope. The fraction of observing time devoted to studies of solar system objects (e.g., planets, planetary satellites, asteroids, and comets) was approximately 26%.
DTIC
Telescopes; Astronomical Observatories

20000067638 NASA Marshall Space Flight Center, Huntsville, AL USA
Relativistically Skewed Iron Emission and Disk Reflection in Galactic Microquasar XTE J1748-288
Miller, J. M., Massachusetts Inst. of Tech., USA; Fox, D. W., Massachusetts Inst. of Tech., USA; DiMatteo, T., Harvard-Smithsonian Center for Astrophysics, USA; Wijnands, R., Massachusetts Inst. of Tech., USA; Belloni, T., OAB, Italy; Kouveliotou, C., NASA Marshall Space Flight Center, USA; Lewin, W. H. G., Massachusetts Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We report evidence for an Fe K-alpha fluorescence line feature in the Very High, High, and Low state X-ray spectra of the galactic microquasar XTE JI748-288 during its June 1998 outburst. Spectral analyses were made on observations spread across the outburst, gathered with the Rossi X-ray Timing Explorer. Gaussian line. disk emission line, relativistic disk emission line, and disk reflection models are fit to the data. In the Very High State, the line profile is strongly redshifted and consistent with emission from the innermost radius of a maximally rotating Kerr black hole, 1.235 R(sub g). The line profile is less redshifted in the High State, but increasingly prominent. In the Low State, the line profile is very strong and centered af approx. 6.7 keV; disk line emission models constrain the inner edge of the disk to fluctuate between approx.20 and approx.59 R(sub g). We trace the disk reflection fraction across the full outburst of this source, and find well-constrained fractions below those observed in AGN in the Very High and High States, but consistent with other galactic sources in the Low State. We discuss the possible implications for black hole X-ray binary system dynamics and accretion flow geometry.
Author
X Ray Binaries; X Ray Spectra; Skewness; Spectrum Analysis; Black Holes (Astronomy); Iron; Quasars

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20000062020 National Optical Astronomy Observatories, Tucson, AZ USA
Kapteyn and the Selected Areas: A Personal Perspective, Chapter 10
Kinman, T. D., Kitt Peak National Observatory, USA; June 2000; 18p; In English
Report No.(s): NOAO-Preprint-880-CH-10; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A brief description is given of the origin of Kapteyn's "Plan of Selected Areas" in which he proposed that the structure of the Galaxy could be determined by taking samples at regularly spaced intervals across the sky. The Plan was also a call for international co-operation to expedite specific programs. Many observatories embraced the Plan and worked on these programs. The Selected Areas also provided photometric calibration and other support for observational programs other than those in Kapteyn's original proposal. Examples were Fath's early galaxy counts and the early studies of faint blue stars. Baade's thoughts on the Mount Wilson work in Selected Areas and the importance and difficulties of early photometric work are discussed. The call for co-operation and coordination in Galactic research that was implicit in Kapteyn's Proposal was renewed at IAU Symposium No.1 (Groningen in 1955). The Palomar-Groningen variable star survey, proposed at this conference, was an example of this new type of co-ordination.
Author
Blue Stars; Galaxies; Surveys; Variable Stars

20000062309 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Precise Image-Based Motion Estimation for Autonomous Small Body Exploration ***Final Report***
Johnson, Andrew Edie, Jet Propulsion Lab., California Inst. of Tech., USA; Matthies, Larry H., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 3p; In English; 5th; Artificial Intelligence, Robotics and Automation in Space, Unknown; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have developed and tested a software algorithm that enables onboard autonomous motion estimation near small bodies using descent camera imagery and laser altimetry. Through simulation and testing, we have shown that visual feature tracking can decrease uncertainty in spacecraft motion to a level that makes landing on small, irregularly shaped, bodies feasible. Possible future work will include qualification of the algorithm as a flight experiment for the Deep Space 4/Champollion comet lander mission currently under study at the Jet Propulsion Laboratory.
Author
Estimating; Autonomy; Spacecraft Motion; Optical Tracking; Image Analysis; Algorithms

20000062726 NASA Ames Research Center, Moffett Field, CA USA
The Galactic Distribution of Aliphatic Hydrocarbons in the Diffuse Interstellar Medium
Sandford, Scott A., NASA Ames Research Center, USA; Pendleton, Yvonne J., NASA Ames Research Center, USA; Allamandola, Louis J., NASA Ames Research Center, USA; Astrophysical Journal; Feb. 20, 1995; Volume 440, pp. 697-705; In English
Contract(s)/Grant(s): RTOP 199-52-12-04; RTOP 185-52-12-09; RTOP 452-33-93-03; RTOP 188-44-21-04; Copyright; Avail: Issuing Activity

The infrared absorption feature near 2950/ cm (3.4 microns), characteristic of dust in the diffuse interstellar medium (ISM), is attributed to C-H stretching vibrations of aliphatic hydrocarbons. We show here that the strength of the band does not scale linearly with visual extinction everywhere, but instead increases more rapidly for objects near the center of the Galaxy, a behavior that parallels that of the Si-O stretching band due to silicate materials in the diffuse ISM. This implies that the grains responsible for the diffuse medium aliphatic C-H and silicate Si-O stretching bands are different from those responsible for much of the observed visual extinction. It also suggests that the distribution of the carbonaceous component of the diffuse ISM is not uniform throughout the Galaxy, but instead may increase in density toward the center of the Galaxy. The similar behavior of the C-H and Si-O stretching bands suggests that these two components may be coupled, perhaps in the form of silicate-core, organic-mantle grains. Several possible models of the distribution of this material are presented and it is demonstrated that the inner parts of the Galaxy has a carrier density that is 5 to 35 times higher than in the local ISM. Depending on the model used, the density of aliphatic material in the local ISM is found to be about 1 to 2 -CH3 groups /cc and about 2 to 5 -CH2- groups/cc. These densities are consistent with the strengths of the 2955 and 2925/ cm (3.38 and 3.42 microns) subfeatures (due to -CH3 and -CH2- groups, respectively) within the overall 2950/ cm (3.4 microns) band being described by the relations A(sub upsilon)/tau(sub 2925/cm) = 270 +/- 40 and A(sub upsilon)/tau(sub 2925/cm) = 250 +/- 40 in the local diffuse ISM.
Author
Aliphatic Hydrocarbons; Galaxies; Interstellar Matter; Distribution (Property); Dust

20000063499 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Investigating the Near-Infrared Properties of Planetary Nebulae II. Medium Resolution Spectra, 2, Medium Resolution Spectra
Hora, Joseph L., Smithsonian Astrophysical Observatory, USA; Latter, William B., SIRTF Science Center, USA; Deutsch, Lynne K., Boston Univ., USA; [1998]; 34p; In English
Contract(s)/Grant(s): RTOP 399-20-61; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present medium-resolution (R approximately 700) near-infrared (lambda = 1 - 2.5 micrometers) spectra of a sample of planetary nebulae (PNe). A narrow slit was used which sampled discrete locations within the nebulae; observations were obtained at one or more positions in the 41 objects included in the survey. The PN spectra fall into one of four general categories: H1 emission line-dominated PNe, H1 and H2 emission line PNe, H2 emission line-dominated PNe, and continuum-dominated PNe. These categories correlate with morphological type, with the elliptical PNe falling into the first group, and the bipolar PNe primarily in the H2 and continuum emission groups. The categories also correlate with C/O ratio, with the O-rich objects falling into the first group and the C-rich objects in the groups. Other spectral features were observed in all catagories, such as continuum emission from the central star, and warm dust continuum emission towards the long wavelength end of the spectra. H2 was detected in four PNe in this survey for the first time. An analysis was performed using the H2 line ratios in all of the PN spectra in the survey where a sufficient number of lines were observed to determine the ortho-to-para ratio and the rotational and vibrational excitation temperatures of the H-2 in those objects. One unexpected result from this analysis is that the H-2 is excited by absorption of ultraviolet photons in most of the PNe, although there are several PNe in which collisional excitation plays an important role. The correlation between bipolar morphology and H2 emission has been strengthened with the new detections of H2 in this survey.
Author
Planetary Nebulae; Near Infrared Radiation; Emission Spectra; H Lines; Planetary Atmospheres; Resolution

20000064064 National Optical Astronomy Observatories, Tucson, AZ USA
From Stars to Super-Planets: The Low-Mass IMF in the Young Cluster IC348
Najita, Joan R., National Optical Astronomy Observatories, USA; Tiede, Glenn P., National Optical Astronomy Observatories, USA; Carr, John S., Naval Research Lab., USA; May 2000; 66p; In English
Contract(s)/Grant(s): NAS5-26555; STSI-GO-07322.02-96A
Report No.(s): NOAO-Preprint-878; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We investigate the low-mass population of the young cluster IC348 down to the deuterium-burning limit, a fiducial boundary between brown dwarf and planetary mass objects, using a new and innovative method for the spectral classification of late-type objects. Using photometric indices, constructed from HST/NICMOS narrow-band imaging, that measure the strength of the 1.9 micron water band, we determine the spectral type and reddening for every M-type star in the field, thereby separating cluster members from the interloper population. Due to the efficiency of our spectral classification technique, our study is complete from approximately 0.7 solar mass to 0.015 solar mass. The mass function derived for the cluster in this interval, dN/d log M alpha M(sup 0.5), is similar to that obtained for the Pleiades, but appears significantly more abundant in brown dwarfs than the mass function for companions to nearby sun-like stars. This provides compelling observational evidence for different formation and evolutionary histories for substellar objects formed in isolation vs. as companions. Because our determination of the IMF is complete to very low masses, we can place interesting constraints on the role of physical processes such as fragmentation in the star and planet formation process and the fraction of dark matter in the Galactic halo that resides in substellar objects.
Author
Brown Dwarf Stars; Star Formation; Planetary Evolution; Star Distribution; M Stars; Late Stars; Pre-Main Sequence Stars

20000064065 National Optical Astronomy Observatories, Tucson, AZ USA
Astrometry of the omega Centauri Hubble Space Telescope Calibration Field
Mighell, Kenneth J., Kitt Peak National Observatory, USA; May 2000; 19p; In English
Contract(s)/Grant(s): NAS5-26555; NASA Order-S-67046-F; NRA-95-OSS-16
Report No.(s): NOAO-Preprint-877; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Astrometry, on the International Celestial Reference Frame (epoch J2000.0), is presented for the Walker (1994, PASP, 106, 828) stars in the omega Centauri (=NGC 5139=C 1323-1472) Hubble Space Telescope Wide Field/Planetary Camera (WF/PC) calibration field of Harris et al. (1993, AJ, 105, 1196). Harris et al. stars were first identified on a WFPC2 observation of the omega Cen HST calibration field. Relative astrometry of the Walker stars in this field was then obtained using Walker's CCD positions and astrometry derived using the STSDAS METRIC task on the positions of the Harris et al. stars on the WFPC2 observation. Finally, the relative astrometry, which was based on the HST Guide Star Catalog, is placed on the International Celestial Reference Frame with astrometry from the USNO-A2.0 catalog. An ASCII text version of the astrometric data of the Walker stars in the omega Cen HST calibration field is available electronically in the online version of the article.
Author
Astrometry; Hubble Space Telescope; Spaceborne Astronomy; Globular Clusters

20000064070 NASA Ames Research Center, Moffett Field, CA USA

Gas and Dust Properties in Dwarf Irregular Galaxies

Jones, A. P., Search for Extraterrestrial Intelligence Inst., USA; Madden, S. C., Orme des Merisiers, France; Colgan, S. W. J., NASA Ames Research Center, USA; Geis, N., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Haas, M., Orme des Merisiers, France; Maloney, P., Colorado Univ., USA; Nikola, T., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Poglitsch, A., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; [1997], pp. 101-105; In English; Moriond Astrophysics Meeting, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We present a study of the 158 (micron)meter [C II] fine structure emission line from a sample of 11 low metallicity irregular galaxies using the NASA Kuiper Airborne Observatory (KAO). Our preliminary results demonstrate that the ratio of the 158 (micron)meter [C II] emission to the CO-12(1 yields 0) emission ranges from 6,000 to 46,000. These ratios are significantly enhanced relative to clouds within the Galaxy and to normal metallicity galaxies, which typically have values in the range 2,000 to 6,300. We also find that the [C II] emission in dwarf irregular galaxies can be up to 5% of the far-infrared (FIR) emission, a higher fraction of the FIR than in normal metallicity galaxies. We discuss these results for the dwarf irregular galaxies and compare them to those observed in normal metallicity galaxies. The enhanced 158 (micron)meter [C II] emission relative to CO-12(1 yields 0) emission can be understood in terms of the increased penetration depth of ultraviolet (UV) photons into the clouds in low metallicity environments.

Author

Dust; Dwarf Galaxies; Gases; Irregular Galaxies

20000064709 NASA Johnson Space Center, Houston, TX USA

Noble Gases in Iddingsite from the Lafayette Meteorite: Evidence for Liquid Water on Mars in the Last Few Hundred Million Years

Swindle, T. D., Lunar and Planetary Inst., USA; Treiman, A. H., Lunar and Planetary Inst., USA; Lindstrom, D. J., NASA Johnson Space Center, USA; Brkland, M. K., Lunar and Planetary Inst., USA; Cohen, B. A., Lunar and Planetary Inst., USA; Grier, J. A., Lunar and Planetary Inst., USA; Li, B., Lunar and Planetary Inst., USA; Olson, E. K., Lunar and Planetary Inst., USA; Meteoritics and Planetary Science; 2000; Volume 35, pp. 107-115; In English

Contract(s)/Grant(s): NAG5-4767; NAG5-8270; RTOP 344-31-10-17; Copyright; Avail: Issuing Activity

We analyzed noble gases from 18 samples of weathering products (”iddingsite”) from the Lafayette meteorite. Potassium-argon ages of 12 samples range from near zero to 670 +/- 91 Ma. These ages confirm the martian origin of the iddingsite, but it is not clear whether any or all of the ages represent iddingsite formation as opposed to later alteration or incorporation of martian atmospheric Ar-40. In any case, because iddingsite formation requires liquid water, this data requires the presence of liquid water near the surface of Mars at least as recently as 1300 Ma ago, and probably as recently as 650 Ma ago. Krypton and Xe analysis of a single 34 microg sample indicates the presence of fractionated martian atmosphere within the iddingsite. This also confirms the martian origin of the iddingsite. The mechanism of incorporation could either be through interaction with liquid water during iddingsite formation or a result of shock implantation of adsorbed atmospheric gas.

Author

Argon; Krypton; Xenon; Potassium; Silicates; Igneous Rocks; Meteorites

20000064710 National Optical Astronomy Observatories, Tucson, AZ USA

Neutron-Capture Elements in the Early Galaxy: Insights from a Large Sample of Metal-Poor Giants

Burris, Debra L., Oklahoma City Community Coll, USA; Pilachowski, Catherine A., National Optical Astronomy Observatories, USA; Armandroff, Taft E., National Optical Astronomy Observatories, USA; Sneden, Christopher, McDonald Observatory, USA; Cowan, John J., Oklahoma Univ., USA; Roe, Henry, California Univ., USA; June 2000; 62p; In English

Contract(s)/Grant(s): NSF AST-96-18364; NSF AST-96-18332

Report No.(s): NOAO-Preprint-883; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

New abundances for neutron-capture (n-capture) elements in a large sample of metal-poor giants from the Bond survey are presented. The spectra were acquired with the KPNO 4-m echelle and coude feed spectrographs, and have been analyzed using LTE fine-analysis techniques with both line analysis and spectral synthesis. Abundances of eight n-capture elements (SR, Y, Zr, Ba, La, Nd, Eu, Dy) in 43 stars have been derived from blue (Alambda(lambda)4070-4710 A, R approx. 20,000, S/N ratio approx. 100-200) echelle spectra and red (lambda(lambda)6100-6180 A, R approx. 22,000, S/N ratio approx. 100-200) coude spectra, and the abundance of Ba only has been derived from the red spectra for an additional 27 stars. Overall, the abundances show clear evidence for a large star-to-star dispersion in the heavy element-to-iron ratios. This condition must have arisen from individual nucleosynthetic events in rapidly evolving halo progenitors that injected newly manufactured n-capture elements into an inhomogeneous early Galactic halo interstellar medium. The new data also confirm that at metallicities [Fe/H] approx. greater than -2.4,

the abundance pattern of the heavy (Z greater than or = 56) n-capture elements in most giants is well-matched to a scaled Solar System tau-process nucleosynthesis pattern. The onset of the main tau-process can be seen at [Fe/H] approx. = -2.9; this onset is consistent with the suggestion that low mass Type 2 supernovae are responsible for the tau-process. Contributions from the s-process can first be seen in some stars with metallicities as low as [Fe/H] approx. -2.75, and are present in most stars with metallicities [Fe/H] greater than -2.3. The appearance of s-process contributions as metallicity increases presumably reflects the longer stellar evolutionary timescale of the (low-mass) s-process nucleosynthesis sites. The lighter n-capture elements (SR-Y-Zr) are enhanced relative to the heavier tau-process element abundances. Their production cannot be attributed solely to any combination of the Solar System tau- and main s-processes, but requires a mixture of material from the tau-process and from an additional n-capture process which can operate at early Galactic time. This additional process could be the weak s-process in massive (approx.25 Solar Mass) stars, or perhaps a second tau-process site, i.e. different than the site that produces the heavier (Z greater than or = 56) n-capture elements.
Author
Neutrons; Capture Effect; Galaxies; Heavy Elements; Massive Stars; Metallicity; Nuclear Reactions; Solar System

20000067652 NASA Marshall Space Flight Center, Huntsville, AL USA
Laboratory Studies of Optical Characteristics and Condensation Processes of Cosmic Dust Particles
Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; Abbas, M. M., NASA Marshall Space Flight Center, USA; Venturini, C. C., Alabama Univ., USA; [2000]; 1p; In English; 8th; Physics of Dusty Plasma, 26-28 Apr. 2000, Santa Fe, NM, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Information about the optical characteristics and physical processes involving cosmic dust particles is vital for interpretation of astronomical observations and an understanding of the formation and processing of dust in the evolutionary cycle of matter in the interstellar medium. Cosmic dust particles are formed in a variety of astrophysical environments such as in cool stellar outflows and circumstellar envelopes. Definitive knowledge of the nature, composition, and physical processes of cosmic dust grains, however, can only be inferred from astronomical observations through laboratory experiments on the analogs of hypothesized dust particles and with modeling calculations. Laboratory investigations of the nature, composition, and optical characteristics of cosmic dust particles are being, carried out at many institutions with a variety of experimental techniques. Despite a wealth of available data, however, many basic issues remain unresolved. An experimental facility based on suspension of dust particles in electrodynamic balance in a pressure/temperature controlled environment in a cavity has been operational at the NASA Marshall Space Flight Center, and is currently being employed for studies of dust particle charging mechanisms using electron beams and with UV radiation. In this paper, we discuss two general classes of experiments under planning stages that may be simultaneously carried out on this facility for cosmic dust investigations (i) Infrared optical characteristics (extinction coefficients and scattering phase functions) of the analogs of hypothesized of cosmic dust particles, such as natural and synthetic amorphous silicates with varying compositions, amorphous carbon grains, polycyclic aromatic hydrocarbons (PAHs), and icy core-mantle particles etc. The initial spectral range under consideration is 1-25 micrometers, to be extended to the far infrared region in the future (ii) Condensation of volatile gases on nucleus dust particles to be investigated for planetary and astrophysical environments.
Author
Condensing; Cosmic Dust; Optical Properties; Astrophysics; Particles

20000067677 California Inst. of Tech., Pasadena, CA USA
The ISO View of Star Forming Galaxies
Helou, George, California Inst. of Tech., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

ISO studies of normal galaxies in the local Universe have revealed basic new properties whose significant implications for the star formation process and cosmology are only starting to be understood. This review will touch on the general results of a statistical nature, and provide a quick summary of the profusion of exciting results on individual objects. In the mid-infrared, PHT-S has established that the spectra of star forming galaxies between 6 and-13microns are dominated by the Aromatic Features in Emission (AFE), and show little variation as a function of the heating intensity. The Carriers of the AFE (CAFE) are thus a universal component of dust with standard properties, and contribute between 10 and 25% of the total dust luminosity. In addition to AFE, the spectra show a low-level continuum detectable at wavelengths longer than 3.5microns whose origin is still under investigation. The mid-infrared colors formed as the ratio of flux densities in the 6.75micron and the 15micron bands of ISO-CAM remain essentially constant and near unity for quiescent and mildly active galaxies. As dust heating increases further, the 15micron flux increases steeply compared to 6.75microns, indicating that dust heated to 100K<Tislessthan200Kbecomesasinificant component. Such hot dust is presumably located within or just outside HII regions. At the other end of the spectrum, photometry at 120-200microns using ISO-PHOT is starting to constrain the distribution of dust temperatures at the low end of the temperature scale. From LWS data, the far-infrared fine-structure lines of [CII] and [OI], which provide most of the cooling for warm atomic

gas, show variations that have remained controversial in their interpretation. In particular, as the galaxy become more active in star formation, its [CII] flux weakens relative to total dust emission while the [OI] does not. This behavior has attracted much interest because it extrapolates to the most active galaxies, making them weaker in [CII] than previously expected. Several explanations for the effect have been advanced, and will be discussed in this review. Spectroscopy with SWS has measured molecular hydrogen in galaxies, providing a powerful handle on the warm molecular gas content. SWS and CAM-CVF studies targeting ionic fine-structure lines have demonstrated their value as diagnostics of the radiation field.
Author
Star Formation; Active Galaxies; Radiation Distribution; Cosmology; Fine Structure

91
LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see 18 Spacecraft Design, Testing and Performance.

20000061490 NASA Kennedy Space Center, Cocoa Beach, FL USA
Titan III Mars Observer Arrival and Uncrating at PHSF
Jul. 09, 1992; In English; Videotape: 8 min. 25 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000081540; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Live footage of the uncrating and the arrival of the Titan III Mars Observer to the Payload Hazardous Servicing Facility (PHSF) is presented. The Mars Observer's mission is to study the surface, atmosphere, interior and magnetic field of Mars from Martian orbit. At the PHSF, fueling of the spacecraft with its orbit insertion and attitude control propellants will occur. This will be followed by mating to the Transfer Orbit Stage (TOS). This is the upper stage that will provide the final thrust to propel the spacecraft on its 11-month journey to Mars.
CASI
Mars (Planet); Mars Missions; Mars Observer; Payloads; Titan 3 Launch Vehicle

20000061966 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Report on the Loss of the Mars Polar Lander and Deep Space 2 Missions
Albee, Arden, California Inst. of Tech., USA; Battel, Steven, Battel Engineering, USA; Brace, Richard, Jet Propulsion Lab., California Inst. of Tech., USA; Burdick, Garry, Jet Propulsion Lab., California Inst. of Tech., USA; Casani, John, Jet Propulsion Lab., California Inst. of Tech., USA; Lavell, Jeffrey, NASA Langley Research Center, USA; Leising, Charles, Jet Propulsion Lab., California Inst. of Tech., USA; MacPherson, Duncan, Jet Propulsion Lab., California Inst. of Tech., USA; Burr, Peter; Dipprey, Duane; Mar. 22, 2000; 178p; In English; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

NASA's Mars Surveyor Program (MSP) began in 1994 with plans to send spacecraft to Mars every 26 months. Mars Global Surveyor (MGS), a global mapping mission, was launched in 1996 and is currently orbiting Mars. Mars Surveyor '98 consisted of Mars Climate Orbiter (MCO) and Mars Polar Lander (MPL). Lockheed Martin Astronautics (LMA) was the prime contractor for Mars Surveyor '98. The Jet Propulsion Laboratory (JPL), California Institute of Technology, manages the Mars Surveyor Program for NASA's Office of Space Science. MPL was developed under very tight funding constraints. The combined development cost of MPL and MCO, including the cost of the two launch vehicles, was approximately the same as the development cost of the Mars Pathfinder mission, including the cost of its single launch vehicle. The MPL project accepted the challenge to develop effective implementation methodologies consistent with programmatic requirements.
Derived from text
Launch Vehicles; Losses; Mars Atmosphere; Space Probes; Mars Polar Lander; Costs

20000062312 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Rock Abrasion on Mars: Clues from the Pathfinder and Viking Landing Sites
Bridges, N. T., Jet Propulsion Lab., California Inst. of Tech., USA; Parker, T. J., Jet Propulsion Lab., California Inst. of Tech., USA; Kramer, G. M., Minnesota Univ., USA; [2000]; 3p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A significant discovery of the Mars Pathfinder (MPF) mission was that many rocks exhibit characteristics of ventifacts, rocks that have been sculpted by saltating particles. Diagnostic features identifying the rocks as ventifacts am elongated pits, flutes, and grooves (collectively referred to as "flutes" unless noted otherwise). Faceted rocks or rock portions, circular pits, rills, and possibly polished rock surfaces are also seen and could be due, to aeolian abrasion. Many of these features were initially identified in rover images, where spatial resolution generally exceeded that of the IMP (Imager for Mars Pathfinder) camera. These images had two

major limitations: 1) Only a limited number of rocks were viewed by the rover, biasing flute statistics; and 2) The higher resolution obtained by the rover images and the lack of such pictures at the Viking landing sites hampered comparisons of rock morphologies between the Pathfinder and Viking sites. to avoid this problem, rock morphology and ventifact statistics have been examined using new ”super-resolution” IMP and Viking Lander images. Analyses of these images show that: 1) Flutes are seen on about 50% or more of the rocks in the near field at the MPF site; 2) The orientation of these flutes is similar to that for flutes identified in rover images; and 3) Ventifacts are significantly more abundant at the Pathfinder landing site than at the two Viking Landing sites, where rocks have undergone only a limited amount of aeolian abrasion. This is most likely due to the ruggedness of the Pathfinder site and a greater supply of abrading particles available shortly after the Arcs and Tiu Valles outflow channel floods.
Derived from text
Landing Sites; Abrasion; Rocks; Mars Pathfinder; Mars Surface

20000062727 NASA Kennedy Space Center, Cocoa Beach, FL USA
TITAN III Launch Replays
Sep. 25, 1992; In English; Videotape: 9 min. playing time, in color, without sound
Report No.(s): NONP-NASA-VT-2000081549; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
Footage shows several views of the launching of the Mars Observer Titan III satellite. Scenes include different angle and camera views of the launch. Also shown are panoramic views of the launch vehicle on the launch pad.
CASI
Titan; Launch Vehicles; Titan Project; Mars Observer; Launching

20000063384 NASA Kennedy Space Center, Cocoa Beach, FL USA
Mars Observer Press Conference JPL
Aug. 24, 1993; In English; Videotape: 55 min. 1 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-200081550; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
The Mars Observer mission spacecraft was primarily designed for exploring Mars and the Martian environment. The Mars Observer was launched on September 25, 1992. The spacecraft was lost in the vicinity of Mars on August 21, 1993 when the spacecraft began its maneuvering sequence for Martian orbital insertion. This videotape shows a press briefing, held after the spacecraft had not responded to attempts to communicate with it, to explain to the press the problems and the steps that were being taken to re-establish communication with the spacecraft. The communications had been shutdown prior to the orbital insertion burn to protect the instruments. At the time of the press conference, the communications system was still not operational, and attempts were being made to re-establish communication. Bob McMillan of the Public Affairs Office at JPL gives the initial announcement of the continuing communication problem with the spacecraft. Mr. McMillan introduces William Piotrowski, acting director of solar system exploration, who reiterates that there is indeed no communication with the Observer spacecraft. He is followed by Glenn Cunningham, the Project Manager of the Mars Observer who speaks about the attempts to re-establish contact. Mr. Cunningham is followed by Satenios Dallas, the Mission Manager for the Mars Observer Project, who speaks about the sequence of events leading up to the communication failure, and shows an animated video presenting the orbital insertion maneuvers. The briefing was then opened up for questions from the assembled press, both at JPL and at the other NASA Centers. The questions are about the possible reasons for the communication failure, and the attempts to restore communications with the spacecraft. Dr. Arden L. Albee, chief scientist for the Mars Observer Mission, joins the other panel members to answer questions. At the end of the press briefing the animation of the Mars orbital insertion is shown again.
CASI
Failure; Orbit Insertion; Mars Probes; Mars Missions

20000063385 NASA Kennedy Space Center, Cocoa Beach, FL USA
Mars Observer Lecture: Mars Orbit Insertion
Dodd, Suzanne R., Personal Name; Aug. 17, 1993; In English; Videotape: 45 min. 45 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000081538; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
The Mars Observer mission spacecraft was primarily designed for exploring Mars and the Martian environment. The Mars Observer was launched on September 25, 1992. The spacecraft was lost in the vicinity of Mars on August 21, 1993 when the spacecraft began its maneuvering sequence for Martian orbital insertion. This videotape shows a lecture by Suzanne R. Dodd, the Mission Planning Team Chief for the Mars Observer Project. Ms Dodd begins with a brief overview of the mission and the timeline from the launch to orbital insertion. Ms Dodd then reviews slides showing the trajectory of the spacecraft on its trip to Mars. Slides of the spacecraft being constructed are also shown. She then discusses the Mars orbit insertion and the events that will occur to move the spacecraft from the capture orbit into a mapping orbit. During the trip to Mars, scientists at JPL had devised a new strat-

egy, called Power In that would allow for an earlier insertion into the mapping orbit. The talk summarizes this strategy, showing on a slide the planned transition orbits. There are shots of the Martian moon, Phobos, taken from the Viking spacecraft, as Ms Dodd explains that the trajectory will allow the orbiter to make new observations of that moon. She also explains the required steps to prepare for mapping after the spacecraft has achieved the mapping orbit around Mars. The lecture ends with a picture of Mars from the Observer on its approach to the planet.
CASI
Orbit Insertion; Spacecraft Orbits; Mars Probes; Earth-Mars Trajectories; Transfer Orbits; Spacecraft Maneuvers; Orbital Maneuvers

20000064061 Hawaii Univ., Hawaii Inst. of Geophysics and Planetology, Honolulu, HI USA
Formation of a Martian Pyroxenite: A Comparative Study of the Nakhlite Meteorites and Theo's Flow
Friedman, R. C., Hawaii Univ., USA; Taylor, G. J., Hawaii Univ., USA; Treiman, A. H., Lunar and Planetary Inst., USA; Meteorites and Planetary Science; 1999; Volume 34, pp. 919-932; In English
Contract(s)/Grant(s): NAG5-4212; NAGw-3684; NAGw-5098
Report No.(s): SOEST-Publ-4886; HIGP-Publ-1077; Copyright; Avail: Issuing Activity

The unusual composition of the nakhlites, a group of pyroxenitic martian meteorites with young ages, presents an opportunity to learn about nonbasaltic magmatic activity on another planet. However, the limited number of these meteorites makes unraveling their history difficult. A promising terrestrial analog for the formation of the nakhlites is Theo's Flow in Ontario, Canada. This atypical, 120 m-thick flow differentiated in place, forming distinct layered lithologies of peridotite, pyroxenite, and gabbro. Theo's pyroxenite and the nakhlites share strikingly similar petrographies, with concentrated euhedral to subhedral augite grains set in a plagioclase-rich matrix. These two suites of rocks also share specific petrologic features, mineral and whole-rock compositional features, and size and spatial distributions of cumulus grains. The numerous similarities suggest that the nakhlites formed by a similar mechanism in a surface lava flow or shallow intrusion. Their formation could have involved settling of crystals in a phenocryst-laden flow or in situ nucleation and growth of pyroxenes in an ultramafic lava flow. The latter case is more likely and requires steady-state nucleation and growth of clusters of pyroxene grains (and olivine in the nakhlites), circulating in a strongly convecting melt pool, followed by settling and continued growth in a thickening cumulate pile. Trapped pockets of intercumulus liquid in the pile gradually evolved, finally growing Fe-enriched rims on cumulus grains. With sufficient evolution, the melt reached plagioclase supersaturation, causing rapid growth of plagioclase sprays and late-stage mesostasis growth.
Author
Meteorites; Peridotite; Pyroxenes; Mineralogy; Nakhlites

20000064115 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA
Geology of the Smythii and Marginis Region of the Moon: Using Integrated Remotely Sensed Data
Gillis, Jeffrey J., Washington Univ., USA; Spudis, Paul D., Lunar and Planetary Inst., USA; Journal of Geophysical Research; Feb. 25, 2000; ISSN 0148-0227; Volume 105, No. E2, pp. 4217-4233; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG5-6784
Report No.(s): Paper 1999JE001111; LPI-Contrib-985; Copyright; Avail: Issuing Activity

We characterized the diverse and complex geology of the eastern limb region of the Moon using a trio of remote-sensing data sets: Clementine, Lunar Prospector, and Apollo. On the basis of Clementine-derived iron and titanium maps we classify the highlands into low-iron (3-6 wt % FeO) and high-iron (6-9 wt % FeO) units. The association of the latter with basalt deposits west of Smythii basin suggests that the highland chemical variation is the result of mixing between basalt and highland lithologies. Mare Smythii and Mare Marginis soils are compositionally similar, containing moderate iron (15-18 wt % FeO) and titanium (2.5-3.5 wt % TiO2). Smythii basin, in addition to the basalt deposits, contains an older, moderate-albedo plains unit. Our investigation reveals that the dark basin plains unit has a distinct albedo, chemistry, and surface texture and formed as a result of impact-mixing between highland and mare lithologies in approximately equal proportions. Clementine iron and maturity maps show that swirls along the northern margin of Mare Marginis have the same iron composition as the surrounding nonswirl material and indicate that the swirl material is bright because of its low agglutinate content. Gravity data for the eastern limb show high, positive Bouguer gravity anomalies for areas of thin basalt cover (e.g., Smythii basin and complex craters Joliot, Lomonosov, and Neper). We deduce that the uplift of dense mantle material is the primary (and mare basaltic fill the secondary) source for generating the concentration of mass beneath large craters and basins.
Author
Moon; Remote Sensing; Lunar Geology; Lunar Soil; Lunar Composition

20000064708 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Photochemistry of Saturn's Atmosphere, 1, Hydrocarbon Chemistry and Comparisons with ISO Observations

Moses, Julianne I., Lunar and Planetary Inst., USA; Bezard, Bruno, Observatoire de Paris-Meudon, France; Lellouch, Emmanuel, Observatoire de Paris-Meudon, France; Gladstone, G. Randall, Southwest Research Inst., USA; Feuchtgruber, Helmut, Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Allen, Mark, Jet Propulsion Lab., California Inst. of Tech., USA; Icarus; 2000; ISSN 0019-1035; Volume I43, pp. 244-298; In English

Contract(s)/Grant(s): NASw-4574; NAG5-6915

Report No.(s): LPI-Contrib-982; Copyright; Avail: Issuing Activity

To investigate the details of hydrocarbon photochemistry on Saturn, we have developed a one-dimensional diurnally averaged model that couples hydrocarbon and oxygen photochemistry, molecular and eddy diffusion, radiative transfer, and condensation. The model results are compared with observations from the Infrared Space Observatory (ISO) to place tighter constraints on molecular abundances, to better define Saturn's eddy diffusion coefficient profile, and to identify important chemical schemes that control the abundances of the observable hydrocarbons in Saturn's upper atmosphere. From the ISO observations, we determine that the column 12 densities of CH3, CH3C2H, and C4H2 above 10 mbar are 4 (sup +2) (sub -1.5) x 10 (exp 13) cm (sup -2), (1.1 plus or minus 0.3) x 10 (exp 15) cm (exp -2), and (1.2 plus or minus 0.3) x 10 (exp 14) cm (sup -2), respectively. The observed ISO emission features also indicate C2H2 mixing ratios of 1.2 (sup +0.9) (sub -0.6) x 10 (exp -6) at 0.3 mbar and (2.7 plus or minus 0.8) x 10 (exp -7) at 1.4 mbar, and a C2H6 mixing ratio of (9 plus or minus 2.5) x 10 (exp -6) at 0.5 mbar. Upper limits are provided for C2H4, CH2CCH2, C3H8, and C6H2 sensitivity of the model results to variations in the eddy diffusion coefficient profile, the solar flux, the CH4 photolysis branching ratios, the atomic hydrogen influx, and key reaction rates are discussed in detail. We find that C4H2 and CH3C2H are particularly good tracers of important chemical processes and physical conditions in Saturn's upper atmosphere, and C2H6 is a good tracer of the eddy diffusion coefficient in Saturn's lower stratosphere. The eddy diffusion coefficient must be smaller than approximately 3 x 10 (exp 4) sq cm s (sup -1) at pressures greater than 1 mbar in order to reproduce the C2H6 abundance inferred from ISO observations. The eddy diffusion coefficients in the upper stratosphere could be constrained by observations of CH3 radicals if the low-temperature chemistry of CH3 were better understood. We also discuss the implications of our modeling for aerosol formation in Saturn's lower stratosphere-diacetylene, butane, and water condense between approximately 1 and 300 mbar in our model and will dominate stratospheric haze formation at nonauroral latitudes. Our photochemical models will be useful for planning observational sequences and for analyzing data from the upcoming Cassini mission.

Author

Saturn (Planet); Saturn Atmosphere; Photochemical Reactions; Upper Atmosphere; Infrared Astronomy; Mathematical Models

20000064716 NASA Kennedy Space Center, Cocoa Beach, FL USA

Titan III Mars Observer Press Showing at the PHSF

Aug. 13, 1992; In English; Videotape: 2 min. 30 sec. playing time, in color, no sound

Report No.(s): NONP-NASA-VT-2000081554; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Live footage of the Titan 3 Mars Observer is shown at the Payload Hazardous Servicing Facility (PHSF). The Mars Observer is a NASA mission to study the surface, atmosphere, interior and magnetic field of Mars from Martian orbit.

CASI

Mars Observer; Payloads; Titan 3 Launch Vehicle

20000065630 NASA Kennedy Space Center, Cocoa Beach, FL USA

Mars Observer Press Conference

Aug. 25, 1993; In English; Videotape: 18 min. 5 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000081551; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

Footage shows Bob MacMillin, NASA's Public Information Office, as he introduces the Mars Observer Project Manager, Glen Cunningham. Glen is shown addressing the current status of the Mars Observer communication system, the inability of NASA to establish contact, and the action that is currently being taken to establish contact with the spacecraft. Glen is also seen answering questions from both the audience as well as other NASA Centers.

CASI

Conferences; Mars Observer

20000065631 NASA Kennedy Space Center, Cocoa Beach, FL USA
TITAN III/Mars Observer Flow Tape for Playback
Aug. 11, 1992; In English; Videotape: 10 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000081553; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Footage shows components for the Mars Observer Spacecraft during checkout. Arrival of the navigation system is also shown.
CASI
Titan 3 Launch Vehicle; Mars Observer

20000065653 National Air and Space Museum, Center for Earth and Planetary Studies, Washington, DC USA
Lunar Polar Topography Derived from Clementine Stereoimages
Cook, A. C., National Air and Space Museum, USA; Watters, T. R., National Air and Space Museum, USA; Robinson, M. S., Northwestern Univ., USA; Spudis, P. D., Lunar and Planetary Inst., USA; Bussey, D. B. J., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Journal of Geophysical Research; May 25, 2000; ISSN 0148-0227; Volume 105, No. E5, pp. 12,023-12,033; In English
Report No.(s): Paper-199JE001083; Copyright; Avail: Issuing Activity

Clementine stereoimagery has been used to produce digital elevation models of the Moon, at a scale of about 1 km/pixel. These models cover regions poleward of 60 degree in both hemispheres and reveal topography beyond that covered by the Clementine laser altimeter or Earth-based radar. by combining these polar terrain models with the current Clementine laser altimeter data we have produced a global topographic map of the lunar surface. Several topographic features in the new polar topographic data set are described, including three previously unrecognized pre-Nectarian impact basins. Several known basins have also been mapped, including the southern extent of the South Pole-Aitken basin, and other previously suspected basins have been verified.
Author
Lunar Surface; Lunar Topography; Relief Maps; Stereophotography; Selenography; Selenology; Moon; Lunar Maps

20000067676 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Drift Loss-Cone Distributions Electrons in the Jovian Synchrotron Zone from 06 and VIP4 Models
Wang, K., Jet Propulsion Lab., California Inst. of Tech., USA; Bolton, S. J., Jet Propulsion Lab., California Inst. of Tech., USA; Gulkis, S., Jet Propulsion Lab., California Inst. of Tech., USA; Levin, S. M., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Relativistic electrons (10-50 MeV) play an important role to account for the observed synchrotron decimetric radiation in Jupiter's inner radiation belt (L is less than 4). A detailed knowledge of these electron distributions is required to understand the synchrotron emission observations and the associated on-going physical processes. In this paper, instead of assuming electrons drift along constant L-shell at the magnetic equator as many earlier studies adopted, we calculate the size of the theoretical drift-loss cone for relativistic electrons using both the O6 and VIP4 magnetic field models. Model maps of the synchrotron emission for specific electron distributions are shown for comparison.
Author
Relativistic Particles; Electrons; Electron Distribution; High Energy Electrons; Synchrotron Radiation

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SOLAR PHYSICS

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

20000067637 NASA Marshall Space Flight Center, Huntsville, AL USA
The Solar-B Mission
Davis, John M., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 31st, 19-22 Jun. 2000, Stateline, NV, USA; Sponsored by American Astronomical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Solar-B mission is a joint enterprise between Japan, the United States of America and the UK. The collaboration is led by ISAS, the Japanese Institute for Space and Astronautical Science (ISAS), NASA and PPARC (Particle Physics and Astrophysics Research Council) play supporting roles in the development of the scientific objectives and provision of the scientific instruments. The mission's primary objective is to conduct a systems study of the solar atmosphere through the acquisition of coordinated measurements of the photosphere, the transition region/low corona and the upper corona using three instruments: an optical telescope, an extreme ultraviolet imaging spectrometer and a soft x-ray telescope. Drs. Saku Tsuneta (NAOJ) and Alan

Title (LMSAL) lead the optical imaging team. The optical telescope is a 50-cm aperture, diffraction limited, Gregorian. The focal plane package will record high resolution images, Dopplergrams, and vector magnetic fields on spatial scales dominated by elemental photospheric flux tubes, and over a field of view large enough to contain small active regions. Drs. Tetsuya Watanabe, Len Culhane (MSSL) and George Doschek (NRL) led the EUV imaging and spectroscopy team. The EUV telescope has a 15-cm primary mirror feeding a toroidal grating. The optics have multiplayer coatings which select two wavebands between 180-204 A and 250-290 A. Drs. Kiyoto Shibasaki (NAOJ) and Leon Golub (SAO) lead the X-ray imaging team. The x-ray telescope will provide full disk, soft x-ray images with twice the spatial resolution of the Yohkoh SXT and enhanced sensitivity to longer (>40 A) wavelengths. The launch of Solar-B, into a sun-synchronous orbit, is scheduled for August 2004. Solar-B is the second mission in the Sun-Earth Connection, Solar-Terrestrial Probe Program which is managed by the Goddard Space Flight Center. The Science Directorate of the Marshall Space Flight Center manages the Solar-B Project for the ST Probe Project Office. This paper discusses the objectives, specifications, and design of the scientific instruments as presented at the Preliminary Design Review held at MSFC in May 2000.
Author
Space Missions; Solar Atmosphere; Photosphere; X Ray Imagery; Solar Terrestrial Interactions

93
SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see 52 Aerospace Medicine. For theory see 73 Nuclear Physics.

20000063513 Smithsonian Astrophysical Observatory, Cambridge, MA USA
A Comparison of the Extra Nuclear X-ray and Radio Features in M87
Harris, D. E., Smithsonian Astrophysical Observatory, USA; Owen, F., National Radio Astronomy Observatory, USA; Biretta, J. A., Space Telescope Science Inst., USA; Junor, W., New Mexico Univ., USA; Feb. 24, 2000; 4p; In English
Contract(s)/Grant(s): NAS5-99002; NSF AST-98-0307
Report No.(s): astro-ph/0002464; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

ROSAT High Resolution Imager (HRI) data from eight observations have been co-added to obtain an effective exposure of 230 ksec. We have identified a number of features and regions with excess X-ray brightness over that from a circularly symmetric model of the well known hot gas component. A prominent 'spur' extends 4feet from the vicinity of knot A towards the south-west. The brightness to the south and east of this spur is significantly higher than that to the north and west. Excess brightness is also found to the East of the nucleus, with a local maximum centered on the eastern radio lobe 3 feet from the core. There are two well known relationships between radio and X-ray emission for radio galaxies in clusters: coincidence of emissions because the X-rays come from inverse Compton or synchrotron processes; and anti-coincidence caused by exclusion of hot gas from radio entities. We present a radio/X-ray comparison to determine if either of these relationships can be isolated in M87. The greatest obstacle we face is the unknown projection which affects both bands.
Author
X Rays; Brightness; Exposure; Radio Emission; Image Resolution

20000064086 Smithsonian Astrophysical Observatory, Cambridge, MA USA
X-Ray Variability in M87 ***Final Report, 1 Jul. 1997 - 30 Oct. 1999***
Harris, Daniel E., Smithsonian Astrophysical Observatory, USA; Biretta, J. A., Space Telescope Science Inst., USA; Junor, W., New Mexico Univ., USA; June 2000; 24p; In English
Contract(s)/Grant(s): NAG5-4830
Report No.(s): Preprint-Series-4458; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present the evidence for X-ray variability from the core and from knot A in the M87 jet based on data from two observations with the Einstein Observatory High Resolution Imager (HRI) and three observations with the ROSAT HRI. The core intensity showed a 16% increase in 17 months ('79-'80); a 12% increase in the 3 years '92 to '95; and a 17% drop in the last half of 1995. The intensity of knot A appears to have decreased by 16% between 92Jun and 95Dec. Although the core variability is consistent with general expectations for AGB nuclei, the changes in knot A provide constraints on the x-ray emission process and geometry. Thus we predict that the x-ray morphology of knot A will differ significantly from the radio and optical structure.
Author
X Rays; Variability; Active Galactic Nuclei; Elliptical Galaxies; Luminous Intensity

20000064089 Smithsonian Astrophysical Observatory, Cambridge, MA USA

X-ray Variability in M87

Harris, D. E., Smithsonian Astrophysical Observatory, USA; Biretta, J. A., Space Telescope Science Inst., USA; Junor, W., New Mexico Univ., USA; Monthly Notices of the Royal Astronomical Society; 1997; Volume 284, pp. L21-L27; In English
Contract(s)/Grant(s): NAS5-30934; NAG5-2957; Copyright; Avail: Issuing Activity

We present evidence for X-ray variability from the core and from knot A in the M87 jet based on data from two observations with the Einstein Observatory High Resolution Imager (HRI) and three observations with the ROSAT HRI. The core intensity showed a 16 per cent increase in 17 months (1979-80); a 12 per cent increase in the 3 years 1992 to 1995; and a 17 per cent drop in the last half of 1995. The intensity of knot A appears to have decreased by 16 per cent between 1992 June and 1995 December. Although the core variability is consistent with general expectations for AGN, the changes in knot A provide constraints on the X-ray emission process and geometry. Thus we predict that the X-ray morphology of knot A will differ significantly from the radio and optical structure.

Author

X Rays; Variability; Elliptical Galaxies; Morphology

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Optical Variability of Blazars

Ghosh, K. K., NASA Marshall Space Flight Center, USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; Sadun, A. C., Colorado Univ., USA; Soundararajaperumal, S., National Academy of Sciences - National Research Council, USA; Astrophysical Journal Supplement Series; March 2000; Volume 127, No. 1, pp. 11-26; In English; Copyright; Avail: Issuing Activity

In this paper we show the results of our monitoring the flux variability of 15 blazars, within the redshift range of 0.07 - 2.06, all with a visual magnitude range between 14 and 20 mag. Because blazars have displayed variability on diverse timescales, we have chosen to study them over both short and long timescales, ranging from minutes to years. These blazars were observed on 58 nights between 1995 March and 1998 June. Individual sources are discussed in detail. For example, one of our sources, Mrk 501, showed microvariability of as much as 0.13 mag change within 12 minutes. The usual parameters for size, mass, and luminosity are calculated. Relativistic beaming is implied by the data. We also searched for correlations between amplitude of variability, redshift, and luminosity. We found few, if any, such correlations. Discussion and conclusions are given for these and other results as implied by the data.

Author

Blazars; Variability; Optical Control; Time Dependence; Computation

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The Intensity Distribution of Faint Gamma-Ray Bursts Detected with BATSE

Kommers, Jefferson M., Massachusetts Inst. of Tech., USA; Lewin, Walter H. G., Massachusetts Inst. of Tech., USA; Kouveliotou, Chryssa, Universities Space Research Association, USA; VanParadijs, Jan, Alabama Univ., USA; Pendleton, Geoffrey N., Alabama Univ., USA; Meegan, Charles A., NASA Marshall Space Flight Center, USA; Fishman, Gerald J., NASA Marshall Space Flight Center, USA; Astrophysical Journal; Apr. 20, 2000; Volume 533, pp. 696-709; In English
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We have recently completed a search of 6 years of archival BATSE data for gamma-ray bursts (GRBS) that were too faint to activate the real-time burst detection system running on board the spacecraft. These ”nontriggered” bursts can be combined with the ”triggered” bursts detected on board to produce a GRB intensity distribution that reaches peak fluxes a factor of approximately 2 lower than could be studied previously. The value of the <viv (submax) statistic (in Euclidean space) for the bursts we detect is 0.177 plus or minus 0.006. This surprisingly low value is obtained because we detected very few bursts on the 4.096 s and 8.192 s timescales (where most bursts have their highest signal-to-noise ratio) that were not already detected on the 1.024 s timescale. If allowance is made for a power-law distribution of intrinsic peak luminosities, the extended peak flux distribution is consistent with models in which the redshift distribution of the gamma-ray burst rate approximately traces the star formation history of the universe. We argue that this class of models is preferred over those in which the burst rate is independent of redshift. We use the peak flux distribution to derive a limit of 10% (99% confidence) on the fraction of the total burst rate that could be contributed by a spatially homogeneous (in Euclidean space) subpopulation of burst sources, such as type lb/c supernovae. These results lend support to the conclusions of previous studies predicting that relatively few faint ”classical” GRBs will be found below the BATSE onboard detection threshold.

Author

Gamma Ray Bursts; Mathematical Models; Gamma Ray Observatory; Luminous Intensity; Astrophysics

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Cosmic rays - possible generator of electrostatic field in earth atmosphere

Matora, I. M.; Semenova, I. A.; Shakun, N. G.; Shishlyannikov, P.; Dec. 31, 1998; 11p; In Russian; In English

Report No.(s): DE99-607983; JINR-R-1-98-68; No Copyright; Avail: Department of Energy Information Bridge

Closeness to the 1 probability of an inversion of the total electric current, generated by the primary relativistic protons and other hadrons of cosmic rays (CR), from positive at the entrance into the atmosphere to negative at the earth surface is shown. The inversion appears as a result of the fact that the penetration ability of the shower electrons, the direction of the velocities of which is close to that of the primary CR flow, exceeds the paths of the secondary positive ions by more than one order of magnitude.

NTIS

Cosmic Rays; Electrostatic Generators; Electric Fields

20000065673 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR

Possible estimation of atmospheric Cherenkov light parameters

Aleksandrov, L.; Brankova, M.; Kirov, I.; Mavrodiev, S.; Mishev, A.; Dec. 31, 1998; 15p; In English

Report No.(s): DE99-607977; JINR-E-2-98-48; No Copyright; Avail: Department of Energy Information Bridge

A method for analysis of extensive air showers initiated by primary gamma quanta of primary protons and nuclei in the atmosphere is presented. The method is based on measuring of Cherenkov light distribution in showers. A new approximation of the lateral and radial distributions is obtained on the basis of a nonlinear overdetermined inverse problem solution. The concrete mathematical model is created by analysis of recent measurements carried out by the Cherenkov wide angle timing telescope HOTOVO. The model is tested on simulated data obtained with the code CORSIKA. The method is applied to different sets of detectors of CELESTE array. A new detector array for optimal estimation of Cherenkov flux parameters is proposed.

NTIS

Meteorological Parameters; Cosmic Ray Showers

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