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Langley Research Center

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Scientific and Technical Aerospace Reports (STAR) is an electronic abstract journal, listing citations with abstracts for aerospace-related reports obtained from worldwide sources. It is electronically published biweekly and announces documents that have recently been entered into the NASA Scientific and Technical Information (STI) Database. The documents are of the following types:

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

Indexes

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

Subject Term Index

Personal Author Index

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Subject Categories of the Division A. Aeronautics

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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 3

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 7

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 9

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*.

09 Research and Support Facilities (Air) 12

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

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12 Astronautics (General) 13

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*.

13 Astrodynamics 15

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

14 Ground Support Systems and Facilities (Space) 17

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

15 Launch Vehicles and Launch Operations 17

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 18

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 18

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 19

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 20

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 21

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*.

Subject Categories of the Division C. Chemistry and Materials

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

23 Chemistry and Materials (General) 23

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 24

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

25 Inorganic, Organic, and Physical Chemistry 27

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 31

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

27 Nonmetallic Materials 33

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 37

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 38

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

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

31 Engineering (General) 39

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 40

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 44

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 49

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 52

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 57

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 58

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 60

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

39 Structural Mechanics 61

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

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

42 Geosciences (General) 61

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 71

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 79

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 84

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

46 Geophysics 93

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 98

Includes weather observation forecasting and modification.

48 Oceanography 106

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*.

Subject Categories of the Division F. Life Sciences

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

51 Life Sciences (General) 107

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 108

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 111

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

54 Man/System Technology and Life Support 112

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*..

Subject Categories of the Division G. Mathematical and Computer Sciences

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

59 Mathematical and Computer Sciences (General) 112

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

61 Computer Programming and Software 114

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 116

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 117

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

64 Numerical Analysis 119

Includes iteration, differential and difference equations, and numerical approximation.

66 Systems Analysis and Operations Research 119

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

67 Theoretical Mathematics 121

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

Subject Categories of the Division H. Physics

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70 Physics (General) 121

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 122

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 123

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

73 Nuclear Physics 126

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

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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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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.*

Subject Categories of the Division I. Social and Information Sciences

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

80 Social and Information Sciences (General) 139

Includes general research topics related to sociology; educational programs and curricula.

81 Administration and Management 139

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82 Documentation and Information Science 140

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

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84 Law, Political Science and Space Policy 144

Includes aviation law; space law and policy; international law; international cooperation; and patent policy.

Subject Categories of the Division J. Space Sciences

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

89 Astronomy 145

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90 Astrophysics 149

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

91 Lunar and Planetary Science and Exploration 155

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*.

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93 Space Radiation 165

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*

Key

1. Document ID Number; Corporate Source
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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 38, AUGUST 25, 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.

20000076641 NASA Langley Research Center, Hampton, VA USA
Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplement 417
July 2000; 92p; In English
Report No.(s): NASA/SP-2000-7037/SUPPL417; NAS 1.21:7037/SUPPL417; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database.

Author
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20000076806 NASA Langley Research Center, Hampton, VA USA
Future Challenges and Opportunities in Aerodynamics
Kumar, Ajay, NASA Langley Research Center, USA; Hefner, Jerry N., NASA Langley Research Center, USA; [2000]; 16p; In English; 22nd; International Council of the Aeronautical Sciences, 27 Aug. - 1 Sep. 2000, Harrogate, UK; Sponsored by International Council of the Aeronautical Sciences, Unknown
Report No.(s): ICAS Paper 2000-0.2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Investments in aeronautics research and technology have declined substantially over the last decade, in part due to the perception that technologies required in aircraft design are fairly mature and readily available. This perception is being driven by the fact that aircraft configurations, particularly the transport aircraft, have evolved only incrementally, over last several decades. If however, one considers that the growth in air travel is expected to triple in the next 20 years, it becomes quickly obvious that the evolutionary development of technologies is not going to meet the increased demands for safety, environmental compatibility, capacity, and economic viability. Instead, breakthrough technologies will he required both in traditional disciplines of aerodynamics, propulsion, structures, materials, controls, and avionics as well as in the multidisciplinary integration of these technologies into the design of future aerospace vehicles concepts. The paper discusses challenges and opportunities in the field of aerodynamics over the next decade. Future technology advancements in aerodynamics will hinge on our ability, to understand, model, and control complex, three-dimensional, unsteady viscous flow across the speed range. This understanding is critical for developing innovative flow and noise control technologies and advanced design tools that will revolutionize future aerospace vehicle systems and concepts. Specifically, the paper focuses on advanced vehicle concepts, flow and noise control technologies, and advanced design and analysis tools.

Author
Aerodynamics; Three Dimensional Flow; Unsteady Flow; Viscous Flow

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.

20000074481 NASA Langley Research Center, Hampton, VA USA
A Sample of NASA Langley Unsteady Pressure Experiments for Computational Aerodynamics Code Evaluation
Schuster, David M., NASA Langley Research Center, USA; Scott, Robert C., NASA Langley Research Center, USA; Bartels, Robert E., NASA Langley Research Center, USA; Edwards, John W., NASA Langley Research Center, USA; Bennett, Robert M., NASA Langley Research Center, USA; [2000]; 28p; In English; Fluids 2000 Conference and Exhibit, 19-22 Jun. 2000, Denver, CO, USA
Report No.(s): AIAA Paper 2000-2602; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

As computational fluid dynamics methods mature, code development is rapidly transitioning from prediction of steady flowfields to unsteady flows. This change in emphasis offers a number of new challenges to the research community, not the least of which is obtaining detailed, accurate unsteady experimental data with which to evaluate new methods. Researchers at NASA Langley Research Center (LaRC) have been actively measuring unsteady pressure distributions for nearly 40 years. Over the last 20 years, these measurements have focused on developing high-quality datasets for use in code evaluation. This paper provides a sample of unsteady pressure measurements obtained by LaRC and available for government, university, and industry researchers to evaluate new and existing unsteady aerodynamic analysis methods. A number of cases are highlighted and discussed with attention focused on the unique character of the individual datasets and their perceived usefulness for code evaluation. Ongoing LaRC research in this area is also presented.
Author
Computational Fluid Dynamics; Unsteady Aerodynamics; Unsteady Flow; Nonlinearity; Wind Tunnel Tests; Fixed Wings; Rigid Wings; Aerodynamic Characteristics

20000076810 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]; 54p; In English; Fluids 2000, 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 around-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; Aerodynamics; Aerospace Vehicles; Wind Tunnels; Supersonic Speed; Measuring Instruments

20000076815 NASA Langley Research Center, Hampton, VA USA
A Sample of NASA Langley Unsteady Pressure Experiments for Computational Aerodynamics Code Evaluation
Schuster, David M., NASA Langley Research Center, USA; Scott, Robert C., NASA Langley Research Center, USA; Bartels, Robert E., NASA Langley Research Center, USA; Edwards, John W., NASA Langley Research Center, USA; Bennett, Robert M., NASA Langley Research Center, USA; [2000]; 30p; In English; Fluids, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1769; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

As computational fluid dynamics methods mature, code development is rapidly transitioning from prediction of steady flowfields to unsteady flows. This change in emphasis offers a number of new challenges to the research community, not the least of which is obtaining detailed, accurate unsteady experimental data with which to evaluate new methods. Researchers at NASA

Langley Research Center (LaRC) have been actively measuring unsteady pressure distributions for nearly 40 years. Over the last 20 years, these measurements have focused on developing high-quality datasets for use in code evaluation. This paper provides a sample of unsteady pressure measurements obtained by LaRC and available. for government. university, and industry researchers to evaluate new and existing unsteady aerodynamic analysis methods. A number of cases are highlighted and discussed with attention focused on the unique character of the individual datasets and their perceived usefulness for code evaluation. Ongoing LaRC research in this area is also presented.
Author
Computational Fluid Dynamics; Aerodynamic Characteristics; Unsteady Aerodynamics; Unsteady Flow

20000076831 NASA Langley Research Center, Hampton, VA USA
Effects of Passive Porosity on Interacting Vortex Flows At Supersonic Speeds
Erickson, Gary E., NASA Langley Research Center, USA; [2000]; 10p; In English; 9th; Flow Visualization, 2000, Edinburgh, UK; Original contains color illustrations
Report No.(s): Paper 86; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
A wind tunnel experiment was conducted in the NASA Langley Research Center (LaRC) Unitary Plan Wind Tunnel (UPWT) to determine the effects of passive surface porosity on vortex flow interaction about a general research fighter configuration at supersonic speeds. Optical flow measurement and flow visualization techniques were used and included pressure-sensitive paint (PSP), schlieren, and laser vapor screen (LVS) These techniques were combined with force and moment and conventional electronically-scanned pressure (ESP) measurements to quantify and to visualize the effects of flow-through porosity applied to a wing leading-edge extension (LEX) mounted to a 65 deg cropped delta wing model.
Author
Wind Tunnel Tests; Flow Distribution; Pressure Measurement; Porosity; Vortices; Supersonic Speed

20000078370 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Conquering the Downwind Turn - SFTE Paper Followup
Kolwey, Herman; Jan. 2000; 29p; In English
Report No.(s): AD-A378153; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
During the month that I gave the paper, an article appeared - again in the August Plying Magazine by Peter Garrison) in which he asserted that there is no problem in turning downwind. I have watched the subsequent issues of Plying but have not seen any mail responses from the crop dusters. They have either given up or are being ”filtered Out” by the aviation press. Also, the August 16 issue of Newsweek contained an article about Making Small Planes Safer (Science and Technology). This article indicates the FAA statistics attribute 1,022 general aviation accidents from 1976 to 1992 to ”Spatial Disorientation”. That’s 64 accidents per year to this problem, one piece of which is the turning downwind problem. It also States that: ”The way human beings perceive their own movement is fairly well understood”. I’m not so sure.
DTIC
Wind Direction; Spatial Distribution; CH-46 Helicopter; Human Beings; Physiological Factors; Disorientation

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.

20000074274 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA
Aviation Safety: Research Supports Limited Use of Personal Computer Aviation Training Devices for Pilots. Report to Congressional Requesters
July 1999; 47p; In English
Report No.(s): AD-A366143; GAO/RCED-99-143; B-280735; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
In 1998, general aviation had 1,907 accidents, with 621 fatalities. The National Transportation Safety Board estimates that 87 percent of all fatal general aviation accidents are caused by pilot error, especially when pilots who do not have appropriate instrument training fly when visibility is poor, such as during bad weather. to reduce the occurrence of general aviation accidents, the Federal Aviation Administration (FAA) has been exploring a number of means to enhance the training of general aviation

pilots. One possible enhancement is the use of new technologies for the training that occurs on the ground. For over 40 years, general aviation student pilots have used flight training devices to help them learn how to fly using an aircraft's instruments alone. These flight-training devices resemble an aircraft's cockpit and are often constructed with actual airplane instruments; they can be used by student pilots to substitute for up to 20 of the 40 hours of airplane training required by FAA to obtain an instrument rating. The instrument rating permits a pilot to fly when visibility is poor. In May 1997, FAA also approved the use of special personal computers, controls, and software called personal computer-based aviation training devices (PCATD), which can be used for up to 10 hours of instrument training. FAA's decision to allow the use of PCATDs has sparked debate. Some assert that pilots trained with these devices will be less skilled, thereby compromising aviation safety. Others argue that pilots trained with the devices are actually better trained at lower cost.
Derived from text
Aircraft Safety; Flight Safety; Flight Training; General Aviation Aircraft; Pilot Error; Pilot Training; Training Devices

20000074480 Akron Univ., Dept. of Electrical and Computer engineering, Akron, OH USA
System and Propagation Availability Analysis for NASA's Advanced Air Transportation Technologies ***Final Report***
Ugweje, Okechukwu C., Akron Univ., USA; July 2000; 43p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG3-2279; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes the research on the System and Propagation Availability Analysis for NASA's project on Advanced Air Transportation Technologies (AATT). The objectives of the project were to determine the communication systems requirements and architecture, and to investigate the effect of propagation on the transmission of space information. In this report, results from the first year investigation are presented and limitations are highlighted. to study the propagation links, an understanding of the total system architecture is necessary since the links form the major component of the overall architecture. This study was conducted by way of analysis, modeling and simulation on the system communication links. The overall goals was to develop an understanding of the space communication requirements relevant to the AATT project, and then analyze the links taking into consideration system availability under adverse atmospheric weather conditions. This project began with a preliminary study of the end-to-end system architecture by modeling a representative communication system in MATLAB SIMULINK. Based on the defining concepts, the possibility of computer modeling was determined. The investigations continue with the parametric studies of the communication system architecture. These studies were also carried out with SIMULINK modeling and simulation. After a series of modifications, two end-to-end communication links were identified as the most probable models for the communication architecture. Link budget calculations were then performed in MATHCAD and MATLAB for the identified communication scenarios. A remarkable outcome of this project is the development of a graphic user interface (GUI) program for the computation of the link budget parameters in real time. Using this program, one can interactively compute the link budget requirements after supplying a few necessary parameters. It provides a framework for the eventual automation of several computations required in many experimental NASA missions. For the first year of this project, most of the stated objectives were accomplished. We were able to identify probable communication systems architectures, model and analyze several communication links, perform numerous simulation on different system models, and then develop a program for the link budget analysis. However, most of the work is still unfinished. The effect of propagation on the transmission of information in the identified communication channels has not been performed. Propagation effects cannot be studied until the system under consideration is identified and characterized. to study the propagation links, an understanding of the total communications architecture is necessary. It is important to mention that the original project was intended for two years and the results presented here are only for the first year of research. It is prudent therefore that these efforts be continued in order to obtain a complete picture of the system and propagation availability requirements.
Author
Air Transportation; Communication Networks; Computerized Simulation; Data Transmission; Simulation; Telecommunication; Radio Communication; Phase Shift Keying

20000075719 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
A Tabu Search Metaheuristic for the Air Refueling Tanker Assignment Problem
Capehart, Shay R.; Mar. 2000; 96p; In English
Report No.(s): AD-A378299; AFIT/GOR/ENS/00M-07; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In a joint effort between Air Mobility Command (AMC) and the Air Force Institute of Technology, we present a Tanker Assignment Problem (TAP) Tool capable of providing tanker mission plans for deployment scenarios. Due to the complex nature of extracting a mission plan from the Combined Mating and Ranging Planning System (CMARPS), AMC requires a tool to provide similar results in a simpler and less time consuming manner. The tool developed allows AMC to input several receiver groups consisting of various aircraft types and numbers. Each receiver group contains a point of origin and destination, with the option

of providing one waypoint along the path. In addition, each group has a neatly to load date (RLD) and required delivery date (RDD). The user may also able to specify the locations of military tanker aircraft. The main goal of this tool is to assign the tankers to the different refueling points of the receiver groups so that all receiver groups arrive before their RDD. Secondary goals include the reuse of tankers and limiting the total flight distance for all tanker aircraft. The TAP Tool uses the heuristic technique tabu search to determine an assignment of tankers to receiver groups during a deployment.
DTIC
Air to Air Refueling; Heuristic Methods; Tanker Aircraft

20000075721 Army War Coll., Carlisle Barracks, PA USA
Develop a Better Simulation Strategy for Army Aviation
Adams, Gregory A.; Apr. 10, 2000; 51p; In English
Report No.(s): AD-A378302; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Aviation modernization programs do not assure that Army aviation forces will remain trained and ready. Modernization programs for Army helicopters throughout the 1990s did not include upgrades to the fleet of supporting training devices leaving them outdated. The U.S. Army currently operates a fleet of 36 high fidelity helicopter flight simulators at 17 sites around the world to include the continental U.S., Alaska, Hawaii, Germany and Korea. Fielding of these devices began in 1980 through 1996 and represents an investment of more than $600,000,000. Army Aviation has relied and continues to rely on these simulators for initial and sustainment training. But the computation systems, image generation and instructional system technology used in these simulators is approaching 20 years in age, and has been in great need of modernization for many years. After nearly a full decade of under-funded flight training and research, development and acquisition, Army aviation readiness is down. This represents a significantly increased operational risk to the aviation mission. A partial cause of the reduction in Army aviation readiness is outdated flight simulators.
DTIC
Aircraft Maintenance; Helicopters; Flight Simulators; Flight Training

20000075723 Naval Postgraduate School, Monterey, CA USA
Cost and Operational Effectiveness Analysis of Aiternative Force Structures for Fulfillment of the USA Marine Corps Operational Support Airlift and Search and Rescue Missions
Chase, Eric T.; Mar. 2000; 132p; In English
Report No.(s): AD-A378317; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This thesis provides a preliminary cost and operational effectiveness analysis of alternative force structures for the USA Marine Corps operational support airlift and search and rescue missions. The four alternative force structures include C-12s and CH-46Es, C-35s and CH-46Es and HV-609s. Lifecycle cost analysis of the alternative force structures using Crystal Bali forecasting provides a 90% upper confidence level lifecycle cost estimate that identifies a mix of C-35s for operational support airlift and CH-46Es for search and rescue as the least expensive alternative. Operational effectiveness analysis provides a measure of overall utility for each of the four alternative force structures based on five measures of effectiveness. The measures of effectiveness examined are air travel time, total travel time, landing site requirements, range versus time on station, and payload versus range. Analytical hierarchy process rankings indicate that the HV-609 is the preferred alternative considering these measures of effectiveness. Analysis of cost versus operational effectiveness identifies the HV-609 as the most cost and operationally effective alternative for fulfilling the Marine Corps operational support airlift and search and rescue missions.
DTIC
Air Drop Operations; Air Transportation; Cost Analysis; Rescue Operations

20000075964 Army War Coll., Carlisle Barracks, PA USA
The Army's 21st Century Aviation Brigade In a Light Division
McWethy, Robert W.; Apr. 10, 2000; 35p; In English
Report No.(s): AD-A378264; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This research project expresses concern over the future of Army Aviation. There are many changes that are ongoing within the Army today. Army Aviation needs to be proactive and recommend some changes to the way it does business and the way it should look in the years to come to support the Army's future. Army Aviation is and will be supporting the Chief of Staff of the Army's (CSA) new vision for the Army. while there is much experimentation ongoing, as well as numerous proposals for the way the structure of the Army will look in the future, there is nothing substantial published on what the future of Army Aviation should be to support the CSA's vision. This project will address some of the issues and concerns of future Army Aviation operations and structure, and will propose some recommendations for the way Army Aviation should look in the not too distant future. Currently,

most of the information concerning changes to Army Aviation is sensitive in nature so the majority of this paper will contain the author's thoughts and recommendations.
DTIC
Armed Forces (USA); Military Technology; Defense Program

20000075966 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Analysis of UH-60 Blackhawk Safety Controls Using Value Focused Thinking and Monte Carlo Simulation
Gallan, Roger D., Jr; Mar. 2000; 143p; In English
Report No.(s): AD-A378277; AFIT/GOA/ENS/00M-03; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

In the past few years, Army aviation accidents have been on the rise, due largely to increases in mission frequency and complexity, and diminishing resources. The magnitude of the resulting losses (casualties, dollars, equipment) has prompted the Commanding General of the Army Safety Center to demand a complete examination of the way safety hazards and subsequent safety controls are evaluated and selected. This project integrates value focused thinking, Monte Carlo simulation, and integer programming in response to this demand by developing and using a methodology that effectively identifies and evaluates portfolios of controls. An integer program generates portfolios of controls that maximize the reduction of hazards that contribute to Army aviation accidents. Monte Carlo simulation using the bootstrap method is used to simulate the number and types of losses resulting from accidents that occur in 100,000 UH-60 flying hours. A value model has been developed to quantify the severity of these losses. The expected performance of the portfolios of controls is calculated as the anticipated decrease in severity of losses resulting from implementation of those controls.
DTIC
Aircraft Accidents; Monte Carlo Method; Helicopters; UH-60A Helicopter

20000076130 Federal Aviation Administration, Washington, DC USA
Notices to Airmen Domestic/International, April 20, 2000
Apr. 20, 2000; 238p; In English
Report No.(s): PB2000-106506; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Contents include the following: Airway Notams; Airports; Facilities and Procedural Notams; General FDC Notams; Part 95 Revisions to Minimum En Route IFR Altitudes and Changeover Points; International Notices to Airmen; and Graphic Notices.
NTIS
Air Navigation; Airports; Runways; Navigation Aids; Flight Paths; Air Traffic Control

20000076134 Federal Aviation Administration, Washington, DC USA
Flight Services (7110.10N)
Feb. 24, 2000; 352p; In English
Report No.(s): PB2000-106267; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

This order prescribes procedures and phraseology for use by air traffic personnel providing flight services. Flight service specialists are required to be familiar with the provisions of this order that pertain to their operational responsibilities and to exercise their best judgment if they encounter situations that are not covered.
NTIS
Air Traffic Controllers (Personnel); Terminology; Air Traffic Control; Procedures

20000076486 Federal Aviation Administration, Washington, DC USA
Facility Operation and Administration. 7210.3R
Feb. 24, 2000; 368p; In English
Report No.(s): PB2000-106206; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

This order provides direction and guidance for the day to day operation of facilities and offices under the administrative jurisdiction of the Federal Aviation Administration's Director of Air Traffic. All concerned personnel shall familiarize themselves with the provisions pertaining to their responsibilities. When a situation arises that is not adequately covered, exercise good judgement. This order consists of the following parts: (1) Part 1 contains information generally applicable to two or more types of facilties; (2) Parts 2, 3, and 4 contain instructions unique to center, terminal, or flight service facilities; (3) Part 5 contains information applicable to Traffic Management Systems; and (4) Part 6 contains regulatory information concerning waivers, authorizations, exemptions, and flight restrictions.
NTIS
Air Traffic; Information Management; Air Traffic Control; Regulations

20000076601 National Aerospace Lab., Amsterdam Netherlands

Flight Tests to Investigate Supercooled Large Droplets in Icing Conditions

Jentink, H. W.; Jul. 1999; 17p; In English; Presented at the 11th Annual Symposium of the European Chapter of the Society of Flight Test Engineers, Delft, The Nethelands, June 21-23, 1999

Report No.(s): AD-A378180; NLR-TP-99273; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NLR investigated the icing atmosphere for aircraft by flying with an instrumented research aircraft through clouds. Liquid water content, droplet diameter distributions and air temperature were measured. Large droplets were found in air masses with a limited extent. The flight campaign and the results from the campaign are presented. Measurements are compared with limits in regulations for aircraft and helicopter operation in icing conditions. The investigation was made in the framework of a European co-operation in the EURICE project, partially funded by the Directorate General VII for Transport of the European Commission. DTIC

Flight Tests; Ice Formation; Aircraft Safety; Research Aircraft

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.

20000074699 Onsala Space Observatory, Sweden

A New GPS-VLBI Tie at the Onsala Space Observatory

Bergstrand, Sten, Onsala Space Observatory, Sweden; Haas, Ruediger, Onsala Space Observatory, Sweden; Johansson, Jan, Onsala Space Observatory, Sweden; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 128-132; In English; See also 20000074683

Contract(s)/Grant(s): FMRX-CT96-0071; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Onsala is a collocated reference site for International VLBI Service for Geodesy and Astrometry (IVS) as well as International GPS Service (IGS). In order to establish a new type of tie between the two reference frames, we have installed two Dorne Margolin GPS choke ring antennas on the 20 m VLBI telescope that is situated inside a radome. One of the antennas is permanently mounted on the subreflector support structure, the other one is intermittently attached close to the vertex of the parabola with a rigid support. Since mid 1999, repeated measurements have been performed pointing the VLBI telescope to the zenith position. In addition we made experiments with a moving 20 m dish, but without success. to obtain accurate positions of the two antennas, we found that measurements inside the radome are feasible without further multipath suppression than that already provided by the choke rings and that a data set consisting of 24 hour uninterrupted measurements was necessary.

Author

Global Positioning System; Very Long Base Interferometry; Astronomical Observatories; Radio Telescopes; Parabolic Antennas

20000074727 Norwegian Defence Research Establishment, Norway

Combination of VLBI, GPS and SLR Data at the Observation Level: A Status Report

Andersen, Per Helge, Norwegian Defence Research Establishment, Norway; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 288; In English; See also 20000074683; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A significant number of VLBI and SLR stations are equipped with GPS receivers. A few true fundamental stations with all three techniques even exist. Each technique has its strength and weakness with respect to the determination of geodetic parameters and together they complement each other in a way that should be fully taken advantage of in the data analysis. The simultaneous analysis of different data types at the observation level, due consideration of the physical interrelations, and presentation of results in a common reference system, are the main ideas behind the development of the GEOSAT software. A new and improved version of the software has been implemented with automatic generation of 1) observation residuals and observation partial derivatives for VLBI, GPS and SLR, consistent at the 0.1 ppb level, and 2) a simultaneous arc-by-arc UD-filtering at the observation level. A very advanced multi-level (presently four parameter levels including stochastic parameter representations at each level) SRIF arc combination software for long-term solutions has been developed and validated. The main elements of the processing scheme will be presented. The first results with a simultaneous analysis of different space geodetic data types (VLBI, GPS, and SLR) at the observation level were presented at the IERS-98 symposium in Potsdam and at GPS99 in Tsukuba. The analysis has recently been extended with significantly more observations. Results (Earth orientation parameters, geocenter, radio source coordinates,

station coordinates, ...) from the new analysis will be presented. It is demonstrated that UT1 and nutation parameters can be determined also for days where VLBI data is unavailable.
Author
Geodesy; Global Positioning System; Very Long Base Interferometry; Radio Receivers; Computer Programs; Data Processing

20000075266 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Breadth of Scientific Activities and Network Station Specifications in the International GPS Service (IGS)
Moore, A. W., Jet Propulsion Lab., California Inst. of Tech., USA; Neilan, R. E., Jet Propulsion Lab., California Inst. of Tech., USA; Springer, T. A., Bern Univ., Switzerland; Reigber, Ch., GeoForschungsZentrum, Germany; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A strong multipurpose aspect of the International GPS Service (IGS) is revealed by a glance at the titles of current projects and working groups within the IGS: IGS/BIPM Time Transfer Project; Ionosphere Working Group; Troposphere Working Group; International GLONASS Experiment; Working Group on Low-Earth Orbiter Missions; and Tide Gauges, CGPS, and the IGS. The IGS network infrastructure, in large part originally commissioned for geodynamical investigations, has proved to be a valuable asset in developing application-oriented subnetworks whose requirements overlap the characteristics of existing IGS stations and future station upgrades. Issues encountered thus far in the development of multipurpose or multitechnique IGS projects as well as future possibilities will be reviewed.
Author
Global Positioning System; Multidisciplinary Research

20000075423 Norwegian Defence Research Establishment, Kjeller, Norway
Two Approaches for Automatic Recognition of PRF-Patterns ***To Metoder for Automatisk Gjenkjenning av PRF-Monstre***
Pedersen, Stein Inge, Norwegian Defence Research Establishment, Norway; Malnes, Eirik, Norwegian Defence Research Establishment, Norway; Jun. 07, 2000; 56p; In Norwegian; Original contains color illustrations
Contract(s)/Grant(s): Proj. FFIE/728/113
Report No.(s): FFI/RAPPORT-2000-02480; ISBN 82-464-0420-2; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report is part of the KONTUR videreforing project which focuses on the development of an ESM-system for air traffic surveillance. From signals received by the ESM-sensor, one would wish to be able to identify which type of radars the signals are emitted from. Modern MPRF-radars vary between a set of different PRFs on a pulstrain to pulstrain basis. The pulstrains which are emitted with different PRFs, comprise a pattern which is characteristic for the specific type of radar, and by extracting and recognising such patterns, classification of radars can be performed. In this report, we propose a strategy for performing automatic recognition of PRF-patterns. We start by examining how the continuous flow of radar signals in the sensor should be divided into manageable parts, how multiples of a pulstrain can be removed and how abrupted emissions can be connected. In the process of extracting the patterns, we examine two different ways of performing this task. The first approach is based on examining the transitions from a PRF-state to another and choosing the most frequently appearing transition as being the pattern between the two states. This is done for all states, and the complete pattern is thus deduced. This approach has problems coping with patterns which include repetitions of PRF-states and overlapping patterns which all include the same PRF-states. As a solution to this, a second approach is examined which will be able to overcome such problems. The approach consist of two layers, where the bottom layer produces different candidate patterns, from which the most appealing pattern is chosen in the logic layer. Finally, we briefly discuss how a pattern database should be designed and how this can be used to eliminate familiar patterns from the data prior to the pattern analysis, and also how emission tracking may be performed.
Author
Radar Detection; Surveillance Radar; Pulse Repetition Rate; Signal Detection; Identifying

20000075651 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Highlights of Recent Developments in the International GPS Service and Perspectives for Future Directions
Neilan, R., Jet Propulsion Lab., California Inst. of Tech., USA; Reigber, C., GeoForschungsZentrum, Germany; Springer, T., Bern Univ., Switzerland; Beutler, G., Bern Univ., Switzerland; Kouba, J., Natural Resources Canada, Canada; [1999]; 1p; In English, Birmingham, UK; Sponsored by International Council of Scientific Unions, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

In December 1998, the IGS Governing Board officially changed the name of this IAG service from 'International GPS Service for Geodynamics to simply the 'International GPS Service'. This change of name reflects the fact that today the IGS supports numerous scientific projects outside the traditional geodetic and geodynamic disciplines. A number of IGS projects and working groups have been established, each concentrating on a particular science application, such as the ionosphere, atmosphere, refer-

ence frame, precise time transfer, etc. These activities are enabled and simulated by the IGS and directly contribute to the continuing development of the service. The IGS is currently poised to respond to evolving user requirements that focus on timeliness and reliability of data and products, particularly in support of a slate of Low Earth Orbiter missions over the next decade. Perspectives on the future of the IGS will be developed based on current directions as well as anticipated external influences, such as GPS satellite modernization, GLONASS, availability of global communications, and plans for the European GALILEO (Global Navigation Satellite System - GNSS). We will address development of user friendly interfaces and IGS product tutorials.
Author
Global Positioning System; Geodynamics; Galileo Spacecraft; Coordinates

20000076599 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA
National Airspace System Persistent Problems in FAA's New Navigation System Highlight Need for Periodic Reevaluation
Jun. 2000; 40p; In English; Report to the Chairman, Subcommittee on Transportation, Committee on Appropriations, U.S. Senate
Report No.(s): AD-A378233; GAO/RCED/AIMD-OO-130; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Currently, the Federal Aviation Administration (FAA) relies principally on a ground-bases navigation system that uses various types of equipment to assist pilots in navigating their assigned route and to provide them with guidance for landing their aircraft safely in different types of weather. However, this ground-based navigation system is aging and limited in its geographic coverage. FAA is planning a transition from its ground-based navigating system to a satellite-based system using radio signals generated by Global Positioning System (GPS) to provide greater geographic coverage, among other things. The Department of Defense developed GPS to support military missions and functions. However, the system is now a dual-use system, and other users --- pilots, truckers, and boaters -- rely on signals from the GPS satellites to calculate their time, speed, and position anywhere on or above the earths surface. As part of its efforts to maintain GPS and make it more useful for civilians, in May 2000, Defense ceased its practice of intentionally degrading the accuracy of the GPS signal available for civil use. Furthermore, Defense plans to begin gradually replacing the existing satellites with new ones that will also improve system performance.
DTIC
Global Positioning System; Navigation Satellites; Flight Safety; National Airspace System; Navigation

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.

20000074277 Army Research Lab., Survivability/Lethality Analysis Directorate, Aberdeen Proving Ground, MD USA
Analytical Calculations of Helicopter Torque Coefficient (C(sub Q)) and Thrust Coefficient (C(sub T)) Values for the Helicopter Performance (HELPE) Model *Final Report*
Kim, Ki C., Army Research Lab., USA; June 1999; 30p; In English
Contract(s)/Grant(s): DA Proj. 1L1-62618-AH-80
Report No.(s): AD-A365512; ARL-TR-1986; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A computer program for calculating helicopter torque coefficients (CQ) and thrust coefficients (CT) as a function of a vehicle's forward speed has been developed in conjunction with the helicopter performance assessment project. The model is based on the energy principle, in which helicopter power is broken into three components: induced power, profile power, and parasite power. This report documents the b.)sic mathematical model used in the code, along with the numerical solution scheme used in implementing the model. Results are calculated for the UH-60A Black Hawk helicopter for hover and different forward speed settings and correlated with existing flight test data. The effects of different disk loading on helicopter power requirements are also investigated. The present model agrees reasonably well with the flight test data, providing the author with a certain confidence in the helicopter aerodynamic model developed in the present study.
Author
Helicopter Performance; Mathematical Models; Thrust; Torque; UH-60A Helicopter

20000075539 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Improving UAV Handling Qualities Using Time Delay Compensation
Thurling, Andrew J.; Mar. 2000; 297p; In English
Report No.(s): AD-A378376; AFIT/GAB/ENY/00M-01; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

This research investigated control loop time delay and its effect on UAV handling qualities. Compensation techniques to improve handling qualities in the presence of varying amounts of time delay were developed and analyzed. One technique was selected and successfully flight-tested on a UAV. Flight-testing occurred at a constant flight condition with varying levels of additional time delay introduced into the control loop. Research pilots performed a pitch tracking task and gave Cooper-Harper ratings and comments. Tracking errors were used as a quantitative measure of Pilot/Display/UAV system performance. Predictive pitch compensation was found to significantly reduce pilot workload and improve Cooper-Harper ratings. Using the predictive display doubled the amount of system time delay that research pilots could tolerate while tracking the task bars. Overall system tracking performance, however, was not improved. Parameter variations of +/- 20% in the aerodynamic model used to generate the predictive display produced statistically significant, although not operationally significant, changes in both pilot opinion and performance. Analysis of flight test data and follow-on simulations resulted in predictor improvements that increased predictor accuracy to the point of restoring system tracking performance to equal that of the system with no additional time delay.
DTIC
Computer Programs; Data Processing; Data Simulation; Flight Conditions; Flight Tests; Pilot Performance

20000075547 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Defense Acquisitions: Use of Cost Reduction Plans in Estimating F-22 Total Production Costs
Jun. 15, 2000; 14p; In English
Report No.(s): AD-A378432; GAO/T-NSIAD-00-200; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
I am pleased to be here today to discuss our ongoing work on the impact that production cost reduction plans are projected to have on the Air Force's F-22 Raptor Program. The F-22 Raptor is an air superiority aircraft being developed to replace F-15 fighter aircraft. Lockheed Martin Corporation and Pratt & Whitney Corporation are the contractors for the airframe and engine, respectively. Development, which started in 1991, is scheduled to be completed in August 2003. The Air Force plans to enter low-rate initial production in December 2000. Appendix I lists products we have issued that relate to the F-22 program. Projections of higher production costs have been a source of concern for several years. In 1996, because of potential cost increases, the Air Force established a team--known as the Joint Estimating Team--to review the total estimated cost of the F-22 program. The team concluded that the cost of production could grow substantially from the amounts planned, but that cost reduction initiatives could be implemented to offset that cost growth. The Office of the Undersecretary of Defense for Acquisition, Technology, and Logistics generally adopted the team's recommendations to change certain aspects of the program, as well as a plan to define and implement cost reduction initiatives. F-22 production costs were also discussed in the National Defense Authorization Act for Fiscal Year 1998 (P.L. 105-85, Nov. 18,1997). That act limited the total cost of F-22 production but did not specify the total number of aircraft to be procured. The most recent production costs estimates were completed by the Air Force and the Office of the Secretary of Defense in 1999. Both of these estimates considered cost reduction initiatives known as production cost reduction plans. Hundreds of these plans-totaling $21 billion--had been identified by the airframe and engine contractors, with participation by the Air Force's F-22 program office.
DTIC
Aircraft Production; Production Costs; Cost Reduction; Congressional Reports; F-22 Aircraft

20000076057 CSA Engineering, Inc., Palo Alto, CA USA
An Experimental Investigation of Tangential Blowing to Reduce to Buffet Response of the Vertical Tails of an F-15 Wind Tunnel Model. Volume 2 Response Data ***Final Report, 1 Jun. 1996-31 Dec. 1998***
Ferman, Marty A.; Turner, Elijah W.; Jan. 1999; 624p; In English
Contract(s)/Grant(s): F33615-94-C-3200; AF Proj. 2404
Report No.(s): AD-A377712; AFRL-VA-WP-TR-1999-3019; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche
This is Volume 2 of AN EXPERIMENTAL INVESTIGATION OF TANGENTIAL BLOWING TO REDUCE BUFFET RESPONSE OF THE VERTICAL TAILS OF AN F-15 WIND TUNNEL MODEL. This volume presents the detailed PSD graphs and summary tables of rms response data from those graphs. to aid with the comprehension of this data, figures from Volume 1 showing the model, setup, and model instrumentation are repeated here. The reader will most likely have to refer to Volume 1 of added tie-in.
DTIC
F-15 Aircraft; Wind Tunnel Models; Aircraft Models; Buffeting; Wind Tunnel Tests

20000076484 Federal Aviation Administration, Office of Aviation Research, Washington, DC USA
Aircraft Materials Fire Test Handbook ***Final Report***
Horner, A.; Apr. 2000; 252p; In English
Report No.(s): PB2000-106510; DOT/FAA/AR-00/12; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

The purpose of the Aircraft Materials Fire Test Handbook is to describe all FAA-required fire tests methods for aircraft materials in a consistent and detailed format. The handbook provides information to enable the user to assemble and properly use the test methods. Moreover, to broaden the utility of the handbook, the appendices contain the following information: FAA fire safety regulations, FAA approval process, aircraft materials, regulatory methodology used by other countries, aircraft industry internal test methods and guidelines, laboratories actively using fire test methods, and commercial manufacturers of fire test equipment.
NTIS
Fire Prevention; Handbooks; Aircraft Construction Materials; Regulations; Flammability

20000076600 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
The Effect of Helicopter Main Rotor Blade Damage on the Rotor Disk (Whole Rotor) Motion ***Final Report, Aug.-Oct. 1995***
Fries, Joseph; Jun. 2000; 41p; In English
Report No.(s): AD-A378211; ARL-TR-2241; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

When a helicopter main rotor blade is ballistically damaged, an imbalance is created in the rotor, causing the rotor disk to execute unwanted motions, which are detrimental to performance. The normally smooth-flying helicopter develops new vibrations that can be physiologically annoying or debilitating to the pilot, can exceed structural fatigue endurance limits, can cause aeromechanical instabilities, and can reduce helicopter performance ability. This report examines the effect of the loss of the outboard section of one rotating blade of a rotor set of four blades on the fixed-system (nonrotating) rotor disk motion. The report shows, beginning with the rotor blade forcing, how a damaged blades response changes, and how this change feeds into the rotor's fixed-system disk motion (the disk referring to the blades acting in concert as a whole entity). With a normally undamaged rotor (referring to all the blades), there exists within the rotor itself the capability of motion canceling of certain frequencies depending on the number of rotor blades in the rotor. This study tracks each individual harmonic (integer multiples of the rotor speed) frequency, one at a time, in order to obtain a first-principles understanding of the phenomena involved with rotor imbalance.
DTIC
Helicopters; Rotary Wings; Rotors; Damage; Fatigue (Materials); Helicopter Performance; Rotor Aerodynamics; Aircraft Reliability

20000076816 NASA Johnson Space Center, Houston, TX USA
X-38 Landing Gear Skid Test Report
Gafka, George K., NASA Johnson Space Center, USA; Daugherty, Robert H., NASA Langley Research Center, USA; June 2000; 116p; In English
Contract(s)/Grant(s): RTOP 522-62-11-02
Report No.(s): NASA/TM-2000-210293; NAS 1.15:210293; L-18968; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

NASA incorporates skid-equipped landing gear on its series of X-38 flight test vehicles. The X-38 test program is the proving ground for the Crew Return Vehicle (CRV) a gliding parafoil-equipped vehicle designed to land at relatively low speeds. The skid-equipped landing gear is designed to attenuate the vertical landing energy of the vehicle at touchdown using crushable materials within the struts themselves. The vehicle then slides out as the vehicle horizontal energy is dissipated through the skids. A series of tests was conducted at Edwards Airforce Base (EAFB) in an attempt to quantify the drag force produced while "dragging" various X-38 landing gear skids across lakebed regions of varying surface properties. These data were then used to calculate coefficients of friction for each condition. Coefficient of friction information is critical for landing analyses as well as for landing gear load and interface load analysis. The skid specimens included full- and sub-scale V201 (space test vehicle) nose and main gear designs, a V131/V 132 (atmospheric flight test vehicles) main gear skid (actual flight hardware), and a newly modified, full-scale V201 nose -ear skid with substantially increased edge curvature as compared to its original design. Results of the testing are discussed along with comments on the relative importance of various parameters that influence skid stability and other dynamic behavior.
Author
X-38 Crew Return Vehicle; Drag; Dynamic Characteristics; Flight Test Vehicles; Gliding; Landing Gear; Skid Landings; Skidding

20000076837 Norwegian Defence Research Establishment, Kjeller, Norway
Talus: Users Guide
Glaerum, Sigurd, Norwegian Defence Research Establishment, Norway; Hovik, Lars, Norwegian Defence Research Establishment, Norway; May 24, 2000; 84p; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj. FFISYS/723/161.3
Report No.(s): FFI/RAPPORT-2000/02733; ISBN 82-464-0416-4; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This document is a Users Guide to the TALUS tactical air combat simulation model. It describes how to install and run the model. It also describes in a quite detailed manner how to define a scenario. The Users Guide is not a reference manual for developers, it is primarily intended for the end user who wishes to analyze the performance of combat aircraft and/or their subsystems over a range of scenarios.
Author
Applications Programs (Computers); Computerized Simulation; Combat; User Manuals (Computer Programs); Models

20000078419 Dayton Univ. Research Inst., OH USA
Statistical Loads Data for B-767-200ER Aircraft in Commercial Operations ***Final Report***
Tipps, D. O.; Rustenburg, J. H.; Skinn, D. A.; Mar. 2000; 92p; In English
Report No.(s): PB2000-106507; URD-TR-99-00072; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The primary objective of this research is to support the FAA Airborne Data Monitoring Systems Research Program by developing new and improved methods and criteria for processing and presenting large commercial transport airplane flight and ground loads usage data. The scope of activities performed involved (1) defining the service-related factors which affect the operational life of commercial aircraft; (2) designing an efficient software system to reduce, store, and process large quantities of optical quick access recorder data; and (3) providing processed data in formats that will enable the FAA to reassess existing certification criteria. Equally important, these new data will also enable the FAA, the aircraft manufacturers, and the airlines to better understand and control those factors which influence the structural integrity of commercial transport aircraft. Presented are analyses and statistical summaries of data collected from 1285 flights representing 9164 flight hours of 10 typical B-767-200ER aircraft during operational usage recorded by a single airline. The data include statistical information on accelerations, speeds, altitudes, flight duration and distance, gross weights, speed brake/spoiler cycles, thrust reverser usage, and gust velocities encountered.
NTIS
Boeing 767 Aircraft; Flight Load Recorders; Flight Characteristics; Loads (Forces)

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).

20000074745 Bundesamt fuer Kartographie und Geodaesie, Wettzell, Germany
Transportable Integrated Geodetic Observatory (TIGO)
Hase, Hayo, Bundesamt fuer Kartographie und Geodaesie, Germany; Boeer, Armin, Bundesamt fuer Kartographie und Geodaesie, Germany; Riepl, Stefan, Bundesamt fuer Kartographie und Geodaesie, Germany; Schlueter, Wolfgang, Bundesamt fuer Kartographie und Geodaesie, Germany; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 383-387; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

TIGO is a transportable fundamental station for geodesy. TIGO consists of VLBI and SLR modules as well as of a so called basic service module which comprise a GPS array, atomic clock ensemble, superconducting gravity meter, seismometer, meteorological sensors including a water vapour radiometer and a server for the LAN. The energy module allows the operation of TIGO at remote sites with little infrastructure. The primary purpose of TIGO is to contribute to the realization of global reference systems for geodesy (ITRF). Its transportability allows us to place TIGO at a site which improves homogeneity in the network of fundamental stations within the ITRF, if the necessary support of the hosting country can be made available to this project. After an Announcement of Opportunity for hosting TIGO and a reconnaissance of proposed sites as well as some analysis concerning the optimal use of TIGO, the Chilean city of Concepcion got the highest priority for hosting TIGO beginning 2001.
Author
Geodesy; Very Long Base Interferometry; Geophysical Observatories

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.

20000074639 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Deep Space 4/Champollion Comet Rendezvous and Lander Technology Demonstration Mission
Smythe, William D., Jet Propulsion Lab., California Inst. of Tech., USA; Weissman, Paul R., Jet Propulsion Lab., California Inst. of Tech., USA; Muirhead, Brian K., Jet Propulsion Lab., California Inst. of Tech., USA; Tan-Wang, Grace H., Jet Propulsion Lab., California Inst. of Tech., USA; Sabahi, Dara, Jet Propulsion Lab., California Inst. of Tech., USA; Grimes, James M., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Deep Space 4/Champollion mission is designed to test and validate technologies for landing on and anchoring to small bodies, and sample collection and transfer, in preparation for future sample return missions from comets, asteroids, and satellites. in addition, DS-4 will test technologies for advanced, multi-engine solar electric propulsion (SEP) systems, inflatable-rigidizable solar arrays, autonomous navigation and precision guidance for landing, autonomous hazard detection and avoidance, and advanced integrated avionics and packaging concepts. Deep Space-4/Champollion consists of two spacecraft: an orbiter/carrier vehicle which includes the multi-engine SEP stage, and a lander, called Champollion, which will descend to the surface of the 46P/Tempel 1 cometary nucleus. The spacecraft will launch in April, 2003 and land on the comet in September, 2006 Deep Space 4/Champollion is a joint project between NASA and CNES, the French space agency.
Author
Deep Space; Space Missions; Mission Planning; Landing; Comets; Asteroids

20000074645 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
NASA Participation in the ISAS MUSES C Asteroid Sample Return Mission
Jones, Ross, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

NASA and Japan's Institute of Space and Astronautical Science (ISAS) have agreed to cooperate on the first mission to collect samples from the surface of an asteroid and return them to Earth for in-depth study. The MUSES-C mission will be launched on a Japanese MV launch vehicle in January 2002 from Kagoshima Space Center, Japan, toward a touchdown on the asteroid Nereus in September 2003. A NASA-provided miniature rover will conduct in-situ measurements on the surface. The asteroid samples will be returned to Earth by MUSES-C via a parachute-borne recovery capsule in January 2006. NASA and ISAS will cooperate on several aspects of the mission, including mission support and scientific analysis. In addition to providing the rover, NASA will arrange for the testing of the MUSES-C re-entry heat shield at NASA/Ames Research Center, provide supplemental Deep Space Network tracking of the spacecraft, assist in navigating the spacecraft and provide arrangements for the recovery of the sample capsule at a landing site in the U. S. Scientific coinvestigators from the U.S. and Japan will share data from the instruments on the rover and the spacecraft. They will also collaborate on the investigations of the returned samples. With a mass of about I kg, the rover experiment will be a direct descendant of the technology used to build the Sojourner rover. The rover will carry three science instruments: a visible imaging camera, a near-infrared point spectrometer and an alpha X ray spectrometer. The solarpowered rover will move around the surface of Nereus collecting imagery data which are complimentary to the spacecraft investigation. The imaging system will be capable of making surface texture, composition, and morphology measurements at resolutions better than 1 cm. The rover will transmit this data to the spacecraft for relay back to Earth. Due to the microgravity environment on Nereus, the rover has been designed to right itself in case it flips over. Solar panels on all sides of the rover will ensure that enough power will always be available to the rover to activate the motors needed to turn over. Posable struts will allow the rover to position its chassis such that the camera can be pointed straight down at the surface or straight up at the sky. The presentation will describe the mission, scientific objectives and current state of the rover in detail.
Author
Asteroid Missions; Asteroids; Spacecraft Tracking; Alpha Particles; Data Acquisition

20000074802 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
2005 Earth-Mars Round Trip
[2000]; 38p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents, in viewgraph form, the 2005 Earth-Mars Round Trip. The contents include: 1) Lander; 2) Mars Sample Return Project; 3) Rover; 4) Rover Size Comparison; 5) Mars Ascent Vehicle; 6) Return Orbiter; 7) A New Mars Surveyor Program Architecture; 8) Definition Study Summary Result; 9) Mars Surveyor Proposed Architecture 2003, 2005 Opportunities; 10) Mars Micromissions Using Ariane 5; 11) Potential International Partnerships; 12) Proposed Integrated Architecture; and 13) Mars Exploration Program Report of the Architecture Team.
CASI
Earth (Planet); Mars Missions; Mars Exploration; Mars Surface; Planetary Orbits

20000074961 NASA Marshall Space Flight Center, Huntsville, AL USA
NASA's Needs for Biomaterials within the HEDS Initiative
Gillies, Donald C., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Spacebound, 15 May 2000, Vancouver, Canada; No Copyright; Avail: Issuing Activity; Abstract Only

The part to be played by materials scientists to further NASA's exploration missions cannot be underestimated. to quote Jerome Groopman (New Yorker, February 14, 2000), "The rocket science will be the easy part". The four main risks on the Critical Path Road Map during a three-year sojourn to Mars are osteoporosis, psychological problems, radiation induced cancer and acute medical trauma. NASA's microgravity materials science program has investigations in membrane fabrication, bone growth and materials for radiation protection. These programs will be reviewed in the context of the four main risks, as will other potential uses of biomaterials and applications of biomimetic processing.
Author
Radiation Protection; Risk; Psychological Factors; Membranes; Fabrication; Long Duration Space Flight

20000075267 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
QuikSCAT Mission
Liu, W. Timothy, Jet Propulsion Lab., California Inst. of Tech., USA; Graf, James E., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The QuikSCAT Mission of the National Aeronautics and Space Administration (NASA) is planned for launch in Spring 1999, reducing the data gap in ocean-wind vector created by the loss of the NASA Scatterometer (NSCAT) on the Japanese Advanced Earth Observing Satellite (ADEOS) spacecraft. The NSCAT instrument ceased functioning when ADEOS failed on June 30, 1997. The follow-on scatterometer for monitoring ocean winds, called SeaWinds, is scheduled for launch on the Japanese ADEOS-II spacecraft in 2000. The Jet Propulsion Laboratory (JPL) has met the challenge to develop and integrate the instrument, ground system, and launch vehicle in less than a year. QuikSCAT will use pencil-beam-antennas in a conical-scan design which is more compact than the fixed fan-beam design of NSCAT. The antenna will radiate ku-band microwaves at 40 and 46 incident angle and measure the backscatter power across a continuous 1800 km swath. QuikSCAT is capable of providing wind-speed and wind-direction at 25 km resolution over 92 percent of the Earth's ice-free oceans every day, under both clear and cloudy conditions. Standard data products will be delivered to science users within 14-days, and fast data products will be available to operational users within two hours of data acquisition. QuikSCAT will be managed by JPL for the NASA's Office of Earth Science Enterprise. It will be launched from Vandenberg Air Force Base, aboard a Titan II vehicle. The satellite core-systems was built by Ball Aerospace Systems Division, Boulder, CO. The operation of QuikSCAT is expected to overlap with ERS-2 and SeaWinds. Spaceborne scatterometers have demonstrated a broad spectrum of scientific applications, including weather systems, wind-driven ocean circulation, land vegetation, polar ice morphology and dynamics, and Ocean-atmosphere-ice interaction.
Author
Satellite-Borne Instruments; Scatterometers; Pencil Beams; Antenna Radiation Patterns; Microwave Scattering

20000075650 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
New Millennium EO3
Li, Fuk K., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The New Millennium Program (NMP) is a NASA technology program that focuses on the validation of advanced spacecraft and instrumentation technologies in space. This program specifically seeks technologies that could significantly benefit future space and Earth science missions by enabling new science capabilities and reducing life cycle costs. These technologies must also require a validation in space to mitigate risks to the first science users, and provide cross-cutting benefits to both NASA's Earth

and Space Science enterprises. The NASA Office of Earth Science (OES) directed the NMP to focus the third Earth Observing mission, E03, on innovative measurement concepts that would facilitate remote sensing observations from orbits beyond conventional low-Earth orbit (LEO). These orbits include geosynchronous orbits, highly elliptical orbits, mid-Earth and high-Earth orbits, and other unique vantage points such as L1 and L2. to maximize the input from the Earth science community, a NASA Research Announcement (NRA) was released to solicit innovative measurement concepts for this NMP flight. Because the NMP is a technology validation program, rather than a conventional science program, the NRA required that these measurement concepts employ revolutionary technologies and/or measurement strategies that will enable future science missions from orbits beyond LEO. Another requirement was that a validation in space was needed to reduce real or perceived risks of this concept to future science users. The proposals submitted in response to this NRA were peer reviewed by the NASA OES. The measurement concepts selected through this process will be summarized in this presentation. The EO3 measurement concept NRA did not solicit complete mission concepts or flight hardware. Instead, the selected investigators will join integrated project formulation teams to define the mission for the demonstration of the measurement technique and participate in mission design trades and implementation planning. The teams will define and document the measurement approach, the required technologies, the validation plan, the scalability of the design to future science missions, and the infusion path for the completely validated instrument. During this project formulation phase, the specific technologies required to implement each measurement concept will be solicited through an open technology solicitation, and the technology providers will be added to the integrated teams. Once a complete candidate mission concept has been formulated for each measurement concept, these concepts will be subjected to a comprehensive review. The Associate Administrator of the OES will use the results of this review to select a single concept for the EO3 flight opportunity. That mission concept will enter its implementation phase, which is expected to last for less than 36 months before launch. During this phase, and after launch, the implementation team will work with the NMP to document and disseminate the information gathered during the flight qualification testing and operations of the measurement concept and its component technologies. This information will be archived and published, where appropriate, to encourage the rapid infusion of these validated technologies into future space and Earth science missions.
Author
Geosynchronous Orbits; Mission Planning; Earth Sciences; Flight Tests; Low Earth Orbits

13
ASTRODYNAMICS

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

20000074246 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Nozomi Cis-Lunar Phase Orbit Determination
Ryne, Mark, Jet Propulsion Lab., California Inst. of Tech., USA; Criddle, Kevin, Sterling Software, Inc., USA; [2000]; 3p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Japan's Institute of Space and Astronautical Science (ISAS) launched Nozomi, its first mission to the planet Mars using the newly developed M-V launch vehicle on July 3, 1998. Scientific objectives of the mission are to study the structure and dynamics of the Martian upper atmosphere and its interaction with the solar wind. Nozomi is a cooperative mission between ISAS and the National Aeronautics and Space Administration (NASA). The NASA contribution includes navigation and tracking services provided by the Jet Propulsion Laboratory (JPL). The spacecraft also serves as an engineering demonstration of basic technology for planetary exploration. One of the new technologies was a unique trajectory, developed by ISAS, which used solar gravitational perturbations at the weak stability boundary as an aid to achieve an Earth-Mars transfer orbit. This trajectory saves approximately 120 m/s of Delta V compared to direct hyperbolic insertion and is considered an enabling technology for the mission. Nozomi was the first spacecraft to employ this trajectory and provided on-orbit validation of the technique. The trajectory was achieved by initially placing the spacecraft in a highly elliptical cis-lunar phasing orbit. Six maneuvers were performed during this period to correct injection errors and target an outbound lunar swingby in September 1998. The gravity assist from the lunar swingby raised apogee to the vicinity of the weak stability boundary. After three more targeting maneuvers, Nozomi performed an inbound lunar swingby followed immediately by a powered Earth swingby in late December 1998. A 420 m/s Trans Mars Insertion (TMI) burn at the final Earth periapsis was intended to place the spacecraft on a heliocentric trajectory leading to Mars orbit insertion in October 1999. Orbit determination for Nozomi is performed in parallel by both ISAS and the Multi-Mission Navigation (MMNAV) group at JPL. This was an advantage for the mission because each group would generate solutions based on data collected from their respective tracking networks. Spacecraft events, such as sequence uplinks and maneuvers, were generally scheduled during passes at the Usuda tracking station in Japan. As a result, maneuver design and reconstruction was derived from MMNAV solutions based on JPL tracking data obtained immediately prior to or following maneuvers. Data was also exchanged

between ISAS and MMNAV so orbit determination could be performed on joint data sets in support of critical targeting late in the cis-lunar phase. In this paper, information regarding the MMNAV orbit determination effort for the first six months of the mission is presented. The spacecraft trajectory is characterized first, followed by a discussion of the orbit determination estimation procedure and models. Results from selected orbit solutions are presented and compared against reconstructed trajectories. One area of emphasis in this paper is orbit determination in the vicinity of the weak stability boundary. Precise navigation was necessary to target the second lunar swingby and the powered Earth swingby. Delivery accuracy of 150 m was required for these critical encounters, but a number of factors contributed to the general degradation of orbit determination accuracy. This included the fact that the spacecraft was at apogee, at a range of 1.7 million km and moving at less than I km/sec perpendicular to the line of sight. Nozomi was also close to zero degrees declination where there are known limitations on orbit determination performance. Finally, S-band tracking data was acquired through the Nozomi backup low gain antenna. This antenna is offset from the axis of this spin stabilized spacecraft and superimposed large signatures in the Doppler and range data. These difficulties were overcome by combining long data arcs, spanning several maneuvers, with a high fidelity solar pressure model. The model included a physically accurate representation of the spacecraft structure and a high time resolution orientation model. Observation modeling included the removal of the spin induced Doppler bias, spin signature and per pass correction of range calibration errors applied for data leading up to critical events. As a result, all orbit determination goals were met. A second area of emphasis in this paper is the JPL tracking and orbit determination effort in support of the TMI maneuver. TMI occurred out of contact with ground stations and the JPL Goldstone tracking complex had the first pass following the bum. As a result, MMNAV had the responsibility to make a rapid assessment of the maneuver performance. MMNAV made the determination that a 100 m/s under bum had occurred and promptly informed ISAS via voice lines. ISAS immediately began preparations for a correction maneuver (TMIc), which had to be performed during the next Usuda pass. The near real time assessment by MMNAV provided accurate antenna frequency and pointing updates for the spacecraft acquisition at Usuda and the close coordination between the two agencies enabled the design and successful execution of the TMc maneuver. Propellant consumption during the correction burn dictated that the mission be redesigned. ISAS developed a new plan which adds 3 full solar orbits, two Earth swingbys and one lunar swingby with arrival at Mars in January 2004. The final Mars orbit will still enable the mission to achieve all of its science objectives.
Author

Mars (Planet); Nozomi Mars Orbiter; Orbit Insertion; Earth-Mars Trajectories; Orbital Mechanics; Swingby Technique; Interplanetary Transfer Orbits; Japanese Space Program; International Cooperation

20000076821 Howard Univ., Washington, DC USA

Control of Formation Flying Satellites ***Final Report, 13 May 1999-12 May 2000***

Bainum, Peter M.; Strong, Avaine; Tan, Zhaozhi; May 26, 2000; 127p; In English

Contract(s)/Grant(s): MDA972-99-C-0020; DARPA ORSER-H899

Report No.(s): AD-A378318; 0002-AD; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report summarizes the work completed during the reporting period cited above. A technique for maintaining nominal separation distance between adjacent satellites in an elliptically orbiting constellation is developed and parametric trade-off studies performed. This technique is based on an initial impulsive-type correction of the daughter spacecraft at the first perigee in order to shift the direction of the line of apsides by a small angle. The technique works well in Keplerian orbits. In the presence of perturbations the results are critically dependent on the amplitude of the shift angle. Without subsequent corrections near collision situations can exist over the long term. Additional feedback type of correctional control is recommended to prevent unwanted secular drifts. Two types of feedback control strategies are considered here: an application of the linear quadratic regulator (LQR) theory based on errors in position, and also based on a Lyapunov function using osculating orbital elements. A preliminary deployment strategy is introduced based on near Hohmann-type of transfer orbits, and shows deployment can be achieved in one orbit.
DTIC

Artificial Satellites; Flight Control; Feedback Control

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

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

20000076604 NASA Glenn Research Center, Cleveland, OH USA
ACTS Ka-Band Earth Stations: Technology, Performance, and Lessons Learned
Reinhart, Richard C., NASA Glenn Research Center, USA; Struharik, Steven J., Communications Satellite Corp., USA; Diamond, John J., Analex Corp., USA; Stewart, David, GTE Technology Organization, USA; May 2000; 24p; In English; 6th; Sixth KA-Band Utilization Conference, 31 May - 2 Jun. 2000, Cleveland, OH, USA; Sponsored by Istituto Internazionale delle Comunicazioni, Italy
Contract(s)/Grant(s): RTOP 315-90-81
Report No.(s): NASA/TP-2000-210047; NAS 1.60:210047; L-12250; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Advanced Communications Technology Satellite (ACTS) Project invested heavily in prototype Ka-band satellite ground terminals to conduct an experiments program with ACTS. The ACTS experiments program proposed to validate Ka-band satellite and ground-station technology, demonstrate future telecommunication services, demonstrate commercial viability and market acceptability of these new services, evaluate system networking and processing technology, and characterize Ka-band propagation effects, including development of techniques to mitigate signal fading. This paper will present a summary of the fixed ground terminals developed by the NASA Glenn Research Center and its industry partners, emphasizing the technology and performance of the terminals and the lessons learned throughout their 6-year operation, including the inclined orbit phase-of-operations. The fixed ground stations used for experiments by government, academic, and commercial entities used reflector-based offset-fed antenna systems with antennas ranging in size from 0.35 to 3.4 in. in diameter. Gateway earth stations included two systems referred to as the NASA Ground Station (NGS) and the Link Evaluation Terminal (LET).
Author
Extremely High Frequencies; Satellite Communication; Earth Terminals; Telecommunication; ACTS

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.

20000074276 Army Research Lab., Weapons and Materials Research Directorate, Aberdeen Proving Ground, MD USA
A Lumped Circuit Model of a Compensated Pulse Generator and Rail Gun
Hummer, Charles R., Army Research Lab., USA; June 1999; 70p; In English
Contract(s)/Grant(s): DA Proj. 61104-BH-62
Report No.(s): AD-A365930; ARL-TR-1990; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Because of its compact size, an electrical generator that uses an internal rotating mass as an energy source for electrical power is being developed to power a rail gun in a future combat system. At this stage of development, there are many proposed designs for these electric generators and many proposed designs for their possible uses: rail guns, coil guns, electromagnetic armor, etc. to study these various designs, a computer program was written to calculate the current in all parts of the electric generator, the load, the angular velocity of the rotating mass, and the velocity of the projectile from a rail gun or a coil gun. This was accomplished by modeling the electric generator and the rail gun by a circuit of inductors and resistors. This model results in a set of differential equations that are coupled with the equation of motion for the rotating mass, and with the equation of motion for the projectile.
Author
Electric Generators; Pulse Generators; Mathematical Models; Military Technology; Guns (Ordnance)

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.

20000076832 NASA Kennedy Space Center, Cocoa Beach, FL USA
A NASA Spaceliner 100 Propulsion Oriented Technology Assessment
Dankhoff, W., NASA Kennedy Space Center, USA; Dayton, K., NASA Kennedy Space Center, USA; Levack, D., NASA Kennedy Space Center, USA; Odom, P., NASA Kennedy Space Center, USA; Rhodes, R., NASA Kennedy Space Center, USA; Robinson, J., NASA Kennedy Space Center, USA; [2000]; 30p; In English; 39th; Joint Propulsion, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-3603; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

In response to a NASA request, the National Space Propulsion Synergy Team (SPST) team agreed to provide technical and programmatic support to NASA in formulating a Spaceliner 100 Technology Program. The SPST offered a broad cross-section of expertise and experience. Its membership consists of senior level, volunteer representatives from across government, industry, and academia. The purpose of this paper is to provide a summary of the SPST support of SL100, which culminated in a propulsion technologies assessment and prioritization workshop conducted at MSFC. The results of this workshop and the follow-up analysis are part of this report. Also included, is a review of some ”lessons learned” that were solicited from the workshop participants. Author
Propulsion; Technology Assessment; Propulsion System Configurations; Spacecraft Configurations

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.

20000075272 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The NASA Spacecraft Transponding Modem
Berner, Jeff B., Jet Propulsion Lab., California Inst. of Tech., USA; Kayalar, Selahattin, Jet Propulsion Lab., California Inst. of Tech., USA; Perret, Jonathan D., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A new deep space transponder is being developed by the Jet Propulsion Laboratory for NASA. The Spacecraft Transponding Modem (STM) implements the standard transponder functions and the channel service functions that have previously resided in spacecraft Command/Data Subsystems. The STM uses custom ASICs, MMICs, and MCMs to reduce the active device parts count to 70, mass to I kg, and volume to 524 cc. The first STMs will be flown on missions launching in the 2003 time frame. The STM tracks an X-band uplink signal and provides both X-band and Ka-band downlinks, either coherent or non-coherent with the uplink. A NASA standard Command Detector Unit is integrated into the STM, along with a codeblock processor and a hardware command decoder. The decoded command codeblocks are output to the spacecraft command/data subsystem. Virtual Channel 0 (VC-0) (hardware) commands are processed and output as critical controller (CRC) commands. Downlink telemetry is received from the spacecraft data subsystem as telemetry frames. The STM provides the following downlink coding options: the standard CCSDS (7-1/2) convolutional coding, ReedSolomon coding with interleave depths one and five, (15-1/6) convolutional coding, and Turbo coding with rates 1/3 and 1/6. The downlink symbol rates can be linearly ramped to match the G/T curve of the receiving station, providing up to a 1 dB increase in data return. Data rates range from 5 bits per second (bps) to 24 Mbps, with three modulation modes provided: modulated subcarrier (3 different frequencies provided), biphase-L modulated direct on carrier, and Offset QPSK. Also, the capability to generate one of four non-harmonically related telemetry beacon tones is provided, to allow for a simple spacecraft status monitoring scheme for cruise phases of missions. Three ranging modes are provided: standard turn around ranging, regenerative pseudo-noise (PN) ranging, and Differential One-way Ranging (DOR) tones. The regenerative ranging provides the capability of increasing the ground received ranging SNR by up to 30 dB. Two different avionics interfaces to the command/data subsystem’s data bus are provided: a MIL STD 1553B bus or an industry standard PCI interface. Digital interfaces

provide the capability to control antenna selection (e.g., switching between high gain and low gain antennas) and antenna pointing (for future steered Ka-band antennas).
Author
Modems; Transponders; Spacecraft Components; Spacecraft Communication; Spacecraft Equipment; Downlinking

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

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

20000075208 NASA Goddard Space Flight Center, Greenbelt, MD USA
Polar Operational Environmental Satellites: Looking at Earth
Aleman, Roberto M., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English
Report No.(s): NP-2000-3-025GSFC; No Copyright; Avail: Issuing Activity; Abstract Only

A broad overview of the Polar Operational Environmental Satellites (POES) Project is presented at a very high level. A general description of the scientific instruments on the Television Infrared Observational Satellite (TIROS) spacecraft is presented with emphasis put on their mission and the products derived from the data. Actual pictures produced from POES instruments data are shown to help the audience relate our work to their everyday life, as affected by the weather systems.
Author
Earth (Planet); Satellite Observation; Meteorological Satellites; Polar Orbits; Spacecraft Instruments

20000075276 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Mars Micromission Spacecraft
Leschly, Kim, Jet Propulsion Lab., California Inst. of Tech., USA; Bousquet, Pierre, Centre National d'Etudes Spatiales, France; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The concept of a small common Mars Micromission spacecraft design, using the Ariane-5 GTO piggyback launch opportunities has been studied over the past year by NASA/JPL and CNES. The study is based on the 200 kg ASAP twin configuration, due to its clear performance and cost advantages for planetary missions over the 100-kg ASAP configuration. The spacecraft design commonalty has been explored for the Mars 2003, 2005, and 2007 launch opportunities and for three main mission types: Probe Carrier missions, with one or more probes, measuring 40-80 cm in diameter. Science Orbiter missions, with additional fuel for orbit insertion. and Telecommunication Relay Orbiter missions, with optimal data return link.
Author
Data Links; Spacecraft Design; Telecommunication; Design Analysis

20000075635 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Vibration and Acoustic Testing for Mars Micromission Spacecraft
Kern, Dennis L., Jet Propulsion Lab., California Inst. of Tech., USA; Scharton, Terry D., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 2p; In English; 1st; Launch Vehicle Vibrations, 14-16 Dec. 1999, Toulouse, Toulouse, France, France; Sponsored by Centre National d'Etudes Spatiales, France; No Copyright; Avail: Issuing Activity; Abstract Only

The objective of the Mars Micromission program being managed by the Jet Propulsion Laboratory (JPL) for NASA is to develop a common spacecraft that can carry telecommunications equipment and a variety of science payloads for exploration of Mars. The spacecraft will be capable of carrying robot landers and rovers, cameras, probes, balloons, gliders or aircraft, and telecommunications equipment to Mars at much lower cost than recent NASA Mars missions. The lightweight spacecraft (about 220 Kg mass) will be launched in a cooperative venture with CNES as a TWIN auxiliary payload on the Ariane 5 launch vehicle. Two or more Mars Micromission launches are planned for each Mars launch opportunity, which occur every 26 months. The Mars launch window for the first mission is November 1, 2002 through April 2003, which is planned to be a Mars airplane technology demonstration mission to coincide with the 100 year anniversary of the Kittyhawk flight. Several subsequent launches will create a telecommunications network orbiting Mars, which will provide for continuous communication with lenders and rovers on the Martian surface. Dedicated science payload flights to Mars are slated to start in 2005. This new cheaper and faster approach to Mars exploration calls for innovative approaches to the qualification of the Mars Micromission spacecraft for the Ariane 5 launch vibration and acoustic environments. JPL has in recent years implemented new approaches to spacecraft testing that may be effec-

tively applied to the Mars Micromission. These include 1) force limited vibration testing, 2) combined loads, vibration and modal testing, and 3) direct acoustic testing. JPL has performed nearly 200 force limited vibration tests in the past 9 years; several of the tests were on spacecraft and large instruments, including the Cassini and Deep Space One spacecraft. Force limiting, which measures and limits the spacecraft base reaction force using triaxial force gages sandwiched between the spacecraft and the test fixture, alleviates the severe overtest at spacecraft resonances inherent in rigid fixture vibration tests. It has the distinct advantage over response limiting that the method is not dependent on the accuracy of a detailed dynamic model of the spacecraft. Combined loads, vibration, and modal testing were recently performed on the QuikSCAT spacecraft. The combined tests were performed in a single test setup per axis on a vibration shaker, reducing test time by a factor of two or three. Force gages were employed to measure the true c.g. acceleration of the spacecraft for structural loads verification using a sine burst test, to automatically notch random vibration test input accelerations at spacecraft resonances based on predetermined force limits, and to directly measure modal masses in a base drive modal test. In addition to these combined tests on the shaker, the QuikSCAT spacecraft was subjected to a direct field acoustic test by surrounding the spacecraft, still on the vibration shaker, with rock concert type acoustic speakers. Since the spacecraft contractor does not have a reverberant field acoustic test facility, performing a direct field acoustic test -saved the program nearly two weeks schedule time that would have been required for packing / unpacking and shipping of the spacecraft. This paper discusses the rationale behind and advantages of the above test approaches and provides examples of their actual implementation and comparisons to flight data. The applicability of the test approaches to Mars Micromission spacecraft qualification is discussed.
Author
Acoustics; Dynamic Models; Field Tests; Landing Modules; Measuring Instruments; Random Vibration; Robots; Vibration Tests

20000075647 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Boundary Scan Test Vehicle for Direct Chip Attach Testing
Parsons, Heather A., Jet Propulsion Lab., California Inst. of Tech., USA; DAgostino, Saverio, Jet Propulsion Lab., California Inst. of Tech., USA; Arakaki, Genji, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

To facilitate the new faster, better and cheaper spacecraft designs, smaller more mass efficient avionics and instruments are using higher density electronic packaging technologies such as direct chip attach (DCA). For space flight applications, these technologies need to have demonstrated reliability and reasonably well defined fabrication and assembly processes before they will be accepted as baseline designs in new missions. As electronics shrink in size, not only can repair be more difficult, but 49 probing" circuitry can be very risky and it becomes increasingly more difficult to identify the specific source of a problem. to test and monitor these new technologies, the Direct Chip Attach Task, under NASA's Electronic Parts and Packaging Program (NEPP), chose the test methodology of boundary scan testing. The boundary scan methodology was developed for interconnect integrity and functional testing at hard to access electrical nodes. With boundary scan testing, active devices are used and failures can be identified to the specific device and lead. This technology permits the incorporation of "built in test" into almost any circuit and thus gives detailed test access to the highly integrated electronic assemblies. This presentation will describe boundary scan, discuss the development of the boundary scan test vehicle for DCA and current plans for testing of direct chip attach configurations.
Author
Chips; Test Vehicles; Boundaries; Scanners

19
SPACECRAFT INSTRUMENTATION AND ASTRIONICS

Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information, see also 06 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.

20000075264 Meteorological Satellite Center, Kiyose, Japan
The Status of Calibration of VISSR on Board GMS-5
Kurihara, Shigehisa, Meteorological Satellite Center, Japan; Tokuno, Masami, Meteorological Satellite Center, Japan; Meteorological Satellite Center Technical Note; March 2000; ISSN 0388-9653, No. 38, pp. 53-68; In Japanese; No Copyright; Avail: Issuing Activity

GMS-5 acquires calibration data in orbit and the calibration table is made from the data in the ground station. The calibration table is delivered Medium-scale Data Utilization Station (MDUS) users with Stretched-VISSR (S-VISSR) and is used in Data Processing Center (DPC) for producing several satellite products. Thus the calibration data is indispensable to users for utilizing the S-VISSR data of GMS-5. This paper describes the status of calibration of VISSR (Visible and Infrared Spin Scan Radiometer) on board GMS-5 and a matter to pay attention for using the calibration data on the following subjects: Techniques for calibrating visible and infrared channels' data. Correction of the calibration tables of infrared channels' data observed before. The necessary care to be taken and problems encountered on applying infrared channels' calibration tables (including observations for satellite wind estimation) and S-VISSR fixed calibration tables operationally. A doubt about the response function of the water vapor channel. and Long term trend of visible channel's data.
Author
Calibrating; Data Processing; Visible Infrared Spin Scan Radiometer; Procedures; Correction

20
SPACECRAFT PROPULSION AND POWER

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

20000074670 NASA Marshall Space Flight Center, Huntsville, AL USA
Experimental/Analytical Characterization of the RBCC Rocket-Ejector Mode
Ruf, J. H., NASA Marshall Space Flight Center, USA; Lehman, M., Pennsylvania State Univ., USA; Pal, S., Pennsylvania State Univ., USA; Santoro, R. J., Pennsylvania State Univ., USA; [2000]; 1p; In English; Propulsion, 13-17 Nov. 2000, Monterey, CA, USA; Sponsored by NASA, USA
Contract(s)/Grant(s): NAS8-40890; No Copyright; Avail: Issuing Activity; Abstract Only

The experimental/analytical research work described here addresses the rocket-ejector mode (Mach 0-2 operational range) of the RBCC engine. The experimental phase of the program includes studying the mixing and combustion characteristics of the rocket-ejector system utilizing state-of-the-art diagnostic techniques. A two-dimensional variable geometry rocket-ejector system with enhanced optical access was utilized as the experimental platform. The goals of the experimental phase of the research being conducted at Penn State are to: (a) systematically increase the range of rocket-ejector understanding over a wide range of flow/geometry parameters and (b) provide a comprehensive data base for evaluating and anchoring CFD codes. Concurrent with the experimental activities, a CFD code benchmarking effort at Marshall Space Flight Center is also being used to further investigate the RBCC rocket-ejector mode. Experiments involving the single rocket based optically-accessible rocket-ejector system have been conducted for Diffusion and Afterburning (DAB) as well as Simultaneous Mixing and Combustion configurations. For the DAB configuration, air is introduced (direct-connect) or ejected (sea-level static) into a constant area mixer section with a centrally located gaseous oxygen (GO2)/gaseous hydrogen (GH2) rocket combustor. The downstream flowpath for this configuration includes a diffuser, an afterburner and a final converging nozzle. For the SMC configuration, the rocket is centrally located in a slightly divergent duct. For all tested configurations, global measurements of the axial pressure and heat transfer profiles as well as the overall engine thrust were made. Detailed measurements include major species concentration (H2 O2 N2 and H2O) profiles at various mixer locations made using Raman spectroscopy. Complementary CFD calculations of the flowfield at the experimental conditions also provide additional information on the physics of the problem. These calculations are being conducted at Marshall Space Flight Center to benchmark the FDNS code for RBCC engine operations for such configurations. The primary fluid physics of interests are the mixing and interaction of the rocket plume and secondary flow, subsequent combustion of the fuel rich rocket exhaust with the secondary flow and combustion of the injected afterburner flow. The CFD results are compared to static pressure along the RBCC duct walls, Raman Spectroscopy specie distribution data at several axial locations, net engine thrust and entrained air for the SLS cases. The CFD results compare reasonably well with the experimental results.
Author
Experimentation; Numerical Analysis; Combustion Chambers; Data Bases; Ejectors; Flow Distribution; Flow Geometry; Rocket Exhaust; Thrust

20000074967 NASA Marshall Space Flight Center, Huntsville, AL USA
Development Progress in Phase 1 Fission Propulsion Systems
Houts, Michael G., NASA Marshall Space Flight Center, USA; VanDyke, Melissa, NASA Marshall Space Flight Center, USA; Godfroy, Tom, NASA Marshall Space Flight Center, USA; Martin, Jim, NASA Marshall Space Flight Center, USA; Dickens,

Ricky, NASA Marshall Space Flight Center, USA; Pedersen, Kevin, NASA Marshall Space Flight Center, USA; Poston, David, Los Alamos National Lab., USA; Reid, Bob, Los Alamos National Lab., USA; Lipinski, Ron, Sandia National Labs., USA; Wright, Steve, Sandia National Labs., USA; Lenard, Roger, Sandia National Labs., USA; [22 June 2000]; 1p; In English; Advanced Space Propulsion Research, 31 May - 2 Jun. 2000, Pasadena, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Phase 1 fission propulsion systems are those fission propulsion systems that are highly testable and require no development of nuclear fuels or materials. The systems can be developed without new or significantly modified facilities, have adequate performance for numerous missions of interest, and demonstrate technologies and programmatics that are traceable to Phase 2 and Phase 3 systems. Phase 1 fission propulsion systems focus on safety, cost and schedule. Phase 1 flight units can be tested at full thrust using resistance heaters to simulate heat from fission. The development and use of Phase 1 systems will help enable Phase 2 or Phase 3 fission propulsion systems capable of giving rapid, affordable access to any point in the solar system. A Phase 1 fission propulsion system under development at the Marshall Space Flight Center (MSFC) in collaboration with individuals from Department of Energy Laboratories and industry is the Safe Affordable Fission Engine (SAFE). The propellant energy source of a 30 kW SAFE unit (SAFE-30) is being fabricated, and will begin testing at MSFC in FY00. The conceptual design of a 300 kW SAFE unit (SAFE-300)is nearing completion. Experiments have been performed on both SAFE-30 and SAFE-300 components. Module tests have confirmed the performance potential of the SAFE series of propulsion systems. This paper will report on the development status of the Phase 1 SAFE fission propulsion system.

Author

Fission; Propulsion System Performance; Propulsion System Configurations; Propellants; Fabrication

20000076055 Aerospace Corp., Technology Operations, El Segundo, CA USA

Full-Scale DELTA GEM MPS Demonstration - May 11-12, 1999 AFRL/EAFB Rocket Laboratory

Osborn, J.; Brown, B.; Amimoto, S.; Fournier, E.; Nov. 15, 1999; 20p; In English

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

Report No.(s): AD-A377699; TR-99(1494)-2; SMC-TR-00-11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A prototype Multiparameter Sensor System (MPS) is described for impact detection and environmental condition monitoring of graphite epoxy composite structures. This system is applied to a full-scale inert Delta-II solid rocket Graphite Epoxy Motor (GEM) casing. Microelectro-mechanical (MEMS) sensors are used in this demonstration, including those for 3-axis acceleration, temperature, pressure and humidity. All sensor measurements are made within a single package mounted at the center of mass of the test article. Sensor analog outputs are sampled with a National Instruments Inc. data acquisition PCMCIA card, and data is processed on a Pentium-II 200 MHz laptop computer. Sensor information collected during this demonstration was passed wirelessly to a remote user terminal for display and data storage. Data presented in this report includes peak acceleration for impacts just below damage threshold, environmental sensor trends, and wireless RF performance in a warehouse environment.

DTIC

Solid Propellant Rocket Engines; Flight Simulation; Computerized Simulation; Microelectromechanical Systems; Rocket Engine Cases

20000078389 Pennsylvania State Univ., Dept. of Aerospace Engineering, University Park, PA USA

Plasma Stabilization in Low-Power C Band Microwave Arcjets ***Final Report, 1 Mar. 1997-31 Oct. 1999***

Micci, Michael M.; Nordling, D.; Souliez, F.; Oct. 31, 1999; 34p; In English; Presented at 34th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit at Cleveland, OH., on 13-15 Jul 1998.

Contract(s)/Grant(s): F49620-97-1-0117; AF Proj. 2308

Report No.(s): AD-A378396; AIAA-98-3499; AFRL-SR-BL-TR-00-0211; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Performance evaluation of a 100 Watt 7.5 GHz resonant cavity microwave thruster was conducted using helium, nitrogen and ammonia propellants exhausting to both atmospheric and vacuum conditions. Emission spectroscopy of the plasma was made in order to measure the plasma electron temperature at different specific power levels, and the assumption of Local Thermodynamic Equilibrium (LTE) was examined. Electron temperature values of approximately 4000 Kelvin were measured. In order to obtain specific impulse data under vacuum conditions, the Doppler shift between light emitted by the exhaust plume parallel and perpendicular to the gas flow was measured using a high resolution Fabry-Perot interferometer. Centerline specific impulse values were obtained for helium propellant at various specific powers with a maximum value of 1330 seconds measured.

DTIC

Electron Plasma; Plasma Temperature; Electron Energy; Stabilization; C Band; Microwaves; Arc Jet Engines; Electric Propulsion

23
CHEMISTRY AND MATERIALS (GENERAL)

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

20000076014 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1996 project on the R and D of industrial scientific technology under consignment from NEDO. Report on the results of the R and D of technologies to invent original high-functional materials
Mar. 31, 1998; 449p; In Japanese; In English
Report No.(s): DE99-718337; ETDE/JP-99718337; No Copyright; Avail: Department of Energy Information Bridge

Technologies were described of creating original high-functional materials. In the field of new materials of living organism imitation type, remarkably high-performance/high-functional new materials are invented by imitating the precise function manifestation mechanism of the ultimate living organism in which a great variety of matters are in harmony with each other and manifest complicated and high-level functions. In the field of structural control/synthesis process technology, the paper is aimed at manifestation of newer and higher functions/performance and innovation of the synthesis process, and also at developing technology to precisely control structure and process of materials including surface and interface in correspondence with atomic/molecular to macro levels. Up to now, conducted were an examination of autonomous response materials (the subtheme is a R and D of polymer/composite multi-stimuli-responsive materials) and a R and D of precise polymerization (control) polymer materials.
NTIS
Control Systems Design; Research and Development

20000076015 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 result of the R and D project of industrial science and technology under consignment from NEDO. R and D of creation technology of original advanced materials
Mar. 31, 1998; 25p; In Japanese; In English
Report No.(s): DE99-718338; ETDE/JP-99718338; No Copyright; Avail: Department of Energy Information Bridge

This paper describes R and D of creation technology of original advanced materials in the R and D project of industrial science and technology. Although new material technology is dependent on the needs of a future society, it should correspond to a global environment preservation society, information-oriented society and aging society as observed based on the present social trend, and new materials superior in hot strength, light weight, corrosion resistance, decomposability, photo-function, magnetism, conductivity, bio-copying and adaptability are demanded. This project has been promoted since fiscal 1996 to develop formation technology of high-performance advanced new materials by precise molecular control of structure and production process of organic polymers and molecular assemblies. The research started on 4 themes such as advanced stimulus-response material, precision catalytic polymerization, condensed system structure control and multi-dimensional polymer structure. The research on molecule harmonizing material was added in fiscal 1997. In fiscal 1997, the general committee discussed a progress situation and next year research plan, and surveyed an overseas technology trend.
NTIS
Research and Development; Technologies; Polymers

20000076016 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 project on the R and D of industrial scientific technology under consignment from NEDO. Report on the results of the R and D of technologies to invent original high-functional materials
Mar. 31, 1998; 297p; In Japanese; In English
Report No.(s): DE99-718341; ETDE/JP-99718341; No Copyright; Avail: Department of Energy Information Bridge

The paper described the fiscal 1997 results of the study of the condensation base precise structure control conducted as a technical development of materials to heighten efficiency of power generation facilities. The study is aimed at developing basic technologies on the molecular weight and regularity by which a remarkable improvement can be expected in performance of condensation polymerization/ring-opening polymerization polymer materials, polymerization catalyst which arbitrarily controls the primary structure such as branch and end group structures, and development of the precision polymerization process. In the synthesis of ordered polymer by direct polycondensation, synthesis of ordered polyamide from asymmetric monomers is studied. In the synthesis of chemically selective polyamide by direct polymerization, polyamide with functional group is synthesized by polymerizing without protecting functional group the monomer with such functional group as causes side reaction in polymerization.

In the synthesis of polyamide having the limited distribution of molecular weight, the molecular weight/distribution of polyamide are controlled by connectedly conducting polycondensation which is itself to be done successively.
NTIS
Polymerization; Research and Development

20000076817 Naval Research Lab., Ocean Sciences Branch, Bay Saint Louis, MS USA
The Relationship Between Corrosion and the Biological Sulfur Cycle
Little, Brenda B.; Ray, Richard I.; Pope, Robert K.; Apr. 2000; 5p; In English
Report No.(s): AD-A378164; NRL/PP/7303-08-0021; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Most microbiologically influenced corrosion (MIC) takes place in the presence of microbial consortia in which many different physiological types of bacteria interact in complex ways within the structure of biofilms. Microbiologically-mediated oxidation and reduction reactions of sulfur and sulfur compounds are important contributors to MIC. Sulfur and sulfur compounds, including sulfides, bisulfides, hydrogen sulfide (H2S), thiosulfates, polythionates and sulfuric acid, may be trapped or bound up in biofilms causing direct corrosion of materials. H2S and sulfuric acid may become gaseous or waterborne.
DTIC
Corrosion; Microorganisms; Sulfur Compounds; Oxidation-Reduction Reactions

24
COMPOSITE MATERIALS

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

20000074272 Minnesota Univ., Dept. of Mechanical Engineering, Minneapolis, MN USA
Advanced Composites Manufacturing: Process Modeling/Analysis of Complex Engineering Structures Manufactured by Resin Transfer Molding (RTM) ***Final Report***
Kanapady, R., Minnesota Univ., USA; Tamma, K. K., Minnesota Univ., USA; Jan. 01, 1999; 55p; In English
Contract(s)/Grant(s): DAAH04-96-1-0172
Report No.(s): AD-A364854; ARO-35543.2-MA; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The present work employs sonic of the major elements of the new computers which are promising parallel computer architectures of the future, and describes some recent developments in the finite element analysis of process modeling and manufacturing applications of composites that are designed to exploit these major elements for large scale engineering applications. The work includes finite element computational schemes, data structures and interprocessor communication strategies for the implementation of large scale practical advanced manufacturing simulations with particular emphasis on isothermal resin transfer molding (RTM) process manufacturing simulations on the symmetric multiprocessor. For process modeling studies thin-shell composite mold configurations are used to illustrate the validity of the present implementation of: (i) the traditional explicit control volume-finite element, and (ii) a recently developed and new pure finite element implicit methodology in conjunction with a diagonal preconditioned conjugate gradient solver for parallel computations on the SGI Power Challenge and the SGI Origin2000 symmetric multiprocessor machines. The techniques developed are applied to large scale problems to demonstrate the practical applicability to realistic industrial size problems.
Author
Composite Materials; Finite Element Method; Resin Transfer Molding; Structural Analysis; Computerized Simulation; Mathematical Models

20000074667 NASA Marshall Space Flight Center, Huntsville, AL USA
Solid Freeform Fabrication of Continuous Fiber Reinforced Composites for Propulsion Applications
Vaidyanathan, R., Advanced Ceramics Research, Inc., USA; Walish, J., Advanced Ceramics Research, Inc., USA; Fox, M., Advanced Ceramics Research, Inc., USA; Rigali, M., Advanced Ceramics Research, Inc., USA; Sutaria, M., Advanced Ceramics Research, Inc., USA; Gillespie, John W., Jr., Delaware Univ., USA; Yarlagadda, Shridhar, Delaware Univ., USA; Effinger, Mike, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 4th; Aerospace Materials, Processes and Environmental Techniques, 18-21 Sep. 2000, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

For propulsion related applications, materials must be able to demonstrate excellent ablation and oxidation resistance at temperature approaching 3500’C, adequate load bearing capabilities, non-catastrophic failure modes, and ability to withstand transient thermal shock. A potential list of propulsion-material property requirements includes, low density, high elastic modulus, low thermal-expansion coefficient, high thermal conductivity, excellent erosion and oxidation/corrosion resistance, and flaw-insensi-

tivity. In many cases, they will also need to be able to be joined, survive thermal cycling and multi-axial stress states, and for reusable applications, the materials must maintain the above attributes after prolonged exposure to extremely harsh chemical environments. The final and possibly most important attribute for these materials are the need to be lower cost and readily available in large quantities. Recently, Advanced Ceramics Research, Inc. (ACR) has developed low cost, flexible- manufacturing processes for Zr & Hf-based carbon fiber reinforced composites, materials with good oxidation and ablation resistance up to 3500 C. This process, called Continuous Composite Co-extrusion (C(sup 3)), incorporates carbon fibers to fabricate 'in-situ' carbide and boride-matrix/carbon fiber composites. This is a variation of ACR's manufacturing process for low-cost structural ceramic materials called Fibrous Monoliths With carbon fiber reinforcements. Fibrous Monolithic materials have a distinct fibrous texture, consist of intertwined cells of a primary phase, separated by cell boundaries of a tailored secondary phase and show very high fracture energies, damage tolerance, and graceful failure. Since they are monolithic powder based composites-, they can be manufactured by conventional powder processing techniques using inexpensive raw materials. This combination of high performance and low cost is a breakthrough that could enable wider application of ceramics in high temperature applications. Typical volume fractions of the two phases are 80 to 95% for the cell phase and 5 to 20% for the interpenetrating cell boundary phase. ACR is currently developing an innovative solid freeform form fabrication (SFF) approach to produce Hf and Zr based ceramic composite components reinforced with continuous carbon fiber tows for critical structural components such as tubes and blisks. The process is simple, robust and will be widely applicable to a number of material systems. This technique was originally developed at the University of Delaware Center for Composite Materials (UD-CCM) for rapid fabrication of polymer matrix composites by a technique called automated tow placement or ATP. The current process is being developed in collaboration with UD-CCM. The paper will detail the freeform fabrication process to create low-cost ceramic fiber reinforced composites for high-temperature applications. The results of mechanical properties and microstructural characterization will be presented, together with examples of complex shapes and parts. It is believed that the process will be able to create complex shaped parts for propulsion applications at an order of magnitude lower cost than current CVI and PIP process.
Author
Fiber Composites; Manufacturing; Reinforced Plastics; Technology Assessment; Procedures; Carbon Fibers

20000075238 University of Southern California, Dept. of Materials Science, Los Angeles, CA USA
Creep Properties of Metal Matrix Composites
Li, Yong, University of Southern California, USA; Langdon, Terence G., University of Southern California, USA; Creep Behavior of Advanced Materials for the 21st Century; 1999, pp. 73-82; In English
Contract(s)/Grant(s): DAAH04-96-1-0332
Report No.(s): AD-A364717; ARO-34391.32-MS; Copyright; Avail: Issuing Activity
Several recent investigations have described the creep behavior of metal matrix composites at elevated temperatures and this has led to significant advances in understanding the properties of these materials and the deformation processes occurring in high temperature flow. This paper examines the recent developments with special reference to the nature and significance of the threshold stresses. It is demonstrated that the rate-controlling mechanisms in these materials divide, as in solid solution alloys, into the distinct processes of dislocation climb and viscous glide representing class M and class A behavior, respectively.
Author
Creep Properties; Deformation; Metal Matrix Composites; High Temperature; Stress Analysis

20000075239 University of Southern California, Dept. of Materials Science, Los Angeles, CA USA
Creep Properties of an AZ91 Magnesium-Based Composite
Li, Yong, University of Southern California, USA; Sklenicka, Vaclav, Ceskoslovenska Akademie Ved, Czechoslovakia; Langdon, Terence G., University of Southern California, USA; Creep Behavior of Advanced Materials for the 21st Century; 1999, pp. 171-178; In English
Contract(s)/Grant(s): DAAH04-96-1-0332; NSF INT-96-02022
Report No.(s): AD-A364768; ARO-34391.35-MS; Copyright; Avail: Issuing Activity
Creep tests were conducted on an AZ91 (Mg-9% Al- 1% Zn) alloy reinforced with 20 volume % Al2O3 fibers (Saffil) using a double-shear configuration. The experimental results reveal a non-linearity in the plots of shear strain rate versus shear stress, thereby indicating the presence cf a threshold stress. By incorporating a threshold stress into the analysis, it is shown that the results are consistent with the behavior anticipated for a magnesium solid solution alloy, including a stress exponent close to 3.
Author
Creep Properties; Magnesium Alloys; Shear Strain; Metal Matrix Composites; Stress Analysis

20000075240 University of Southern California, Dept. of Materials Science, Los Angeles, CA USA

Fundamental Aspects of Creep in Metal Matrix Composites

Li, Yong, University of Southern California, USA; Langdon, Terence G., University of Southern California, USA; Metallurical and Materials; February 1999; Volume 30A, pp. 315-324; In English; Fatigue and Creep of Composite Materials, 14-18 Sep. 1997, Indianapolis, IN, USA; Sponsored by Metallurgical Society, USA

Contract(s)/Grant(s): DAAH04-96-1-0332

Report No.(s): AD-A365174; ARO-34391.23-MS; Copyright; Avail: Issuing Activity

The primary characteristics of the creep of metal matrix composites (MMCs) are reviewed, including the shapes of the creep curves, the origin of the threshold stresses, and the nature of the rate-controlling processes. A detailed analysis of two representative MMCs provides no support for the concept of a constant substructure model for creep with a stress exponent (n) of 8. Analysis of the data demonstrates that creep is controlled by deformation in the matrix alloys and, as in solid solution alloys, there is a division into control by viscous glide (class A) and climb (class M), respectively.

Author

Creep Properties; Metal Matrix Composites; Plastic Flow; Structural Failure

20000076812 Rensselaer Polytechnic Inst., Troy, NY USA

The Design and Synthesis of Epoxy Matrix Composites Curable by Electron Beam Induced Cationic Polymerization

Crivello, James V., Rensselaer Polytechnic Inst., USA; Jul. 12, 2000; 12p; In English

Contract(s)/Grant(s): NAG1-1939; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Several new series of novel, high reactivity epoxy resins are described which are designed specifically for the fabrication of high performance carbon fiber reinforced composites for commercial aircraft structural applications using cationic UV and e-beam curing. The objective of this investigation is to provide resin matrices which rapidly and efficiently cure under low e-beam doses which are suitable to high speed automated composite fabrication techniques such as automated tape and tow placement. It was further the objective of this work to provide resins with superior thermal, oxidative and atomic oxygen resistance.

Derived from text

Electron Beams; Epoxy Matrix Composites; Polymerization; Cations; Synthesis (Chemistry); Design Analysis

20000078392 California Inst. of Tech., Graduate Aeronautical Labs., Pasadena, CA USA

Proceedings of a Symposium on the Dynamic Deformation and Failure of Materials (Journal of the Mechanics and Physics of Solids. Volume 46, Number 10) ***Final Report, 24 Feb. 1997-23 Feb. 1998***

Ravichandran, Guruswami; May 17, 2000; 493p; In English

Contract(s)/Grant(s): DAAG55-97-1-0107

Report No.(s): AD-A378420; GR-AR0-00-33; ARO-36701.1-EGCF; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche

The grant provided support for the organization of a conference on ”Dynamic Deformation and Failure of Materials.” The conference was held at the California Institute of Technology campus in Pasadena during May 22-24, 1997. The conference attracted researchers from all over the world and provided a forum to assess the state-of-the-art in this field. More than 30 presentations were made on a wide range of subjects including, high strain rate behavior of materials, dynamic fracture and shear banding, topics that are of interest to the Army. The talks were focussed on various physical phenomena including failure waves and factors influencing strength at high temperatures and high loading rates. There were a number of participants from the Army and included two presentations by scientists from the Army Research Laboratories. The proceedings of the conference was published in a bound volume by Elsevier and as a special issue of the Journal of the Mechanics and Physics of Solids.

DTIC

Conferences; Dynamic Characteristics; Deformation; Failure; Composite Materials

20000078405 Federal Energy Technology Center, Morgantown, WV USA

Task 6.7.3 - Interfacial Mass Transport Effects in Composite Materials

Nowok, J. W.; Feb. 01, 1998; 20p; In English

Report No.(s): DE00-001709; DE-FC21-93MC30097-27; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Advanced metal-matrix composites (MMCS) consisting of titanium-based alloys possess some unique mechanical, physical, and chemical characteristics that make them highly desirable for aircraft and gas turbine engines. Tailoring MMC properties is essential for advanced product design in materials processing. The main factors that affect materials processing and, further, the nature of a metal-ceramic interface, its structure, and morphological stability is liquid surface mass transport related to adhesional

wetting physical effect and reactive wetting (chemical effect). Surfaces and interfaces dominate many of the technologically important processes in composite materials such as liquid-solid sintering and joining. The objective of this work is threefold: (1) to get insight into the role of the nonstoichiometry of chemical composition in ceramic materials used as reinforcement components in MMC processing, (2) to extend previous energetic analysis of mass transport phenomena to wetting behavior between liquid metal and the quasi-solid like skin resulting from the presolidification of liquid on nonstoichiometric solids on a scale of interatomic distance, and (3) to provide experimental verification of our concept.
NTIS
Mass Transfer; Transport Properties; Metal Matrix Composites

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.

20000074279 National Inst. of Standards and Technology, Process Measurements Div., Gaithersburg, MD USA
Characterization of the Inlet Combustion Air in NIST's Reference Spray Combustion Facility: Effect of Vane Angle and Reynolds Number
Widmann, J. F.; Charagundla, S. R.; Presser, C.; Jan. 2000; 32p; In English
Report No.(s): PB2000-102877; NISTIR-6458; No Copyright; Avail: National Technical Information Service (NTIS)

The airflow through a 12-vane cascade swirl generator is examined numerically to characterize the inlet combustion air in the reference spray combustion facility at NIST. A three-dimensional model is used to simulate the aerodynamics in the swirl generator that imparts the desired degree of angular momentum to the air in the annulus leading into the reactor. A parametric study is presented in which the effects of the vane angle and Reynolds number are examined. The Renormalization Group method (RNG) k-epsilon turbulence model is used to model the transport, production, and dissipation of turbulence due to its superior performance (relative to the standard k-epsilon turbulence model) for this type of flow.
NTIS
Air Flow; Fluid Dynamics; Computational Fluid Dynamics; Inlet Flow

20000074285 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Ionic charge transport in strongly structured molten salts
Tatlipinar, H.; Amoruso, M.; Tosi, M. P.; Aug. 31, 1999; 8p; In English
Report No.(s): DE99-636785; IC-99/107; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Data on the d.c. ionic conductivity for strongly structured molten halides of divalent and trivalent metals near freezing are interpreted as mainly reflecting charge transport by the halogen ions. On this assumption the Nernst-Einstein relation allows an estimate of the translational diffusion coefficient D(sub tr) of the halogen. In at least one case (molten ZnCl2), D(sub tr) is much smaller than the measured diffusion coefficient, pointing to substantial diffusion via neutral units. The values of D(sub tr) estimated from the Nernst-Einstein relation are analyzed on the basis of a model involving two parameters, i.e. a bond-stretching frequency (omega) and an average waiting time (tau). With the help of Raman scattering data for omega, the values of tau are evaluated and found to mostly lie in the range 0.02 - 0.3 ps for a vast class of materials.
NTIS
Ion Currents; Charge Transfer; Ion Exchanging; Ionic Reactions; Transport Properties

20000074965 NASA Marshall Space Flight Center, Huntsville, AL USA
Energetic Combustion Devices for Aerospace Propulsion and Power
Litchford, Ron J., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 11th; Advanced Space Propulsion Research, 31 May - 2 Jun. 2000, Pasadena, CA, USA; Sponsored by Jet Propulsion Lab., California Inst. of Tech., USA; No Copyright; Avail: Issuing Activity; Abstract Only

Chemical reactions have long been the mainstay thermal energy source for aerospace propulsion and power. Although it is widely recognized that the intrinsic energy density limitations of chemical bonds place severe constraints on maximum realizable performance, it will likely be several years before systems based on high energy density nuclear fuels can be placed into routine service. In the mean time, efforts to develop high energy density chemicals and advanced combustion devices which can utilize such energetic fuels may yield worthwhile returns in overall system performance and cost. Current efforts in this vein are being carried out at NASA MSFC under the direction of the author in the areas of pulse detonation engine technology development and

light metals combustion devices. Pulse detonation engines are touted as a low cost alternative to gas turbine engines and to conventional rocket engines, but actual performance and cost benefits have yet to be convincingly demonstrated. Light metal fueled engines also offer potential benefits in certain niche applications such as aluminum/CO2 fueled engines for endo-atmospheric Martian propulsion. Light metal fueled MHD generators also present promising opportunities with respect to electric power generation for electromagnetic launch assist. This presentation will discuss the applications potential of these concepts with respect to aero ace propulsion and power and will review the current status of the development efforts.
Author
Combustion; Carbon Dioxide; Engine Design; Gas Turbine Engines; Rocket Engines; Spacecraft Propulsion

20000075241 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 report on the results of the introductory R and D of the New Sunshine Project under a consignment from NEDO. Introductory R and D of the supercritical fluid use technology
Mar. 31, 1998; 511p; In Japanese; In English
Report No.(s): DE99-714268; ETDE/JP-99714268; No Copyright; Avail: Department of Energy Information Bridge
The R and D of chemical reaction using supercritical fluids started in fiscal 1997. In the R and D of solvent reaction, as the research on polymer decomposition with supercritical water, studies were conducted of the mechanism of conversion reaction to chemical materials, cleavage mechanism of stable chemical bonds, and synthetic reaction in the supercritical state reaction field. In the research on oxidation reaction, as the study of complete oxidation in supercritical water for high efficiency energy recovery, studies of complete oxidation of liquid fuels, and complete oxidation of solid fuels. In the research on hydrogenation, studies of lightening of heavy oil in supercritical water, etc. In the R and D of the basic technology, studies of corrosion mechanism of metals in supercritical water, construction of the basic framework for technical database of supercritical fluids, etc. In the survey of technical trends and new research themes, the introductory R and D of element technology, etc. were conducted, and the results were described of the survey of technical trends and new research themes and the trend survey of overseas technology.
NTIS
Supercritical Fluids; Chemical Reactions

20000075540 Washington Univ., Dept. of Mechanical Engineering, Seattle, WA USA
Evaluation of Closure Models of Turbulent Diffusion Flames ***Final Report***
Kosaly, George; Riley, J. J.; Feb. 14, 2000; 8p; In English
Contract(s)/Grant(s): F49620-97-1-0092; AF Proj. 2308
Report No.(s): AD-A378388; AFRL-SR-BL-TR-00-0215; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Modeling methods applied in the field of turbulent combustion were investigated via Direct Numerical Simulations (DNS) and theoretical analysis with an emphasis on subgrid-scale modeling to be applied in Large Eddy Simulations (LES). The DNS results supported the conditional moment closure approximation, refuted the common modeling of differential diffusion effects, raised a suggestion for valid modeling of differential diffusion, resolved outstanding theoretical issues regarding mixing layers, and demonstrated the need for including flamelet/flamelet interactions in the modeling of extinction/reignition events. The DNS methodology was reconfirmed by comparison to the classical laboratory results of Comte-Bellot and Corrsin. A new subgrid-scale model (Large Eddy Laminar Flamelet; LELFM, a quasi-steady model) was established and applied to the prediction of laboratory results in a simulated mixing layer with nitric oxide/ozone reaction. The results support the modeling. New results were derived and confirmed via DNS regarding the subgrid-scale modeling of the filtered mixture fraction, its second moment and dissipation rate.
DTIC
Turbulent Combustion; Large Eddy Simulation; Diffusion Flames; Direct Numerical Simulation; Scale Models; Laminar Flow

20000075543 Cornell Univ., Dept. of Mechanical and Aerospace Engineering, Ithaca, NY USA
Modeling Mixing and Reaction in Turbulence Combustion ***Final Report, 15 Feb. 1997-14 Feb. 2000***
Pope, S. B.; May 08, 2000; 15p; In English
Contract(s)/Grant(s): F49620-97-1-0126; AF Proj. 2308
Report No.(s): AD-A378397; AFRL-SR-BL-TR-00-0213; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The most advanced probability density function (PDF) turbulent combustion models were developed and applied to make calculations of turbulent flames. The numerical accuracy of the calculations was carefully studied, and algorithmic improvements were developed. Various turbulence and combustion sub-models were developed and improved. The most significant achievement was the accurate calculation of the Sandia piloted jet nonpremixed flames, including quantitative predictions of local extinction, reignition, and minor species concentrations. Essential ingredients for these successful calculations were: the

numerically-accurate particle-mesh method; the augmented reduced chemical mechanism; the in situ adaptive tabulation (ISAT) algorithm; and the Euclidean minimum spanning tree (EMST) mixing model.
DTIC
Combustion Physics; Combustion; Probability Density Functions; Turbulent Combustion; Premixed Flames; Turbulence Models

20000075645 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
High Resolution Thermometry for EXACT
Panek, J. S., Jet Propulsion Lab., California Inst. of Tech., USA; Nash, A. E., Jet Propulsion Lab., California Inst. of Tech., USA; Larson, M., Jet Propulsion Lab., California Inst. of Tech., USA; Mulders, N., Delaware Univ., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

High Resolution Thermometers (HRTs) based on SQUID detection of the magnetization of a paramagnetic salt or a metal alloy has been commonly used for sub-nano Kelvin temperature resolution in low temperature physics experiments. The main applications to date have been for temperature ranges near the lambda point of He-4 (2.177 K). These thermometers made use of materials such as Cu(NH4)2Br4 *2H2O, GdCl3, or PdFe. None of these materials are suitable for EXACT, which will explore the region of the He-3/He-4 tricritical point at 0.87 K. The experiment requirements and properties of several candidate paramagnetic materials will be presented, as well as preliminary test results.
Author
High Resolution; Thermometers; Low Temperature Physics; Temperature Measurement

20000076122 Ministere de l'Enseignement Superieur et de la Recherche, Algiers, Algeria
Colorimetric determination of TOPO and determination of number of ligands of complex
Meddour, L.; Nahnah-Boudjellah,; Achache, M.; Dec. 31, 1998; 130p; In French; In English
Report No.(s): DE99-616826; INIS-DZ-0010; No Copyright; Avail: Department of Energy Information Bridge

The aim of the present work is the establishment of a new dosage method of trioctylphosphine oxide (TOPO). The basis of this method is colorimetry. It consist on the formation of TOPO-iron thiocynate complex which is brick-red colored, then the analysis by spectrometry UV-Vis at a length wave situated between 480 to 488nm. The number of ligands of this complex (TOPO-iron thiocynate) is determined by means of the curve which join the optic density to the SCN concentration and also to the Fe-SCN complex concentration. After that, the calibration curve for the dosage of TOPO in the synthesis mixture is established.
NTIS
Colorimetry; Ligands; Dosage

20000076616 Strasbourg Univ., Inst. de Recherches Subatomiques, France
Electrodynamic modeling applied to micro-strip gas chambers
Fang, R.; Dec. 31, 1998; 89p; In English
Report No.(s): DE99-616057; IRES-98-15; No Copyright; Avail: Department of Energy Information Bridge

Gas gain variations as functions of time, counting rate and substrate resistivity have been observed with Micro-Strip Gas Chambers (MSGC). Such a chamber is here treated as a system of 2 dielectrics, gas and substrate, with finite resistivities. Electric charging between their interface results in variations of the electric field and the gas gain. The electrodynamic equations (including time dependence) for such a system are proposed. A Rule of Charge Accumulation (RCA) is then derived which allows to determine the quantity and sign of charges accumulated on the surface at equilibrium. In order to apply the equations and the rule to MSGCs, a model of gas conductance induced by ionizing radiation is proposed, and a differential equation and some formulae are derived to calculate the rms dispersion and the spatial distribution of electrons (ions) in inhomogeneous electric fields. RCA coupled with a precise simulation of the electric fields gives the first quantitative explanation of gas gain variations of MSGCs. Finally an electrodynamic simulation program is made to reproduce the dynamic process of gain variation due to surface charging with an uncertainty of at most 15% relative to experimental data. As a consequence, the methods for stabilizing operation of MSGCs are proposed.
NTIS
Microstrip Devices; Chambers

20000076805 Lund Univ., Dept. of Combustion Physics, Sweden
Development of laser-induced fluorescence for precombustion diagnostics in spark-ignition engines
Neij, H.; Nov. 30, 1998; 84p; In English
Report No.(s): DE99-721561; LUTFD2-TFCP-41; ISBN 91-628-3083-X; No Copyright; Avail: Department of Energy Information Bridge

Motivated by a desire to understand and optimize combustion in spark-ignition (SI) engines, laser techniques have been developed for measurement of fuel and residual gas, respectively, in the precombustion mixture of an operating SI engine. The primary objective was to obtain two-dimensional, quantitative data in the vicinity of the spark gap at the time of ignition. A laser-induced fluorescence (LIF) technique was developed for fuel visualization in engine environments. Since the fluorescence signal from any commercial gasoline fuel would be unknown to its origin, with an unpredictable dependence on collisional partners, pressure and temperature, a non-fluorescent base fuel - isooctane - was used. For LIF detection, a fluorescent species was added to the fuel. An additive not commonly used in this context - 3-pentanone - was chosen based on its suitable vaporization characteristics and fluorescent properties. The LIF technique was applied to an optically accessible research engine. By calibration, the fluorescence signal from the additive was converted to fuel-to-air equivalence ratio ((phi)). The accuracy and precision of the acquired data were assessed. A statistical evaluation revealed that the spatially averaged equivalence ratio around the spark plug had a significant impact on the combustion event. The strong correlation between these two quantities suggested that the early combustion was sensitive to large-scale inhomogeneities in the precombustion mixture. A similar LIF technique, using acetone as a fluorescent additive in methane, was applied to a combustion cell for ion current evaluation. The local equivalence ratio around the spark gap at the time of ignition was extracted from LIF data. Useful relations were identified between different ion current parameters and the local equivalence ratio, although the impact of the flow field, the fuel type, and the electrode geometry were identified as areas for future research. A novel fuel - dimethyl ether (DME) - was investigated with respect to optical properties relevant to laser-based combustion diagnostics, by flame emission, optical absorption, laser-induced fluorescence, spontaneous Raman scattering, and rotational CARS. The potential for LIF detection of water vapor in combustion processes was evaluated. Water molecules were excited in a two-photon process at 248 nm yielding fluorescence around 400-500 nm. Spectrally interfering species at flame conditions were identified as hot O(sub 2), and laser-generated C(sub 2) and N(sub 2)(sup +). The detection limit for two-dimensional single-shot detection of water vapor at atmospheric conditions was estimated to 0.2%. Extrapolations to flame conditions were presented. A pressure-dependent process was identified, which decreased the signal intensity, broadened the linewidths, and degraded the spectral-excitation feature as the ambient pressure was increased. Two-photon water vapor LIF was applied to a research engine for residual gas visualization. The accuracy and precision of both two-dimensional and spatially averaged data were discussed. The LIF data was used to explain the engine behavior on a cycle-by-cycle basis. A significant correlation was identified between the combustion event and the spatially averaged water signal around the spark gap at the time of ignition.
NTIS
Laser Induced Fluorescence; Combustion Physics

20000078386 Yale Univ., Dept. of Mechanical Engineering, New Haven, CT USA
Two- and Three-Dimensional Measurements in Turbulent Nonpremixed Flames ***Final Report, 16 Feb. 1997-15 Feb. 2000***
Long, Marshall B.; May 14, 2000; 26p; In English
Contract(s)/Grant(s): F49620-97-1-0096; AF Proj. 2308
Report No.(s): AD-A378382; AFRL-SR-BL-TR-00-0005; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
As part of an ongoing research program aimed at developing techniques capable of quantitative imaging of mixture fraction and scalar dissipation in turbulent flames, three-scalar measurements were made in a turbulent nonpremixed flame. The use of nitrogen Raman scattering to detect a passive conserved scalar made it possible to increase confidence in the two-scalar technique based on simultaneous imaging of Rayleigh scattering and fuel Raman scattering. These experiments showed that proper parameterization of mixture fraction-dependent terms appearing in the expression for mixture fraction can improve accuracy for lean values of mixture fraction as well as those near stoichiometric. Additionally, a new experimental technique was investigated which allows the extraction of velocity information from laser-based scalar imaging in turbulent flows. Preliminary results from simultaneous particle-imaging velocimetry (PIV) and optical flow velocimetry showed that this technique has potential for unseeded velocity measurements compatible with the mixture fraction imaging. The optical flow approach was based on extracting velocity vectors from the intensity variations naturally present in inhomogeneous turbulent flow images of a mixing-dependent scalar quantity.
DTIC
Turbulent Flames; Turbulent Flow; Turbulent Combustion

20000078414 Lund Univ., Dept. of Heat and Power Engineering, Sweden
Study of fluid flow and combustion with variable valve timing
Soederberg, F.; Oct. 31, 1998; 53p; In English
Report No.(s): DE99-721566; LUTMDN-TMHT-98-7029; No Copyright; Avail: Department of Energy Information Bridge

The effects of variable valve timing (VVT) were examined by in-cylinder Laser Doppler Velocimetry flow measurements and heat-release calculations. A single-cylinder Volvo B5254 engine was used for all experiments and the valve timing was altered by phasing or exchanging the camshaft. Special cam lobes were developed for simulation of throttle-less operation. With the standard double camshaft, a tumbling flow was generated and with valve deactivation, a swirling flow was generated. The turbulence was increased with valve deactivation. This increased the combustion rate making lean burn possible. The standard camshaft with inlet valve deactivation and late cam phasing had a faster combustion at (lambda) = 1.8 than the standard camshaft with normal cam phasing at (lambda) = 1.0. Early and late inlet valve closing was used for enabling throttle-less operation. Early inlet valve closing (EIVC) generated a very slow tumble with low turbulence. Late inlet valve closing generated both very high and low turbulence. The net indicated efficiency was improved with up to 10%. Some reduction was observed for the gross indicated efficiency, due to a too large reduction in effective compression ratio. A very stable combustion was obtained for EIVC with gasoline, possibly due to a sheering flow over the inlet valves resulting in improved fuel-air preparation. Wavelet analysis was used for dividing LDV flow measurements into time and frequency resolved information. The technique rendered the same flow results as the moving window technique, but with a separation of the turbulence into different frequencies. The choice of wavelet was shown not to be crucial. The frequency resolved turbulence was studied for tumble and swirl. A tumbling flow had a larger transfer of energy from low frequency turbulence into high frequency turbulence than a swirling flow. This is caused by the tumble breakdown. A correlation against heat-release indicated that high frequency turbulence have a larger impact on the rate of heat-release than the low frequency turbulence.
NTIS
Fluid Flow; Combustion; Valves

20000078416 Swedish National Energy Administration, Eskilstuna, Sweden
Formation of nitrogen compounds at gasification/pyrolysis condition
Bjoerkman, E.; Nilsson, T.; Stroemberg, B.; Aug. 31, 1998; 32p; In English
Report No.(s): DE99-721586; STEM-FBT-98-2; TPS-97-35; No Copyright; Avail: Department of Energy Information Bridge

A kinetic model by which it is possible to determine reactions constants for the formation/destruction of hydrogen cyanide and ammonia from fuel-N during pyrolysis/gasification conditions in presence of an internal catalyst is here presented, together with the possibilities to experimentally support the model with data. The experiments were performed in a small fixed bed quarts reactor, the bed materials were CaO and iron doped CaO. The fuel used was a liquid mixture of pyridine, ethylene glycol and formic acid (25 mole-% C, 49 mole-% H, 24 mole-% 0 and 1.8 mole-% of N). The product gas was analysed for NH3, HCN, NO, CO, CO2, CH4 and C2H4 with an FTIR. For some of the experiments a gas chromatograph with double thermal conductivity detectors (TCD) was used to measure the nitrogen gas formation. Changing the contact time with the iron doped CaO gave significant changes in mainly ammonia and nitrogen monoxide concentrations. The decomposition of hydrogen cyanide has also been studied, showing that no ammonia was formed from HCN during the experimental conditions used.
NTIS
Nitrogen Compounds; Gasification; Pyrolysis

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METALS AND METALLIC MATERIALS

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

20000074652 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Challenges to the Transition of IPMC Artificial Muscle Actuators to Practical Application
Bar-Cohen, Yoseph, Jet Propulsion Lab., California Inst. of Tech., USA; Leary, Sean, Jet Propulsion Lab., California Inst. of Tech., USA; Oguro, Keisuke, Osaka National Research Inst., Japan; Tadokoro, Satoshi, Kobe Univ., Japan; Harrison, Joycelyn, NASA Langley Research Center, USA; Smith, Joseph, NASA Langley Research Center, USA; Su, Ji, NASA Langley Research Center, USA; [1999]; 1p; In English, 29 Nov. - 1 Dec. 1999, Boston, MA, USA; Sponsored by Materials Research Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Ion-exchange membrane metallic composites (IPMC), which were first reported in 1992, are one of the electroactive materials (EAP) with potential applications as artificial muscle actuators. The recent introduction of perfluorocarboxylate-gold composite with tetra-n-butylammonium and Lithium cations instead of sodium made the most significant improvement of the material electroactivity. Under less than 3 volts, IPMC with the new constituents is capable of bending beyond a complete loop. Taking into account the fact that IMPC materials do not induce a significant force, the authors are extensively seeking applications for these bending EAP. Some of the applications that were demonstrated include dust-wiper, catheter guide, miniature motor, robotic-

gripper, micro-manipulator, etc. Generally, space applications are the most demanding in terms of operating conditions, robustness and durability, and the co-authors of this paper are jointly addressing the associated challenges. Specifically, a dust-wiper is being developed for the Nanorover's infrared camera window of the MUSES-CN mission. This joint NASA and the Japanese space agency mission, is scheduled to be launch from Kagoshima, Japan, in January 2002, to explore the surface of a small near-Earth asteroid. Several issues that are critical to the operation of IPMC are addressed including the operation in vacuum, low temperatures, and the effect of the electromechanical characteristic of the IPMC on its actuation capability. Highly efficient IPMC materials, mechanical modeling, unique elements and protective coating were introduced by the authors and are making a high probability the success of the IPMC actuated dust-wiper.
Author
Electromechanics; Miniaturization; Electroactive Polymers; Microelectromechanical Systems

20000075243 New Energy and Industrial Technology Development Organization, Tokyo, Japan
International research cooperation in fiscal 1997. Report on the development of novel magnesium alloy-base ultralight materials
Mar. 31, 1998; 129p; In Japanese; In English
Report No.(s): DE99-714272; ETDE/JP-99714272; No Copyright; Avail: Department of Energy Information Bridge
Research and development are conducted for the improvement of magnesium alloy characteristics and for the realization of energy and cost saving in the manufacturing process of the said alloys. Concerning manufacturing techniques for high-performance magnesium materials which are among the existing alloys, researches are conducted about the development of superplastic magnesium alloys, development of heat-resistant magnesium alloys, pulverizing techniques and the experimental construction of equipment therefore, safety of magnesium powder, high-precision strain control, processing for enhanced strength and superplasticity, and heat treatment and surface treatment technologies. In the efforts for developing technologies for manufacturing ultrahigh-performance magnesium materials which are novel alloys, researches are conducted concerning the manufacture of amorphous magnesium alloys and methods for evaluating the characteristics thereof, manufacture of amorphous magnesium alloys by a liquid-aided rapid cooling method and the characteristics of the products, and methods for forming the alloys into wires. The developed magnesium materials are tested for strength, resistance to corrosion, etc., and environmental impacts and friendliness toward environments that will eventually affect the life cycle of the new materials are discussed.
NTIS
Magnesium Alloys; Heat Resistant Alloys; Energy Conservation

20000076477 Al-Farabi Kazak State National Univ., Almaty, Kazakhstan
Mechanism of radiation and thermal decomposition of sulphide non-ferrous metals
Mazhrenova, N.; Dec. 31, 1998; 130p; In English
Report No.(s): DE99-616833; INIS-KZ-032; No Copyright; Avail: Department of Energy Information Bridge
This paper deals with the non-ferrous metals sulfides in term of their radiative sensitivity, directed chances of their physical-chemical, and hence technological properties by radiation influence both on sulfide materials and on the processes with their participation.
NTIS
Thermal Decomposition; Radiation Effects

20000076487 Battelle Memorial Inst., Pacific Northwest Labs., Richland, WA USA
An Investigation of Acoustic Emission from Defect Formation in Stainless Steel Weld Coupons
January 1969; 48p; In English
Report No.(s): AD-A377704; BNWL-902; UC-37; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Results of an exploratory investigation to determine capabilities and limitations of acoustic emission techniques for detecting weld defects are presented in this report. Acoustic emissions reveal cracks while they form during the welding operation; data indicate that gross porosity can also be detected with this technique. Interference signals, similar to acoustic emissions from bona-fide weld defects, can be produced by scale flaking away from the weld surface, by electromagnetic interference, and by impact on the weld material by tools, welding rods, and other metal objects. Suggestions for reducing the effects of interference signals are included in the report.
DTIC
Acoustic Emission; Crack Propagation; Cracking (Fracturing); Defects; Stainless Steels

27
NONMETALLIC MATERIALS

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

20000074269 NASA Marshall Space Flight Center, Huntsville, AL USA
Marshall Convergent Coating Development Team: An Aerospace Success Story
Lester, Carl N., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 15th; Continual Improvement and Reinvention, 27 Apr. 2000, USA; Sponsored by NASA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The external thermal insulation systems for the Space Shuttle solid rocket boosters and the Air Force Titan IV payload fairings were in jeopardy due to EPA regulatory problems, endangering the flight status of both vehicles. The Marshall Convergent Coating (MCC-1) Development Team was formed in February 1994 to develop and implement an EPA-compliant external thermal insulation system for both systems. MCC-1 made use of a process known as Convergent Spray Technology (CST), a solventless, sprayable process that eliminated the environmentally hazardous chemicals involved with the old methods. Implemented in record time, the new insulation was so successful that it was selected for two additional flight vehicles, Boeing's Sea Launch and Delta TV. The activity also led to commercial spin-off pilot projects. The team continues today to share data between the various production sites, resolve production issues, expand the material's use, and consider potential improvements for the future.
Author
Coating; Elastic Properties; Technology Transfer; Thermal Insulation

20000074656 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Reliable, Low-Cost, Low-Weight, Non-Hermetic Coating for MCM Applications
Jones, Eric W., Jet Propulsion Lab., California Inst. of Tech., USA; Licari, James J., AvanTeco Corp., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Through an Air Force Research Laboratory sponsored STM program, reliable, low-cost, low-weight, non-hermetic coatings for multi-chip-module(MCK applications were developed. Using the combination of Sandia Laboratory ATC-01 test chips, AvanTeco's moisture sensor chips(MSC's), and silicon slices, we have shown that organic and organic/inorganic overcoatings are reliable and practical non-hermetic moisture and oxidation barriers. The use of the MSC and unpassivated ATC-01 test chips provided rapid test results and comparison of moisture barrier quality of the overcoatings. The organic coatings studied were Parylene and Cyclotene. The inorganic coatings were Al2O3 and SiO2. The choice of coating(s) is dependent on the environment that the device(s) will be exposed to. We have defined four(4) classes of environments: Class I(moderate temperature/moderate humidity). Class H(high temperature/moderate humidity). Class III(moderate temperature/high humidity). Class IV(high temperature/high humidity). by subjecting the components to adhesion, FTIR, temperature-humidity(TH), pressure cooker(PCT), and electrical tests, we have determined that it is possible to reduce failures 50-70% for organic/inorganic coated components compared to organic coated components. All materials and equipment used are readily available commercially or are standard in most semiconductor fabrication lines. It is estimated that production cost for the developed technology would range from $1-10/module, compared to $20-200 for hermetically sealed packages.
Author
Semiconductors (Materials); Protective Coatings; Moisture Resistance; Protection; Weatherproofing; Chips (Electronics); Integrated Circuits

20000074968 NASA Marshall Space Flight Center, Huntsville, AL USA
Non-Asbestos Insulation Testing Using a Plasma Torch
Morgan, R. E., Thiokol Propulsion, USA; Prince, A. S., Thiokol Propulsion, USA; Selvidge, S. A., Thiokol Propulsion, USA; Phelps, J., NASA Marshall Space Flight Center, USA; Martin, C. L., NASA Marshall Space Flight Center, USA; Lawrence, T. W., NASA Marshall Space Flight Center, 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 2000-3317; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

Insulation obsolescence issues are a major concern for the Reusable Solid Rocket Motor (RSRM). As old sources of raw materials disappear, new sources must be found and qualified. No simple, inexpensive test presently exists for predicting the erosion performance of a candidate insulation in the full-scale motor, Large motor tests cost million of dollars and therefore can only be used on a few very select candidates. There is a need for a simple, low cost method of screening insulation performance that can simulate some of the different erosion environments found in the RSRM. This paper describes a series of erosion tests on two

different non-asbestos insulation formulations, a KEVLAR(registered) fiber-filled and a carbon fiber-filled insulation containing Ethylene-Propylene-Diene Monomer (EPDM) rubber as the binder. The test instrument was a plasma torch device. The two main variables investigated were heat flux and alumina particle impingement concentration. Statistical analysis revealed that the two different formulations had very different responses to the main variable. The results of this work indicate that there may be fundamental differences in how these insulation formulations perform in the motor operating environment. The plasma torch appears to offer a low-cost means of obtaining a fundamental understanding of insulation response to critical factors in a series of statistically designed experiments.
Author
Asbestos; Insulation; Erosion

20000075653 NASA Glenn Research Center, Cleveland, OH USA
Evaluation of Non-Ozone-Depleting-Chemical Cleaning Methods for Space Mechanisms Using a Vacuum Spiral Orbit Rolling Contact Tribometer
Jansen, Mark J., AYT Corp., USA; Jones, William R., Jr., NASA Glenn Research Center, USA; Wheeler, Donald R., NASA Glenn Research Center, USA; Keller, Dennis J., Real World Quality Systems, USA; May 2000; 12p; In English; 55th, 7-11 May 2000, Nashville, TN, USA; Sponsored by Society of Tribologists and Lubrication Engineers, USA
Contract(s)/Grant(s): NAS3-27571; RTOP 458-70-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Because CFC 113, an ozone depleting chemical (ODC), can no longer be produced, alternative bearing cleaning methods must be studied. The objective of this work was to study the effect of the new cleaning methods on lubricant lifetime using a vacuum bearing simulator (spiral orbit rolling contact tribometer). Four alternative cleaning methods were studied: ultra-violet (UV) ozone, aqueous levigated alumina slurry (ALAS), super critical fluid (SCF) CO2 and aqueous Brulin 815GD. Baseline tests were done using CFC 113. Test conditions were the following: a vacuum of at least 1.3 x 10(exp -6) Pa, 440C steel components, a rotational speed of 10 RPM, a lubricant charge of between 60-75 micrograms, a perfluoropolyalkylether lubricant (Z-25), and a load of 200N (44.6 lbs., a mean Hertzian stress of 1.5 GPa). Normalized lubricant lifetime was determined by dividing the total number of ball orbits by the amount of lubricant. The failure condition was a friction coefficient of 0.38. Post-test XPS analysis was also performed, showing slight variations in post-cleaning surface chemistry. Statistical analysis of the resultant data was conducted and it was determined that the data sets were most directly comparable when subjected to a natural log transformation. The natural log life (NL-Life) data for each cleaning method were reasonably normally (statistically) distributed and yielded standard deviations that were not significantly different among the five cleaning methods investigated. This made comparison of their NL-Life means very straightforward using a Bonferroni multiple comparison of means procedure. This procedure showed that the ALAS, UV-ozone and CFC 113 methods were not statistically significantly different from one another with respect to mean NL-Life. It also found that the SCF CO2 method yielded a significantly higher mean NL-Life than the mean NL-Lives of the ALAS, UV-ozone and CFC 113 methods. It also determined that the aqueous Brulin 815GD method yielded a mean NL-Life that was statistically significantly higher than the mean NL-Lives of each of the other four methods. Baseline tests using CFC 113 cleaned parts yielded a mean NL-Life 3.62 orbits/micro-g. ALAS and UV-ozone yielded similar mean NL-Life (3.31 orbits/mg and 3.33 orbits/micro-g, respectively). SCF CO2, gave a mean NL-Life of 4.08 orbits/mg and aqueous Brulin 8l5GD data yielded the longest mean NL-Life (4.66 orbits/micro-g).
Author
Chemical Cleaning; Lubricants; Surface Reactions; Spacecraft Components; Performance Tests; Service Life

20000075970 Maryland Univ., Dept. of Chemical and Nuclear Engineering, College Park, MD USA
Instrumentation for Microwave Processing ***Final Report, 1 Sep. 1996-30 Nov. 1997***
Lloyd, Isabel; Apr. 2000; 3p; In English
Contract(s)/Grant(s): F49620-96-1-0457
Report No.(s): AD-A378337; AFRL-SR-BL-TR-00-0209; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

As proposed, and then amended in our request for a no-cost extension of August 1997, we purchased the following systems: (a) Automatic polishing system (including multiple specimen holders for mounted and unmounted specimens and a magnetic wheel and magnetic polishing plates for polishing cloths to facilitate the polishing process and minimize use of consumables; (b) Optical extensometer system to be used as a non-contact optical dilatomer. Includes table to facilitate focusing on sample and computer and software to allow the extensometer to be used for closed loop process control; (c) Centrifuge to allow processing of nanopowders (both consolidation of commercial nanopowders and preparation of experimental nanopowders); (d) Zeta potential analyzer to allow evaluation of size and surface charge of nanopowders. This is being used for development and dispersion of nanopowder systems; (e) Optical pyrometry system, three pyrometers on a computer controlled translation table were purchased to allow process control over at least room temperature to 2000 C. We believe

that the system is capable of reliable temperature measurement and process control at higher temperatures, but we have not yet attempted to process at temperatures above 2000 C.
DTIC
Ceramics; Polishing; Temperature Measurement; Feedback Control

20000076009 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1996 report on the R and D result of industrial science and technology: R and D synergy ceramics
Mar. 31, 1998; 101p; In Japanese; In English
Report No.(s): DE99-718332; ETDE/JP-99718332; No Copyright; Avail: Department of Energy Information Bridge

This paper summarizes the general survey mainly conducted by FCRA (Fine Ceramics Research Association) in fiscal 1996, and the joint research results with some universities, from some R and D on synergy ceramics. Silicon nitride based ceramics expressed the same high thermal conductivity as metal by seed crystal addition, grain growth control and orientation control of sheet lamination. For its practical use, study was made on control factors of material, formation and sintering. Ca2Y2Si2O9 single crystal was prepared by float-zone method to determine its crystal structure. No volume change due to high-temperature phase transition as thermal expansion was found. In carbothermal reduction-nitridation of SiO2, addition of Si3N4 seed powder increased a reaction rate and formed uniform particles with an isotropic shape. An average particle size was dependent on the size and number of fine particles in seed powder. Addition of both Si3N4 and Fe compound could change a particle shape from a spherical grain to an elongated grain. A spherical Fe-Si metal grain was found on the tip of an elongated grain.
NTIS
Research and Development; Ceramics; Technology Utilization

20000076010 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 report on the results of the R and D of industrial scientific technology. R and D of synergistic ceramics (R and D of corrosion prevention technology for the petroleum production system)
Mar. 31, 1998; 433p; In Japanese; In English
Report No.(s): DE99-718333; ETDE/JP-99718333; No Copyright; Avail: Department of Energy Information Bridge

To heighten durability and safety of materials/parts for undersea oil drilling, the development of ceramic base materials was done by developing function harmony type process technology which harmonizes on a high grade contrary characteristics and various functions. The paper summed up the fiscal 1997 results. In the design of system formation, computational simulation technology was developed to the composite process and the diploid system. The development of multifunction simultaneous manifestation materials was made by the higher nano-structure process. A study was made of control of microstructures of porous materials and matrix filling by the gas phase precipitation control. Proposed were selective control of grain growth from species crystals and the columnar particle orientation laminated structure of simultaneous manifestation of strength and toughness. by composite precipitation reaction control, studied were simultaneous dispersion of whisker and increase in density of matrixes, and harmonization with long fibers. Silicon nitride was trially made with low lubrication/friction coefficients and high strength. A simulation method for crack progress behavior evaluation was developed using a testing notched specimen heterogeneous microstructures. Analyses were made of brittle fracture mechanics and reliability evaluation.
NTIS
Research and Development; Technology Utilization; Ceramics; Corrosion Prevention

20000076011 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 report of the R and D result of industrial science and technology: R and D on synergy ceramics
Mar. 31, 1998; 15p; In Japanese; In English
Report No.(s): DE99-718334; ETDE/JP-99718334; No Copyright; Avail: Department of Energy Information Bridge

This paper summarizes the general survey mainly conducted by FCRA (Fine Ceramics Research Association) in fiscal 1997, from some R and D on synergy ceramics. In fiscal 1997, the 4th year of this project, a preliminary midterm evaluation was newly introduced. to cope with this evaluation, FCRA newly established a research planning/control WG in addition to previous research management, operation and survey WGs, and supported research activities through various committees and research meetings. The design, operation and result of the project were evaluated by the preliminary midterm evaluation, resulting in an acceptable evaluation result.
NTIS
Research Management; Ceramics; Technology Utilization

20000076012 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Fiscal 1997 report of the R and D result of industrial science and technology. R and D on synergy ceramics (development of rational energy use technology)

Mar. 31, 1998; 140p; In Japanese; In English

Report No.(s): DE99-718335; ETDE/JP-99718335; No Copyright; Avail: Department of Energy Information Bridge

For rational use of energy resources, the process technology which allows harmonization and multiplication of conflicting characteristics was developed for development of new ceramic system materials. This paper summarizes the result in fiscal 1997. On a structural reaction process among creation technologies of ultra-reliable structure, a study was made on structure control and hot-working technology through atmosphere control in ceramics synthesis. On basic technology for analysis and evaluation, a study was made on the effect of particle bridging on strengthening and toughening of ceramic materials. Study was also made on a toughness expression mechanism, FEM model analysis of particle bridging, and crack growth resistance of ceramics. On control of solid solution precipitation, new alumina ceramics with high strength, hardness and wear resistance was obtained by transgranularly precipitating nano-size particles from a fine-grain high-density matrix through an improved particle formation process. Its toughness was considerably improved by controlling grain shape and grain boundary structure. A precipitation mechanism was also discussed.

NTIS

Ceramics; Research and Development; Energy Technology; Energy Conservation

20000076121 Al-Farabi Kazak State National Univ., Almaty, Kazakhstan

Effect of the magnetron sputtering process parameters on the electrical properties of the amorphous carbon films

Sarsembinov, S.; Prikhod'ko, O.; Maksimova, S.; Urynbaev, J.; Dec. 31, 1998; 130p; In English

Report No.(s): DE99-616829; INIS-KZ-028; No Copyright; Avail: Department of Energy Information Bridge

The effect of the use gas pressure, the distance between the target and substrate, the discharge current, and the substrate temperature on the value of the electrical conductivity of the amorphous carbon films obtained by the magnetron sputtering method for the graphite target in an argon gas atmosphere were studied. It was found that the electrical conductivity of the film is effectively changed to a wide range by changing the substrate temperature. Meanwhile, the obtained films have different structural modification from diamond-like structure to graphite-like structure.

NTIS

Amorphous Materials; Magnetron Sputtering

20000078401 Sandia National Labs., Albuquerque, NM USA

Limitations of the Arrhenius Methodology

Celina, M.; Clough, R. L.; Gillen, K. T.; Oct. 27, 1998; 13p; In English; 26th Water Reactor Safety Information Meeting; Bethesda, MD; 10/2/1998

Report No.(s): DE00-001535; SAND98-1726C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Arrhenius methodology has been utilized for many years to NOV 171998 predict polymer lifetimes in various applications. Unfortunately, there are numerous potential limitations associated with this methodology, many of which can lead to non-Arrhenius behavior. This paper will review several of these limitations, including a brief mention of diffusion-limited oxidation (DLO) effects and a more extensive discussion of the implication of changes in the effective Arrhenius activation energy E. or in the dominant reactions as the temperature changes. Changes in Ea or in the dominant reactions with temperature can happen for any material, making extrapolations beyond the experimental temperature range problematic. Unfortunately, when mechanistic changes occur, they invariably result in a reduction in effective Arrhenius activation energy, leading to lower than expected material lifetimes. Thus it is critically important to derive methods for testing the Arrhenius extrapolation assumption. One approach that we have developed involves ultrasensitive oxygen consumption measurements. Results from the application of this approach will be reviewed.

NTIS

Polymer Chemistry; Life (Durability)

20000078403 Sandia National Labs., Albuquerque, NM USA

Electrochemical Evaluation of Pyrite Films Prepared by Plasma Spraying

Guidotti, R. A.; Reinhardt, F. W.; Oct. 30, 1998; 11p; In English; Fall 1998 Meeting of the Electrochemical Society; Boston, MA; 11/01-06/1998

Report No.(s): DE00-001538; SAND98-2444C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Thermally activated batteries use electrodes that are typically fabricated by cold pressing of powder. In the LiSi/FeS2 system, natural (mineral) pyrite is used for the cathode. In an effort to increase the energy density and specific energy of these batteries, flame and plasma spraying to form thin films of pyrite cathodes were evaluated. The films were deposited on a 304 stainless steel substrate (current collector) and were characterized by scanning electron microscopy and x-ray diffraction. The films were electrochemically tested in single cells at 5000 C and the performance compared to that of standard cells made with cold-pressed powders. The best results were obtained with material deposited by de-arc plasma spraying with a proprietary additive to suppress thermal decomposition of the pyrite.
NTIS
Electrochemistry; Pyrites; Thin Films; Plasma Spraying; Flame Spraying

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.

20000074278 National Inst. of Standards and Technology, Office of Weights and Measures Program, Gaithersburg, MD USA
Uniform Laws and Regulations in the Areas of Legal Metrology and Engine Fuel Quality as Adopted by the 84th Conference on Weights and Measures 1999. 2000 Edition
Coleman, G. T.; Grimes, T. L.; Nov. 1999; 246p; In English
Report No.(s): PB2000-102876; NIST/HB-130/2000; No Copyright; Avail: National Technical Information Service (NTIS)

This Handbook complies uniform laws and regulations developed by the Committee on Laws and Regulations of the National Conference on Weights and Measures (NCWM). This edition contains amendments adopted by the NCWM at its annual meeting in 1999. It includes an Examination Procedure for Price Verification that was adopted in 1995 after a 2-year effort by more than 500 retailers and weights and measures officials and a revision of the Uniform National Type Evaluation Regulation. The NCWM recommends adoption and promulgation by the States of these uniform laws and regulations as updated in this Handbook.
NTIS
Regulations; Metrology; Weight Measurement; Law (Jurisprudence); Fuels

20000076031 Dansk Ingenioerforening, Copenhagen, Denmark
International conference on catalysis in membrane reactors
Sep. 30, 1998; 127p; In English; 3rd; ICCMR '98: catalysis in membrane reactors, Copenhagen, Denmark
Report No.(s): DE99-717594; NEI-DK-3251; No Copyright; Avail: Department of Energy Information Bridge

The 3. International Conference on Catalysis in Membrane Reactors, Copenhagen, Denmark, is a continuation of the previous conferences held in Villeurbanne 1994 and Moscow 1996 and will deal with the rapid developments taking place within membranes with emphasis on membrane catalysis. The approx. 80 contributions in form of plenary lectures and posters discuss hydrogen production, methane reforming into syngas, selectivity and specificity of various membranes etc. The conference is organized by the Danish Catalytic Society under the Danish Society for Chemical Engineering.
NTIS
Chemical Engineering; Catalysis; Membranes; Chemical Reactors; Conferences

20000078418 Swedish Transport and Communications Research Board, Stockholm, Sweden
Emission characteristics when using bioethanol as a fuel for passenger cars
Egebaeck, K. E.; Laurikko, J.; Ryden, C.; Nov. 30, 1998; 24p; In English
Report No.(s): DE99-725913; KFB-98-33; ISBN 91-88371-06-9; No Copyright; Avail: Department of Energy Information Bridge

In 1991 the Swedish Transport and Communication Research Board (KFB), was asked by the Swedish Government to carry out investigations and field tests in order to demonstrate the possibility of using bioethanol and biogas as automotive fuels. A five-year programme was set up for the investigations and demonstrations and the programme was later extended to a seven-year programme. Despite the fact that most of the work has been directed towards heavy-duty vehicles and especially buses in city traffic some important investigations have been carried out in order to demonstrate the use of bioethanol and biogas in passenger cars. The programme for passenger cars has consisted of running and testing 53 Flexible Fuel Vehicles (FFV), fueled with bioethanol (E85), a project run by the Swedish Ethanol Development Foundation, and 20 other cars fueled with biogas, a project carried out

by the City of Stockholm's Material Supply Organization, and sponsored by KFB. For both fleets of vehicles the exhaust emissions have been extensively characterized at a laboratory in Finland owned by the Technical Research Centre of Finland. The aim of this paper is to present some interesting results from the demonstrations of the use of E85 in FFV's and thereby especially focus on the results of the characterisation of both regulated and non-regulated emissions.
NTIS
Exhaust Emission; Automobile Fuels

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.

20000074268 NASA Marshall Space Flight Center, Huntsville, AL USA
The Current Microgravity Materials Science Program
Gillies, Donald C., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Materials Science, 8 Jun. 2000, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A description will be made of the current materials science program within the microgravity research division. This presentation will be made at a plenary session of the biennial materials Science Conference.
Author
Technology Assessment; Solidification; Heat Shielding; Auroras

20000074660 NASA Marshall Space Flight Center, Huntsville, AL USA
A Solid Case for Microgravity Processing
Grugel, Richard N., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Solidification of metals, particularly alloys, is a complicated process. At some sufficiently high temperature, the components comprising an alloy fully mix, producing a single homogeneous liquid. Unfortunately, after this liquid is cast into a mold and allowed to freeze, the resulting solid is usually very inhomogeneous. In most cases the first solid to "freeze out" of the liquid has a composition very close to one of the pure metals. This initially solidifying metal usually comprises microscopic, pine-tree shaped components, collectively referred to as a dendritic array, whose distribution, alignment, and scale directly influence a materials strength and docility. During dendrite growth the adjacent liquid becomes enriched, and consequently, solidifies a much lower temperature and considerably later time. Thus, in the course of solidification, both the solid and the enriched liquid can have compositions (and local temperatures) significantly different from those of the bulk liquid. Different compositions and temperatures imply different densities that, in Earth's gravity, induce motion in the liquid. Such motion promotes formation of a casting that is denser at the bottom and lighter at the top. This condition known as macrosegregation, precludes optimized, uniform material properties.
Author
Solidification; Metals; Alloys; Space Processing

20000075268 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Research Opportunities on the Low Temperature Microgravity Physics Facility (LTMPF) on the International Space Station
Liu, Feng-Chuan, Jet Propulsion Lab., California Inst. of Tech., USA; Adriaans, Mary Jayne, Jet Propulsion Lab., California Inst. of Tech., USA; Pensinger, John, Jet Propulsion Lab., California Inst. of Tech., USA; Israelsson, Ulf, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Low Temperature Microgravity Physics Facility (LTMPF) is a state-of-the-art facility for long duration science Investigations whose objectives can only be achieved in microgravity and at low temperature. LTMPF consists of two reusable, cryogenic facilities with self-contained electronics, software and communication capabilities. The Facility will be first launched by Japanese HIIA Rocket in 2003 and retrieved by the Space Shuttle, and will have at least five months cryogen lifetime on the Japanese Experiment Module Exposed Facility (JEM EF) of the International Space Station. A number of high precision sensors of temperature, pressure and capacitance will be available, which can be further tailored to accommodate a wide variety of low temperature experiments. This paper will describe the LTMPF and its goals and design requirements. Currently there are six candidate

experiments in the flight definition phase to fly on LTMPF. Future candidate experiments will be selected through the NASA Research Announcement process. Opportunities for utilization and collaboration with international partners will also be discussed. This work is being carried out by the Jet Propulsion Laboratory, California Institute of Technology under contract to the National Aeronautics and Space Administration. The work was funded by NASA Microgravity Research Division.
Author
Microgravity; Spacecraft Modules; Research Facilities; Space Laboratories; Test Facilities; Low Temperature Physics

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.

20000074682 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of
Development of High Temperature Electromagnet Coils for Electromagnetic Pumps
Lee, D. N.; Kim, S. H.; Byun, J. S.; Jul. 31, 1997; 110p; In Korean; In English
Report No.(s): DE99-727784; KAERI-CM-090/96; No Copyright; Avail: Department of Energy Information Bridge

The electromagnet coils for generating high magnetic fields in the electromagnetic pump are required to have high electrical conductivity and strength at 600 C. Alumina dispersion strengthened coppers may be appropriate coil materials because they have the high conductivity and strength at room temperature and retain the high strength even at high temperature near the melting point. The heat treatment condition of successful internal oxidation is obtained and formed alumina dispersion was observed. The possible methods of internal oxidation and sheet bonding was evaluated and surface oxidation and hot roll bonding were considered to be most appropriate methods. The sheet fabricated by internal oxidation, hot roll bonding of internally oxidized sheets and subsequent cold rolling had tensile strengths of 484-522 MPa, electrical conductivities of 80-89% IACS. The sheet had the thermal stability of mechanical properties after annealing at 600 C for 1 hour. In order to obtain 500 MPa tensile strength and 85% IACS electrical conductivity, about 100 internally oxidized sheets, the A1 content of which is in the range of 0.15-0.25 wt%, the initial thickness of which is less than 80 (mu)m, should be hot roll bonded, followed by cold rolling to 200 (mu)m in thickness. Insulants for the coils have been reviewed and mica is considered to be the appropriate material because of its high temperature stability.
Author(NTIS)
Electromagnets; Magnetic Coils

20000074799 Research Triangle Inst., Research Triangle Park, NC USA
Environmental Technology Verification (ETV) of Paint Overspray Arrestors
Hanley, J. T.; Owen, M. K.; Farmer, J. R.; Brna, T. G.; [2000]; 12p; In English, 14-17 Mar. 2000, Myrtle Beach, SC, USA; Sponsored by Environmental Protection Agency, USA; See also PB97-147953
Report No.(s): PB2000-105770; No Copyright; Avail: National Technical Information Service (NTIS)

The paper discusses the environmental technology verification (ETV) of paint overspray arrestors undertaken as part of a program to accelerate the development and commercialization of improved environmental technologies through third-party verification and reporting of performance. The goal of the program is to verify the performance characteristics of commercial-ready environmental technologies through the evaluation of objective and quality-assured data so that potential purchasers and permitters are provided with an independent and credible assessment of the technology that they are buying or permitting. The program seeks to achieve this goal by providing high-quality peer-reviewed data on technology performance to those involved in the design, distribution, financing, permitting, purchase, and use of environmental technologies. The program recently evaluated the performance of paint overspray arrestors used primarily in the aerospace industry.
NTIS
Technology Assessment; Technology Utilization; Proving

20000074800 ManTech International Corp., Aerospace Technology Applications Center, USA
American National Standards: The Consensus Process
Schafer, Thom, ManTech International Corp., USA; [2000]; 5p; In English; 1999-2000 Pressure System Safety Seminar, 4-6 Apr. 2000, Greenbelt, MD, USA; Sponsored by NASA Goddard Space Flight Center, USA
Contract(s)/Grant(s): NAS5-32537; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Since the early 20th Century, technical and professional societies have developed standards within their areas of expertise addressing aspects of their industries which they feel would benefit from a degree of standardization. From the beginning, the use

of these standards was strictly voluntary. It did not take jurisdictional authorities long, however, to recognize that application of these voluntary standards enhanced public safety, as well as leveling the playing field in trade. Hence, laws were passed mandating their use. Purchasers of goods and services also recognized the advantages of standardization, and began requiring the use of standards in their procurement contracts. But how do jurisdictions and purchasers know that the standard they are mandating is a broad-based industry standard, or a narrowly focused set of rules which only apply to one company or institution, thereby giving them an unfair advantage? The answer is ”consensus”, and a unified approach in achieving it.
Author
Standardization; Laws; Agreements; Standards

32
COMMUNICATIONS AND RADAR

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

20000075424 Norwegian Defence Research Establishment, Kjeller, Norway
The Performance of HF Modems on High Latitude Paths ***Ytelsen av Standard HF-Modemer pa Norske Breddegrader***
Jodalen, Vivianne, Norwegian Defence Research Establishment, Norway; May 22, 2000; 34p; In Norwegian; Original contains color illustrations
Contract(s)/Grant(s): FFIE Proj. 742/110
Report No.(s): FFI/RAPPORT-2000/02687; ISBN 82-464-0425-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The high latitude HF channel has been measured and characterized in terms of Doppler spread, delay spread and signal-to-noise ratio. The performance of data modems has been determined over a comprehensive range of simulated channel conditions. A comparison is made between the channel measurements and the modem characterizations, and modem availabilities during the measured channel conditions are determined. Two 75 bits per second (bps) modems (compliant with STANAG 4415 and STANAG 4285), a 2400 bps modem (compliant with STANAG 2400 bps), Morse and Voice have been selected for analysis. The two 75 bps modems show 60-75% higher availability than the 2400 bps modem on the measured paths. The 2400 bps modem is degraded in performance during a geomagnetic disturbance whereas the 75 bps modems maintains approximately the same performance level. The paper also addresses the number of frequencies required for a HF circuit to achieve maximum communications availability. For the 75 bps modems, one frequency is required except for geomagnetically disturbed periods where four frequencies are needed. For the 2400 bps modem, 3-4 frequencies are needed on a 200 km path and 4-6 frequencies on a 2000 km path.
Author
Modems; High Frequencies; Characterization; Polar Regions

20000075427 Norwegian Defence Research Establishment, Kjeller, Norway
Methodology for Analysis of Counter-Vulnerability Measures in Telecommunication - Problem Discussion and Theoretical Approach ***Metode for Analyse av Sarbarhets-Reduserende Tiltak Innen Tele-Kommunikasjon: Problematisering og Teoretisk Tiln/Erming***
Nystuen, Kjell Olav, Norwegian Defence Research Establishment, Norway; Hagen, Janne Merete, Norwegian Defence Research Establishment, Norway; May 30, 2000; 54p; In Norwegian; Original contains color illustrations
Contract(s)/Grant(s): Proj. FFISYS/740/204.0
Report No.(s): FFI/RAPPORT-98/06261; ISBN 82-464-0414-8; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The main goal of the FFI project ”Protection of the society 2” is to analyze various means for reducing vulnerabilities in modern public telecommunication systems. This report presents the major methodological challenges and the methodological approach applied in the study of the telecommunication system. The theoretical basis for the following methods are briefly described: (1) Analysis of risk and vulnerability; (2) Development and use of scenarios; (3) Analysis of cost-efficiency of emergency efforts; (4) Analysis of consequences, by use of simulation models, seminar games, system dynamic modelling and causal modelling; (5) Preference analysis.
Author
Emergencies; Telecommunication; Vulnerability; Security

20000075557 Norwegian Defence Research Establishment, Kjeller, Norway

A Shared Mobile Radio System for The Emergency Services: Requirements and Participants ***Et Felles Radionett for Nodetatene: Egenskaper og Deltakere***

Havard, Fridheim, Norwegian Defence Research Establishment, Norway; Jun. 21, 2000; 40p; In Norwegian

Contract(s)/Grant(s): Proj. FFISYS/316301/204.0

Report No.(s): FFI/RAPPORT-2000/03201; ISBN 82-464-0422-9; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report documents the results from a workshop regarding shared mobile radio communication systems for the Norwegian emergency services. The most significant conclusions from the workshop were: (1) The emergency services need a common, reliable mobile communication system for transmitting speech. (2) There is little need for high-bandwidth services, i.e, video and large data files (3) Organizational weaknesses should be solved before introducing a new expensive communication system. Author

Emergencies; Mobile Communication Systems

20000075633 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Analysis of the DFP/AFCS Systems for Compensating Gravity Distortions on the 70-Meter Antenna

Imbriale, William A., Jet Propulsion Lab., California Inst. of Tech., USA; Hoppe, Daniel J., Jet Propulsion Lab., California Inst. of Tech., USA; Rochblatt, David, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

This paper presents the theoretical computations showing the expected performances for both systems. The basic analysis tool is a Physical Optics reflector analysis code that was ported to a parallel computer for faster execution times. There are several steps involved in computing the RF performance of the various systems. 1 . A model of the RF distortions of the main reflector is required. This model is based upon measured holography maps of the 70-meter antenna obtained at 3 elevation angles. The holography maps are then processed (using an appropriate gravity mechanical model of the dish) to provide surface distortion maps at all elevation angles. 2. From the surface distortion maps, ray optics is used to determine the theoretical shape of the DFP that will exactly phase compensate the distortions. 3. From the theoretical shape and a NASTRAN mechanical model of the plate, the actuator positions that generate a surface that provides the best RMS fit to the theoretical model are selected. Using the actuator positions and the NASTRAN model provides an accurate description of the actual mirror shape. 4. Starting from the mechanical drawings of the feed, a computed RF feed pattern is generated. This pattern is expanded into a set of spherical wave modes so that a complete near field analysis of the reflector system can be obtained. 5. For the array feed, the excitation coefficients that provide the maximum gain are computed using a phase conjugate technique. The basic experimental geometry consisted of a dual shaped 70-meter antenna system; a refocusing ellipse, a DFP and an array feed system. To provide physical insight to the systems performance, focal plane field plots are presented at several elevations. Curves of predicted performance are shown for the DFP system, monopulse tracking system, AFCS and combined DFP/AFCS system. The calculated results show that the combined DFP/AFCS system is capable of recovering the majority of the gain lost due to gravity distortion.

Author

Mathematical Models; Numerical Analysis; Computation; Physical Optics; Reflectors; Radio Frequencies; Geometrical Optics

20000075637 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Free-Flying Magnetometer Data System

Blaes, B., Jet Propulsion Lab., California Inst. of Tech., USA; Javadi, H., Jet Propulsion Lab., California Inst. of Tech., USA; Spencer, H., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 2p; In English; 18th; Digital Avionics Systems, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

The Free-Flying Magnetometer (FFM) is an autonomous ”sensorcraft” developed at the Jet Propulsion Laboratory (JPL) for the Enstrophy sounding rocket mission. This mission was a collaborative project between the University of New Hampshire, Cornell University and JPL. The science goal of the mission was the study of current filamentation phenomena in the northern auroral region through multipoint measurements of magnetic field. The technical objective of the mission was the proof of concept of the JPL FFM design and the demonstration of an in-situ multipoint measurement technique employing many free-flying spacecraft. Four FFMs were successfully deployed from a sounding rocket launched from Poker Flats, Alaska on February 11, 1999. These hockey-puck-sized (80 mm diameter, 38 mm. height, 250 gram mass) free flyers each carry a miniature 3-axis flux-gate magnetometer that output +/- 2 V signals corresponding to a +/- 60,000 nT measurement range for each axis. The FFM uses a synchronized four-channel Sigma(Delta) Analog-to-Digital Converter (ADC) having a dynamic range of +/- 2.5V and converting at a rate of 279 samples/second/channel. Three channels are used to digitize the magnetometer signals to 17-bit (1.144 nT/bit) resolution. The fourth ADC channel is multiplexed for system monitoring of four temperature sensors and two battery voltages. The FFM also contains two sun sensors, a laser diode which emits a fan-shaped beam, a miniature S-band transmitter for direct

communication to the ground station antennas, an ultra-stable Temperature Compensated Crystal Oscillator (TCXO) clock, an integrated data subsystem implemented in a Field-Programmable Gate Array (FPGA), a 4 Mbit Static Random Access Memory (SRAM) for data storage and Lithium Thionyl Chloride batteries for power. Communicating commands to the FFM prior to deployment is achieved with an infrared (IR) link. The FFM IR receiver responds to 9-bit pulse coded signals that are generated by an IR Light Emitting Diode (LED) in the payload for turning FFM power on or off and placing the FFM in a test mode or flight mode. The IR links are also used to synchronize (zero) the clocks onboard all the FFMs through a reset pulse originating from the payload GPS receiver that is issued when the FFMs are in flight mode. The FPGA based data subsystem manages continuous data collection from the four ADC channels and sun sensors, formatting and storing the data to SRAM, and controlling downlink transmission. The transmitter is powered only after a 2547 frame SRAM buffer has been filled (approx. 5 minutes of data). The data is Viterbi encoded and sent to the S-band transmitter via a First-In-First-Out (FIFO) buffer who's output is clocked at 100 bits/second. After the 26-second transmission, the transmitter is turned off to reduce noise coupling to the sensitive magnetometer. The data subsystem control consists of a master state machine that performs data flow management and is interfaced through a prioritized interrupt scheme to state machines that service the ADC, sun sensors and transmitter FIFO. Continuous data collection prevents the missing of data during transmission and provides implicit time tagging of the data acquired by the ADC because of synchronization with the TCXO clock.
Author
Magnetometers; Fabrication; Performance Tests; Measure and Integration; Magnetic Fields; Autonomy; Data Acquisition; Radio Transmitters; Solar Prominences

20000075717 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
An Incentive Model for Secure International Telecommunications
Del Vecchio, J.; Mar. 2000; 83p; In English
Report No.(s): AD-A378297; AFIT/GOA/ENS/00M-2; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This study developed a new defensive model for global voice communications. It uses a n-person, zero-sum, cooperative and non-cooperative game to optimize the coalitions revenue after the possibility of a network service provider being tampered by an adversary. This research optimized two measures of effectiveness (coalition revenue and network provider revenue) of international telecommunications coalitions by hardening network service providers and improving their respective revenue with incentives. A multi-criteria optimization problem was developed to establish the strategic competition between the coalition defender and attacker. Irrespective of the amount of incentives, a applicable hardening and tampering strategy can be obtained. All methods and models are general and could be easily adapted to other specific applications. Examples of analysis was conducted on a sample network of seven nodes and presented in this study. It was shown that the option to harden NSPs has measurable value whether or not an incentive is provided for the coalition. In addition, the adversary's tampering strategy is revealed in the shadow prices associated with the game constraints. Analysis proved that two objective functions have different measures of effectiveness. A network optimized for one objective is more than likely not optimized for the other objective.
DTIC
Telecommunication; Voice Communication; Mathematical Models

20000076607 Ohio State Univ., Columbus, OH USA
Traffic Monitoring Using Satellite and Ground Data: Preparation for Feasibility Test and an Operational System *Final Report*
McCord, M. R.; Goel, P. K.; Merry, C. J.; Apr. 2000; 232p; In English
Report No.(s): PB2000-106023; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche
The authors address three issues in this report: demonstrate that vehicles can be identified and classified accurately from satellite imagery, develop efficient image processing methods, and determine methods to integrate the imagery with ground-based data and assess the value of this integration. Field tests were replicated, where aerial photographs were used to simulate satellite imagery. The authors developed software to automate many of the calculations involved, and the empirical results show that the authors' approach and software work well. The authors notice discrepancies between image- and ground-based data that lead them to propose that there are inevitable differences between image- and ground-based data sets that cannot be attributed to misidentification of vehicles in the images. Automated image processing must be used to perform the detection and classification of vehicles.
NTIS
Traffic; Aerial Photography; Image Processing; Satellite Imagery; Satellite Control; Remote Control; Ground Based Control

20000076610 Helsinki Univ. of Technology, Espoo, Finland

Helsinki University of Technology, Laboratory of Telecommunications Technology Annual Report, 1999

Haenninen, A.; 1999; 44p; In English

Report No.(s): PB2000-106081; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

In the area of teaching, other notable events were e.g. the Telecommunications Forum, organized for the third with an ever increasing success. In the study year 1999-2000, two majors were offered. In addition to the existing Telecommunications Technology major, the major in Teletraffic Theory was created. The courses provided by the laboratory were developed, and one course was given in English as part of the Master's program. The textbook 'Tietolikenneaapinen' by Seppo Usitupa and Kirsi Viopio was published early 1999, and was later given the 'Textbook of the Year' award by HUT. In addition the booklet 'How to write a diploma thesis' by Timo Laakso became ready for a widespread use. The laboratory was actively involved in the development of the two new degree programs of the department of ECE as well.

NTIS

Telecommunication; Communication Networks; Universities

20000076615 Rutherford Appleton Lab., Oxford, UK

Some Sparse Pattern Selection Strategies for Robust Frobenius Norm Minimization Preconditioners in Electromagnetism

Carpentieri, B.; Duff, I. S.; Giraud, L.; Mar. 31, 2000; 24p

Report No.(s): PB2000-106349; RAL-TR-2000-009; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The authors consider preconditioning strategies for the iterative solution of dense complex symmetric non-Hermitian systems arising in computational electromagnetics. The authors consider in particular sparse approximate inverse preconditioners that use a static nonzero pattern selection. The novelty of the authors' approach comes from using a different nonzero selection for the original matrix from that for the preconditioner and from exploiting geometric or topological information from the underlying meshes instead of using methods based on the magnitude of the entries. The numerical and computational efficiency of the propose preconditioners are illustrated on a set of model problems arising both from academic and from industrial applications. The results of our numerical experiments suggest that the new strategies are viable approaches for the solution of large-scale electromagnetic problems using preconditioned Krylov methods. In particular, the authors' strategies are applicable when fast multipole techniques are used for the matrix-vector product on parallel distributed memory computers.

NTIS

Iterative Solution; Computational Electromagnetics; Electromagnetism; Electromagnetic Scattering

20000078423 Scientific Research Associates, Inc., Glastonbury, CT USA

A Two-Dimensional Moment Equations-Based Analysis of Radio Frequency Capacitively Coupled Discharges

Meyyappan, M., Scientific Research Associates, Inc., USA; Govindan, T. R., Scientific Research Associates, Inc., USA; Kreskovsky, J. P., Scientific Research Associates, Inc., USA; Journal of Applied Physics; May 15, 1996; ISSN 0021-8979; Volume 80, No. 12, pp. 7154-7156; In English

Contract(s)/Grant(s): 50-DKNA-3-00143; Copyright; Avail: Issuing Activity

A two-dimensional nonequilibrium fluid model is used to study plasma uniformity in radiofrequency capacitively coupled discharges. Results for argon and helium discharges are presented for 10 and 30 cm electrodes in terms of plasma density, electron and ion velocity vectors, and other characteristics. The plasma properties are found to be uniform over most of the 30 cm electrode except in an edge zone.

Author

Two Dimensional Models; Nonequilibrium Conditions; Method of Moments; Radio Frequencies

33
ELECTRONICS AND ELECTRICAL ENGINEERING

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

20000074252 NASA Goddard Space Flight Center, Greenbelt, MD USA

RF Single Electron Transistor Readout Amplifiers for Superconducting Astronomical Detectors for X-Ray to Sub-mm Wavelengths

Stevenson, Thomas, NASA Goddard Space Flight Center, USA; Aassime, Abdelhanin, Chalmers Univ. of Technology, Sweden; Delsing, Per, Chalmers Univ. of Technology, Sweden; Frunzio, Luigi, Yale Univ., USA; Li, Li-Qun, Yale Univ., USA; Prober, Daniel, Yale Univ., USA; Schoelkopf, Robert, Yale Univ., USA; Segall, Ken, Yale Univ., USA; Wilson, Chris, Yale Univ., USA; Stahle, Carl, NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; Applied Superconductivity, 17-22 Sep. 2000, Virginia Beach, VA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We report progress on using a new type of amplifier, the Radio-Frequency Single-Electron Transistor (RF-SET), to develop multi-channel sensor readout systems for fast and sensitive readout of high impedance cryogenic photodetectors such as Superconducting Tunnel Junctions and Single Quasiparticle Photon Counters. Although cryogenic, these detectors are desirable because of capabilities not other-wise attainable. However, high impedances and low output levels make low-noise, high-speed readouts challenging, and large format arrays would be facilitated by compact, low-power, on-chip integrated amplifiers. Well-suited for this application are RF-SETs, very high performance electrometers which use an rf readout technique to provide 100 MHz bandwidth. Small size, low power, and cryogenic operation allow direct integration with detectors, and using multiple rf carrier frequencies permits simultaneous readout of 20-50 amplifiers with a common electrical connection. We describe both the first 2-channel demonstration of this wavelength division multiplexing technique for RF-SETs, and Charge-Locked-Loop operation with 100 kHz of closed-loop bandwidth.

Author

Radio Frequencies; Superconductivity; Submillimeter Waves; X Rays; Readout; Power Amplifiers; Transistors; Astronomical Photometry

20000074259 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Assessment and Assurance of Microelectronics Packaging Technology of Microelectromechanical Systems (MEMS)

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

Microelectromechanical systems (MEMS) have shown a significant promise in the last decade for a variety of applications such as air-bag, pressure sensors, accelerometer, microgyro, etc. Standard semiconductor microelectronics packaging needs the integrated circuits to be protected from the harsh environment, and provide electrical communication with the other parts of the circuit, facilitate thermal dissipation efficiently, and impart mechanical strength to the silicon die. Microelectronics packaging involves wafer dicing, bonding, lead attachment, encapsulation to protect from the environment, electrical integrity, and package leak tests to assure the packaging technology. In the case of MEMS the microstructures (active elements) often interfaces with the hostile environment where packaging leak tests and testing of such devices using chemical and mechanical parameters will be very difficult and expensive. Packaging of MEMS is significantly complex as they serve to protect from the environment and microstructures interact with the same environment to measure or affect the desired physical or chemical parameters. The most of the silicon circuitry is sensitive to temperature, moisture, magnetic field, light, and electromagnetic interference. The package must then protect the on-board silicon circuitry while simultaneously exposing the microsensor to the effect it 'measures to assure the MEMS technology by lowering the risk to zero. MEMS technology has a major application in developing a microspacecraft for space systems provided assurance of MEMS technology is sufficiently addressed nondestructively. This technology would eventually miniaturize many of the components of the spacecraft to reach the NASA's safety and mission assurance goal by building faster, cheaper, better, smaller spacecraft to explore the space more effectively by teaming-up with the other NASA centers using the limited resources available. This paper discusses the latest developments in the MEMS technology and challenging issues in the packaging of hermetically sealed and non-hermetically sealed MEMS sensor devices based on silicon, poly-silicon, and other materials for microspacecraft applications considering the space environment and reliability assurance qualification guidelines in perspective. Acknowledgments: The above research work is supported by the NASA Electronics Parts and Packag-

ing Program (NEPP) and performed by the Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA under a contract with the NASA - Code Q for the Office of Safety and Mission Assurance Program 323-79.
Author
Microelectromechanical Systems; Microelectronics; Semiconductors (Materials); Microstructure; Integrated Circuits

20000074260 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
An Agile Beam Transmit Array Using Coupled Oscillator Phase Control
Pogorzelski, Ronald S., Jet Propulsion Lab., California Inst. of Tech., USA; Scaramastra, Rocco P., Jet Propulsion Lab., California Inst. of Tech., USA; Huang, John, Jet Propulsion Lab., California Inst. of Tech., USA; Beckon, Robert J., Jet Propulsion Lab., California Inst. of Tech., USA; Petree, Steve M., Jet Propulsion Lab., California Inst. of Tech., USA; Chavez, Cosme, Jet Propulsion Lab., California Inst. of Tech., USA; [1993]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A few years ago York and colleagues suggested that injection locking of voltage controlled oscillators could be used to implement beam steering in a phased array [I]. The scheme makes use of the fact that when an oscillator is injection locked to an external signal, the phase difference between the output of the oscillator and the injection signal is governed by the difference between the injection frequency and the free running frequency of the oscillator (the frequency to which the oscillator is tuned). Thus, if voltage controlled oscillators (VCOs) are used, this phase difference is controlled by an applied voltage. Now, if a set of such oscillators are coupled to nearest neighbors, they can be made to mutually injection lock and oscillate as an ensemble. If they are all tuned to the same frequency, they will all oscillate in phase. Thus, if the outputs are connected to radiating elements forming a linear array, the antenna will radiate normal to the line of elements. Scanning is accomplished by antisymmetrically detuning the end oscillators in the array by application of a pair of appropriate voltages to their tuning ports. This results in a linear phase progression across the array which is just the phasing required to scan the beam. The scan angle is determined by the degree of detuning. We have constructed a seven element one dimensional agile beam array at S-band based on the above principle. Although, a few such arrays have been built in the past, this array possesses two unique features. First, the VCO MMICs have buffer amplifiers which isolate the output from the tuning circuit, and second, the oscillators are weakly coupled to each other at their resonant circuits rather than their outputs. This results in a convenient isolation between the oscillator array design and the radiating aperture design. An important parameter in the design is the so called coupling phase which determines the phase shift of the signals passing from one oscillator to its neighbors. Using this array, we have been able to verify the theoretical predictions concerning the effect of this phase on both the locking range and ensemble frequency of the array. However, the scan range achieved fell somewhat short of the theoretical value because of the amplitude variation of the oscillator outputs with tuning.
Author
Phased Arrays; Voltage Controlled Oscillators; Microwave Circuits; Beam Steering; Phase Control; Linear Arrays

20000074262 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Fresh Look at Coupled-Oscillator Spatial Power Combining
Pearson, L.W., Clemson Univ., USA; Pogorzelski, R. J., Jet Propulsion Lab., California Inst. of Tech., USA; [1998]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Quasi-optical oscillators were proposed a little more than ten years ago as a means of developing the power levels needed for applications at millimeter frequencies using large numbers of individual semiconductor devices each of which produces only a modest amount of power [J.W. Mink, IEEE Trans. MTT., vol. 34, p. 273, 19861. An operating system was demonstrated soon after [Z.B. Popovic et. al, Int. J. Infrared and Millimeter Waves, v. 9, p. 647, 1988] in the form of a so-called grid oscillator. This device constituted a rectangular array of oscillating devices that are mutually coupled so that they oscillator coherently. The interconnecting lines in one direction serve as radiators so that the oscillators radiate directly, and the radiated fields add. Subsequently, coupled oscillators using resonant transmission line lengths was demonstrated by Mortazawi and Itoh [IEEE Trans. MTT., vol. 38, p. 86,1990). In recent work, coupled-oscillator power combiners have received less attention, with amplifier/combiners receiving more attention. Specific weaknesses of spatial-combining oscillators have motivated this transition. Namely, the oscillators employ low-Q resonators (resulting in low signal quality) and no clear means of modulation has been identified until recently. In this presentation, we review coupled-oscillator combiners in broad terms, indicating the features that make particular systems viable. We indicate how these features can be reconciled to functional requirements for system applications. Comparisons are drawn between two approaches to obtain mutual coupling: One employs low-Q oscillator circuits at each site, with concomitantly high propensity for the oscillators to couple. The other approach employs moderate-Q oscillators at each site with the concomitant requirement to tune the oscillators so that they share a range of frequencies over which they can couple and lock. In either case, precise frequency control and modulation can be achieved through locking to an external frequency source that ensures high quality signals. A recent development in coupled-oscillator arrays provides a means for beam-steering the radiation field of coupled oscillators through de-tuning of the edge elements in the array. This detuning introduces a progressive phase shift across the oscil-

lator array. This 0 suggests architectures that can replace the functionality of a phased array without the cost 0 incurred by phase shifters. A comprehensive theory of the phase interactions among devices in such arrays is under development [e.g., Pogorzelski, York, and Maccarini, 1998 AP-S International Symposium, Atlanta, GA. June, 19981.
Author
Oscillators; Semiconductor Devices; Beams (Radiation); Frequency Control; Phase Shift; Infrared Radiation; Phased Arrays

20000074743 Natural Resources Canada, Geodetic Survey Div., Ottawa, Ontario Canada
Canadian Transportable VLBI Antenna (CTVA)
Berube, Mario, Natural Resources Canada, Canada; LaFrance, Jacques, Natural Resources Canada, Canada; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 373-377; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The Canadian Transportable VLBI Antenna (CTVA) is an integral part of the activities in the Canadian VLBI Technical Development Center and has been involved in a number of S2 frequency-switched VLBI system tests. In this paper we present the CTVA specifications and discuss site preparation and antenna assembly.
Author
Very Long Base Interferometry; Radio Antennas; Ground Stations

20000074746 Northeast Radio Observatory Corp., Haystack Observatory, Westford, MA USA
VLBI Electronics for Analysts: From the Feed to the Recorder
Corey, Brian E., Northeast Radio Observatory Corp., USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 75; In English; See also 20000074683; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This talk will describe how some of the critical electronic components in a VLBI system work, with an emphasis on analog electronics such as mixers, amplifiers, and phase calibrators. The ideal behavior of such devices will be described, as well as what the likely effects on VLBI observables are when a component fails or is used improperly (e.g., when an amplifier is overdriven). The basic principles of operation will be treated, without delving into the underlying semiconductor physics.
Author
Very Long Base Interferometry; Electronic Equipment

20000074781 Naval Postgraduate School, Monterey, CA USA
Distributed Control for Paralleled PWM Inverters in the DC Zonal Distribution System
Sep. 1999; 117p; In English
Report No.(s): AD-A377684; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The modular DC Zonal Electrical Distribution System (DC ZEDS) offers many advantages over traditional radial shipboard electrical distribution. The advantages of DC ZEDS will be exploited in the next class of surface combatants. Part of the development research for DC ZEDS includes the design of autonomous DC-to-AC inverter modules having robust load sharing capability. This thesis will focus on these DC-to-AC inverters. Paralleled inverters in the DC ZEDS must be flexible and modular. The optimum flexibility is achieved when an electrical system can automatically reconfigure after the number of operating inverters changes. A distributed control system for paralleled inverters is investigated to achieve this flexibility and increase the system's battle damage survivability. Modularity of the system design allows for simplified testing and a reduction in cost through bulk purchasing. Unique distributive control methods are developed in this thesis that will allow isolated inverters in separate watertight compartments to coordinate their actions without interconnections between the units.
DTIC
Active Control; Distributed Parameter Systems; Network Analysis; Electric Power Supplies

20000075199 NASA Langley Research Center, Hampton, VA USA
Characterization of Advanced Avalanche Photodiodes for Water Vapor Lidar Receivers
Refaat, Tamer F., Old Dominion Univ., USA; Halama, Gary E., NASA Langley Research Center, USA; DeYoung, Russell J., NASA Langley Research Center, USA; July 2000; 62p; In English
Contract(s)/Grant(s): RTOP 622-63-13-70
Report No.(s): NASA/TP-2000-210096; NAS 1.60:210096; L-17936; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Development of advanced differential absorption lidar (DIAL) receivers is very important to increase the accuracy of atmospheric water vapor measurements. A major component of such receivers is the optical detector. In the near-infrared wavelength

range avalanche photodiodes (APD's) are the best choice for higher signal-to-noise ratio, where there are many water vapor absorption lines. In this study, characterization experiments were performed to evaluate a group of silicon-based APD's. The APD's have different structures representative of different manufacturers. The experiments include setups to calibrate these devices, as well as characterization of the effects of voltage bias and temperature on the responsivity, surface scans, noise measurements, and frequency response measurements. For each experiment, the setup, procedure, data analysis, and results are given and discussed. This research was done to choose a suitable APD detector for the development of an advanced atmospheric water vapor differential absorption lidar detection system operating either at 720, 820, or 940 nm. The results point out the benefits of using the super low ionization ratio (SLIK) structure APD for its lower noise-equivalent power, which was found to be on the order of 2 to 4 fW/Hz(sup (1/2)), with an appropriate optical system and electronics. The water vapor detection systems signal-to-noise ratio will increase by a factor of 10.
Author
Differential Absorption Lidar; Atmospheric Moisture; Avalanche Diodes; Moisture Meters; Photodiodes; Radar Receivers; Water Vapor; Characterization; Radar Measurement

20000076017 Naval Research Lab., Advanced Radar Systems Branch, Washington, DC USA
Measurement Results of an Affordable Hybrid Phased Array Using a Radant Lens
Rao, J. B.; Brockett, S. M.; Evins, J. B.; Parent, M.; Valenzi, J.; May 15, 2000; 32p; In English; Prepared in collaboration with Sachs Freeman Associates, Largo, MD and Radant Technologies, Inc., Stow, MA.
Report No.(s): AD-A377694; NRL/MR/5320--00-8439; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An affordable phased array for a ship self-defense experimental engagement radar is described. The array used a hybrid approach by combining a slotted waveguide array with phase shifters at each column to provide scanning in the azimuth plane and a Radant lens placed in front of the slotted array to provide independent scanning in the elevation plane. The approach avoids using a phase shifter or a T/R module behind each radiating element and simplifies beam steering using row-column controls which reduce the phased array cost. The production cost of the proposed array is estimated to be less than one-third the cost of a similar sized array using a phase shifter or T/R module behind each radiating element. Recently, a 4' x 8' Radant lens was procured from Radant Technologies, Inc. and placed in front of the existing (modified AN/TPQ-36) phased array. This paper reports on the results of this hybrid array.
DTIC
Phased Arrays; Steerable Antennas; Beam Steering; Lens Antennas; Radar Antennas; Radar Measurement

20000076018 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA
Normalized Outputs to Turbulent Boundary Layer (TBL) of Pressure and Velocity Transducers and Their Sensitivities, *1 Jan.-1 Mar. 2000*
Maidanik, G.; Becker, K. J.; Mar. 31, 2000; 166p; In English
Report No.(s): AD-A377692; NSWCCD-70-TR-2000/037; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Two recent reports addressed the wavevector-frequency spectral density of a turbulent boundary layer (TBL) and the manner by which the filtering efficiencies of the boundaries, blankets, transducers and arrays challenge this spectral density. Whereas the goal of a design is to maintain largely intact the output to a signal (a supersonic incident pressure field), the output to a (TBL) must be largely subdued; i.e., a component in the (TBL) must be largely rejected from inducing an output in the transducer. The rejection of (TBL) that can be mustered by a flush-mounted pressure transducer and by a flush-mounted velocity transducer are compared in these reports. In this report the comparison is extended to transducer configurations that are not merely designated flush-mounted. Also, the comparison is made not just on the raw basis of the wavevector-frequency filtering efficiencies and the wavevector-frequency spectral density of (TBL), but, in addition, by evaluating the frequency spectral densities registered by the two sets of transducers. The frequency spectral densities are quantities that are more commensurate with the outputs of actual transducers and arrays. However, the evaluation of the frequency spectral densities provide for more specific assessments than those afforded by consideration of the wavevector-frequency spectral densities. In this sense, this report sacrifices generality in an attempt to render the material discussed in the two referenced reports more akin in format to the kind of information that is usually requested by designers of naval sonar systems.
DTIC
Pressure Sensors; Transducers; Turbulent Boundary Layer; Output

20000076126 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
General relativistic galvano-gravitomagnetic effect in current carrying conductors
Ahmedov, B. J.; Nov. 30, 1998; 10p; In English

Report No.(s): DE99-616014; IC-98/204; No Copyright; Avail: Department of Energy Information Bridge

The analogy between general relativity and electromagnetism suggests that there is a galvano-gravitomagnetic effect, which is the gravitational analogue of the Hall effect. This new effect takes place when a current carrying conductor is placed in a gravitomagnetic field and the conduction electrons moving inside the conductor are deflected transversally with respect to the current flow. In connection with this galvano-gravitomagnetic effect, we explore the possibility of using current carrying conductors for detecting the gravitomagnetic field of the Earth.

NTIS

Gravitational Fields; Magnetic Fields; Conductors; Relativistic Effects

20000076820 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Development of a High Capacity Lithium-Ion Battery for a Navy Aircraft

Stein, Brian J.; Baker, John W.; Shah, Pinakin M.; Isaacs, Nathan D.; Johnson, Bill; Jan. 2000; 13p; In English; Prepared in collaboration with Mine Safety Appliances Co., Sparks, MD.

Report No.(s): AD-A378170; TR-1821; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In response to the Navy's requirement for a lighter, higher capacity, secondary battery, Mine Safety Appliances (MSA) Company designed and built an experimental lithium-ion "drop-in" replacement battery for demonstration of its performance in the Pioneer aircraft. Lithium ion technology using a lithiated cobalt dioxide positive electrode, graphitized carbon negative electrode and liquid organic electrolyte has demonstrated a significant enhancement in performance over other rechargeable systems such as nickel-cadmium and nickel-metal hydride in comparable applications. Key features of the lithium ion system include higher gravimetric and volumetric energy densities, good charge retention (to maximize readiness), and zero memory effect. Such benefits outweigh a higher unit cost and the need for more stringent charge/discharge control. Design of the cells and battery, and preliminary battery test results are described.

DTIC

Lithium Batteries; Product Development; Aircraft Equipment

20000078402 Sandia National Labs., Albuquerque, NM USA

Neural Network Modeling of the Lithium/Thionyl Chloride Battery System

Ingersoll, D.; Jungst, R. G.; O'Gorman, C. C.; Paez, T. L.; Oct. 29, 1998; 12p; In English; 194th Meeting of the Electrochemical Society, Inc.; Boston, MA; 11/01-06/ 1998

Report No.(s): DE00-001536; SAND98-2443C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Battery systems have traditionally relied on extensive build and test procedures for product realization. Analytical models have been developed to diminish this reliance, but have only been partially successful in consistently predicting the performance of battery systems. The complex set of interacting physical and chemical processes within battery systems has made the development of analytical models a significant challenge. Advanced simulation tools are needed to more accurately model battery systems which will reduce the time and cost required for product realization. Sandia has initiated an advanced model- based design strategy to battery systems, beginning with the performance of lithium thionyl chloride cells. As an alternative approach, we have begun development of cell performance modeling using non-phenomenological models for battery systems based on artificial neural networks (ANNs). ANNs are inductive models for simulating input/output mappings with certain advantages over phenomenological models, particularly for complex systems. Among these advantages is the ability to avoid making measurements of hard to determine physical parameters or having to understand cell processes sufficiently to write mathematical functions describing their behavior. For example, ANN models are also being studied for simulating complex physical processes within the Li/SOCl2 cell, such as the time and temperature dependence of the anode interracial resistance. ANNs have been shown to provide a very robust and computationally efficient simulation tool for predicting voltage and capacity output for Li/SOCl2 cells under a variety of operating conditions. The ANN modeling approach should be applicable to a wide variety of battery chemistries, including rechargeable systems.

NTIS

Neural Nets; Network Synthesis; Artificial Intelligence; Belief Networks; Computerized Simulation

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.

20000074674 Centre National de la Recherche Scientifique, Toulouse, France
Data acquisition interface for calculating heat diffusion in certain electronic circuits
Spiesser, P.; May 31, 1996; 67p; In French; In English
Report No.(s): DE99-723897; CNRS-LAAS-96146; No Copyright; Avail: Department of Energy Information Bridge

A user interface has been developed for geometrical and thermal data acquisition, in order to allow calculations of heat diffusion in certain types of electronic circuits such as power hybrids and compact electronic modules, using computerized simulations. Data management, structure and organization, the data acquisition interface program, and variables and sources, are described.
NTIS
Data Acquisition; Data Management; Interfaces; Data Processing; Man Machine Systems

20000074675 Centre National de la Recherche Scientifique, Toulouse, France
Dual cooling in TMODTHERM. Power extraction in SMODTHERM. Software modifications for THDESIGN
Dupuy, P.; Dorkel, J. M.; May 31, 1996; 45p; In French; In English
Report No.(s): DE99-723898; CNRS-LAAS-96145; No Copyright; Avail: Department of Energy Information Bridge

Three developments of a cooperative research program involving CNRS, Motorola and the Midi-Pyrenees region, are presented: advances in the TMODTHERM code for simulating electronic components where heat dissipation is embedded in the sub-structure; introduction of the heat extraction concept in the SMODTHERM code, for simulating static thermal behaviour of electronic components where cooling is achieved through their connections to a heat sink; then, modifications due to the new release of THDESIGN code are presented, together with the induced modifications in the SMODTHERM and TMODTHERM codes.
NTIS
Cooling; Extraction; Computer Aided Design

20000074962 Universities Space Research Association, Huntsville, AL USA
Numerical Calculation of the Drag Force Acting on a Solid Particle Pushed by a Solid/Liquid Interface
Catalina, Adrian V., Universities Space Research Association, USA; Stefanescu, Doru M., Alabama Univ., USA; Sen, Subhayu, Universities Space Research Association, USA; [2000]; 1p; In English
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

The distribution of insoluble particles in a metal casting depends primarily on the interaction of the particles with the solid/liquid interface (SLI) during the solidification process. The balance of the forces acting on the particle essentially determines whether a particle will be engulfed or pushed by the SLI. An important component of this force balance is the drag force generated by the particle motion in front of the SLI. Previously developed mathematical models for particle/SLI interaction made use of steady-state solutions of this force provided by the lubrication theory. However, our numerical model based on the SLI tracking approach shows that the steady-state approach is inappropriate to model the interaction process and that at steady-state the theoretical solution underestimates the drag force. It was found that regression analysis of steady-state numerical solutions for cylindrical particles moving normal to a flat SLI gives a relationship of the form: Abstract The distribution of insoluble particles in a metal casting depends primarily on the interaction of the particles with the solid/liquid interface (SLI) during the solidification process. The balance of the forces acting on the particle essentially determines whether a particle will be engulfed or pushed by the SLI. An important component of this force balance is the drag force generated by the particle motion in front of the SLI. Previously developed mathematical models for particle/SLI interaction made use of steady-state solutions of this force provided by the lubrication theory. However, our numerical model based on the SLI tracking approach shows that the steady-state approach is inappropriate to model the interaction process and that at steady-state the theoretical solution underestimates the drag force. It was found that regression analysis of steady-state numerical solutions for cylindrical particles moving normal to a flat SLI gives a relationship of the form: F(sub D, sup num) =sqoare root of 3(pi)(eta)V(sub p)(R(sub p)/d)(sup 10(gamma)/3). This is to compared to the solution provided by the lubrication theory: F(sub D), sup theor) = 3 square root of 2(pi)(eta)V(sub p)(R(sub p)/d)(sub 3/2), where F(sub D) is the drag force, eta is the dynamic viscosity of the fluid, V(sub p) is the particle velocity, R(sub p) is the particle radius, gamma is Euler's constant (gamma approx. = 0.577), and d is the width of the gap between the particle and the SLI. The domain

on which the equations proposed by the lubrication theory are relevant is clearly identified in the paper. The numerical model was then validated against the classical lubrication theory within the domain of its validity.
Author
Numerical Analysis; Mathematical Models; Drag; Force Distribution; Solubility; Liquid-Solid Interfaces; Particle Motion

20000075724 Illinois Univ. at Urbana-Champaign, Urbana, IL USA
Smart Mesoflaps for Aeroelastic Transpiration for SBLI Flow Control ***Final Report, 15 Mar.-30 Nov. 1998***
Loth, Eric; Geubelle, Philippe; White, Scott; Tortorelli, Daniel; Dutton, Craig; May 2000; 11p; In English
Contract(s)/Grant(s): F49620-98-1-0381; AF Proj. 2307
Report No.(s): AD-A378320; AFRL-SR-BL-TR-00-0208; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This multi-disciplinary research project investigates the capability and performance of a novel concept termed Smart Mesoflaps for Aeroelastic Transpiration (SMAT), which will provide mass and momentum transfer to control shock/boundary-layer interactions (SBLIs). Such flow control can be critical for supersonic mixed-compression inlets which have impinging oblique-shocks. The SMAT concept consists of a matrix of small flaps (sub-millimetric in thickness) covering an enclosed cavity. These flaps are designed to undergo local aeroelastic deflection to achieve proper mass bleed or injection when subjected to impinging oblique shocks. The resulting system is designed to efficiently reduce and prevent flow separation caused by SBLIs. The expected pay-offs in aircraft performance are a lighter, smaller, and more robust bleed system for supersonic inlets with reduced compressor-face inlet distortion. This study closely integrates experimental and computational investigations of the SMAT concept in relevant SBLI flowfields. The numerical studies employ an aeroelastic finite element code to investigate the physics between the supersonic turbulent boundary layer, the subsonic cavity flow, and the deforming mesoflaps. These analyses are coupled to advanced shape-optimization techniques such that mesoflap design can be optimized for a given flow condition. The resulting methodology is being used to guide the fabrication of the mesoflaps using both conventional metal alloys and smart materials. Aerodynamic experiments will be conducted for various flap arrays to investigate fundamental flow phenomenon and measure aerodynamic performance.
DTIC
Aeroelasticity; Boundary Layer Separation; Turbulent Boundary Layer; Transpiration; Flaps (Control Surfaces); Compressible Flow; Supersonic Flow; Supersonic Inlets; Finite Element Method; Flapping

20000075968 California Univ., San Diego, Dept. of the Aerospace and Mechanical Engineering Sciences, La Jolla, CA USA
Compressible Turbulent Reading Flows ***Final Report, 15 Mar. 1996-31 Oct. 1999***
Williams, F. A.; Libby, P. A.; Sarkar, S.; Oct. 31, 1999; 21p; In English
Contract(s)/Grant(s): F49620-96-1-0106; AF Proj. 2308
Report No.(s): AD-A378325; AFRL-SR-BL-TR-00-0206; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Research was conducted under this grant to advance fundamental understanding and predictive models of turbulent reacting flows relevant to Air Force needs in high-speed propulsion Advanced computational schemes including direct numerical simulation (DNS) and large eddy simulation (LES) were used in addition to turbulent combustion theory. Reduced chemical mechanisms for hydrogen-air combustion were developed and tested. Specific flows investigated include the reacting shear layer and the jet. A new mechanism that relates the reduction in fuel/oxidant mixing in high-speed flows to the inhibited communication of pressure signals was proposed. A resulting compressibility model was found to give good predictions. Both mean density changes and Mach number were found to affect the flow development in high-speed combustion. It was found that the transport and molecular mixing of reactive scalars are substantially affected by heat release and must be accounted for in closures of turbulence/chemistry interaction. LES of a spatially-evolving jet were performed and successfully compared with our DNS and previous experiments. New subgrid scale models were developed for LES of nonequilibrium flows. The results obtained here should help improve current abilities to analyze and design propulsion systems that employ high-speed turbulent combustion.
DTIC
Direct Numerical Simulation; Large Eddy Simulation; Turbulent Flow; Flame Propagation; Turbulent Diffusion; Nonequilibrium Flow; Turbulent Combustion

20000075972 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA
IUTAM Symposium "Laminar-Turbulent Transition"
Saric, William S.; Jun. 2000; 11p; In English
Contract(s)/Grant(s): N00014-99-1-0966
Report No.(s): AD-A378346; 99PR07687-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The IUTAM Symposium on Laminar-Turbulent Transition, co-hosted by Arizona State University and the University of Arizona, was held in Sedona Arizona. Although four previous IUTAM Symposia bear the same appellation (Stuttgart 1979, Novosibirsk 1984, Toulouse 1989, and Sendai 1994) the topics that were emphasized were each different and reflect the evolving nature of our understanding of the transition process. The Sedona 1999 meeting was almost exclusively bounded shear layers as open systems. The major impact topics were receptivity of initial disturbances, crossflow instabilities, supersonic flows, and control of transition. More papers appeared on combined numerical and experimental work. In other cases, teams from different institutes combined resources to solve complicated problems. The objectives of many of these studies were to properly define the fundamental physics of the stability and transition process. One can track certain freestream disturbances that provide the initial conditions for unstable waves in somewhat complicated geometries. As a consequence, this fundamental knowledge now enables different techniques of transition control and its subsequent decrease in drag. One expects increased emphasis on this topic. Papers on transient growth and sub-critical development of 3-D disturbances pointed to future areas of research.
DTIC
Turbulent Boundary Layer; Boundary Layer Transition; Conferences; Cross Flow; Laminar Flow; Supersonic Flow; Turbulent Flow

20000075973 SRI International Corp., Menlo Park, CA USA
Experimental Studies on Supercritical Flows ***Final Report***
Faris, Gregory W.; May 2000; 126p; In English
Contract(s)/Grant(s): F49620-97-C-0002; AF Proj. 2308
Report No.(s): AD-A378367; SRI-MP-00-028; AFRL-SR-BL-TR-00-0202; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Stimulated scattering was performed with infrared lasers at 1064 nm and with a ring dye laser at 532 nm. For the measurements at 1064 nm, a Nd:YAG laser was used as the pump laser and a tunable diode laser was used as the probe laser. With this apparatus stimulated Brillouin and stimulated Rayleigh scattering were observed in hexane and other liquids. These were the first high resolution stimulated scattering performed without a ring dye laser and the first stimulated scattering gain spectroscopy in the infrared to our knowledge. Both electrostrictive and absorptive versions of Brillouin and Rayleigh scattering were obtained. The transition from electrostrictive to absorptive Rayleigh scattering was observed for the first time to our knowledge. The influence of scattered pump light was determined not to be a problem for our measurements. A supercritical cell was designed and constructed capable of operation up to 600 K and 2000 psi. A second generation cell was built to reduce the effects of convection at the windows. The first stimulated scattering measurements in a supercritical fluid were performed.
DTIC
Supercritical Flow; YAG Lasers; Ring Lasers; Tunable Lasers; Semiconductor Lasers; Supercritical Fluids

20000076807 NASA Langley Research Center, Hampton, VA USA
Radiation Heat Transfer Between Diffuse-Gray Surfaces Using Higher Order Finite Elements
Gould, Dana C., NASA Langley Research Center, USA; [2000]; 12p; In English; 34th; Thermophysics, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-2371; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents recent work on developing methods for analyzing radiation heat transfer between diffuse-gray surfaces using p-version finite elements. The work was motivated by a thermal analysis of a High Speed Civil Transport (HSCT) wing structure which showed the importance of radiation heat transfer throughout the structure. The analysis also showed that refining the finite element mesh to accurately capture the temperature distribution on the internal structure led to very large meshes with unacceptably long execution times. Traditional methods for calculating surface-to-surface radiation are based on assumptions that are not appropriate for p-version finite elements. Two methods for determining internal radiation heat transfer are developed for one and two-dimensional p-version finite elements. In the first method, higher-order elements are divided into a number of sub-elements. Traditional methods are used to determine radiation heat flux along each sub-element and then mapped back to the parent element. In the second method, the radiation heat transfer equations are numerically integrated over the higher-order element. Comparisons with analytical solutions show that the integration scheme is generally more accurate than the sub-element method. Comparison to results from traditional finite elements shows that significant reduction in the number of elements in the mesh is possible using higher-order (p-version) finite elements.
Author
Radiative Heat Transfer; Surface Cooling; Diffuse Radiation; Finite Element Method; Computational Grids

20000076834 Cornell Univ., Ithaca, NY USA

Structure and Control of the Wall Region in a Turbulent Boundary Layer ***Final Report, 1 Apr. 1997-31 Dec. 1999***

Lumley, John; Leibovich, Sidney; Berkooz, Gal; Dec. 31, 1999; 12p; In English

Contract(s)/Grant(s): F49620-97-1-0203

Report No.(s): AD-A378326; OSP-29160; AFRL-SR-BL-TR-00-0214; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the past decade, our group at Cornell has developed a new approach to turbulent flows. This approach uses low dimensional dynamical models to better understand the time dependent behavior of large scale, or energy dominated, features in turbulent and other complex flows. We have applied our approach to the problem of controlling the turbulent boundary layer, with substantial progress. Our objectives as we continue with this effort are: (1) to explore further the control of the boundary layer in turbulent channel flow, refining the control algorithm and bringing more information from the low-dimensional models to bear on the problems of state estimation and control. (2) to make an extensive evaluation of the potential of compliant surfaces for turbulent drag reduction through the use of low-dimensional models and direct simulations of turbulent flow over a compliant surface.

DTIC

Turbulent Boundary Layer; Turbulent Flow; Walls

20000078388 Dayton Univ., OH USA

Electrohydrodynamic Control of Thin Film Evaporative Heat Transfer in Micro Groove Arrays ***Final Report, 1 Aug. 1996-31 Jul. 1999***

Hallinan, Kevin P.; Kashani, A. R.; Jul. 31, 1999; 48p; In English

Contract(s)/Grant(s): F49620-96-1-0408; AF Proj. A564

Report No.(s): AD-A378389; AFRL-SR-BL-TR-00-0216; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Research has been conducted toward the development of electro-hydrodynamically (EHD) driven micro heat pipe arrays. This research has focused on the following: (1) Completion of the experimentation and analysis of EHD augmented micro heat pipe arrays using dielectrophoretic forces. (2) Development and analysis of ion-drag pumped micro heat pipe arrays. (3) Demonstrated active thermal control with ion-drag pumped micro heat pipe arrays for cyclic heat loadings in excess of 100 W/sq cm. The research has demonstrated that the forces induced via the ion-drag mechanism can be appreciably greater than by the dielectrophoretic effect, i.e., force induced as a result of an electric field present at a liquid-vapor interface. Moreover, because the ion-drag force can be generated within the heat pipe fluid at any location, the localized electric field can be better isolated from the heat source. In the case of electronics cooling, this is particularly critical.

DTIC

Electrohydrodynamics; Thin Films; Heat Transfer; Heat Pipes; Arrays

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.

20000074256 NASA Goddard Space Flight Center, Greenbelt, MD USA

Characterization of Thermal Parameters for Improving Pyranometer and Pyrgeometer Measurements

Tsay, Si-Chee, NASA Goddard Space Flight Center, USA; Jhabvala, Murzy D., NASA Goddard Space Flight Center, USA; Ji, Qiang, Science Systems and Applications, Inc., USA; Rapshun, David, Raytheon STX Corp., USA; Shu, Peter K., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; Remote Sensing of Environment, 27-31 Mar. 2000, Cape Town, South Africa; No Copyright; Avail: Issuing Activity; Abstract Only

Since the introduction of thermopile, pyrano52meters (solar, e.g., 0.3-3.0 micrometers) and pyrgeometers (terrestrial, e.g., 4-50 micrometers) have become instruments commonly used for measuring the broadband hemispherical irradiances at the surface in a long-term, monitoring mode for decades. These commercially available radiometers have been manufactured in several countries such as from the USA, Asia, and Europe, and are generally reliable and economical. These worldwide distributions of surface measurements become even more important in the era of Earth remote sensing in studying climate change. However, recent studies from field campaigns have pointed out that erroneous factors (e.g., temperature gradients between the filter dome and detector, emissivity of the thermopile) are responsible for the unacceptable level of uncertainty (e.g., 20 W m(exp -2)). Using a newly developed instrument of Quantum Well Infrared Photodetector (QWTP), we have characterized the brightness tempera-

ture fields of pyranometers and pyrgeometers under various sky conditions. The QWIP is based on the superlattice (GaAs/AlGaAs) technology and has a noise equivalent temperature (NEAT) less than 0.1 K. The quality of pyranometer and pyrgeometer measure- ments can be improved largely by applying proper knowledge of the thermal parameters affecting the operation of the thermopile systems. Data correction procedure and algorithm will be presented and discussed.
Author
Pyranometers; Radiation Measuring Instruments; Thermal Analysis; Remote Sensing; Algorithms; Radiometers

20000074405 Electrotechnical Lab., Tsukuba, Japan
Ultrahigh Vacuum Electron Beam Lithography System and Nanofabrication
Hiroshima, Hiroshi, Electrotechnical Lab., Japan; Researches of the Electrotechnical Laboratory; February 2000; ISSN 0366-9106, No. 991, pp. 1-55; In Japanese; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

The information-oriented society is based on advances in electron devices such as ULSI. Downsizing is indispensable, enabling lower power consumption, higher switching speed and denser integration. The number of electrons handled by an element device of ULSI is large, however, the number will decrease with downsizing and it will be not possible to disregard the statistical dispersion at last. Therefore, downsizing of current devices will compromise their operating reliability in future. The single electron transistor being widely studied operates reliably with a very small number of electrons, and is considered as an influential candidate of future devices. A single electron transistor with a metal/insulator/metal structure has been already fabricated using conventional electron beam (EB) lithography combined with multiple-angle evaporation. The single electron transistor includes very small islands and operates using charging energy of the islands. to sense the difference in charging energy when electrons in the islands are increased by 1, the capacitance of the island must be extremely small in order to exceed the thermal energy of the operation temperature. The dimension at which the single electron transistor operates at room temperature is so small that conventional high resolution organic EB resists cannot attain the required dimension. We evaluated the system performance of the ultrahigh vacuum EB lithography system and studied nanofabrication. We studied SiO2 as a high resolution resistor and developed device fabrication process using SiO2. We also studied EB-induced deposition and applied to the fabrication of single electron transistors
Author
Electron Beams; Electronic Equipment; Fabrication; Lithography; Silicon Dioxide; Molecular Electronics; Nanostructures (Devices)

20000074643 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Small Nano-Kelvin Resolution Thermometer for Low Temperature Experiments in Space
Welander, Paul, Jet Propulsion Lab., California Inst. of Tech., USA; Barmatz, M., Jet Propulsion Lab., California Inst. of Tech., USA; Hahn, Inseob, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A small high resolution paramagnetic susceptibility thermometer was developed using a GdCl3 paramagnetic salt. The device uses a SQUID magnetometer to determine the temperature dependent magnetization of the salt in a magnetic field. The required magnetic field is provided by a pair of small SmCo permanent magnet disks situated inside the thermometer housing. This eliminates the use of a heavy charging solenoid in a conventional SQUID based magnetic thermometer system using a flux tube. This thermometer can resolve approximately 10(exp -9)K near the liquid-gas critical point of The (approx. 3.31K). The drift in the thermometer is less than 2 x 10(exp -13) K/s. This light weighted thermometer (approx. 7 g) is a candidate for use in future International Space Station flight low temperature experiments.
Author
Thermometers; Low Temperature; Magnetic Fields; Magnetization; Temperature Dependence; Squid (Detectors)

20000074655 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Hot-Electron Far-Infrared Direct Detector
Karasik, B. S., Jet Propulsion Lab., California Inst. of Tech., USA; McGrath, W. R., Jet Propulsion Lab., California Inst. of Tech., USA; LeDuc, H. G., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A new approach is proposed to improve the sensitivity of direct-detection bolometers at millimeter, submillimeter and far-infrared wavelengths. The idea is to adjust a speed of the thermal relaxation of hot-electrons in a nanometer size normal metal or super-conductive transition edge bolometer by controlling the elastic electron mean free path. If the bolometer contacts are made of a superconductor with high critical temperature (Nb, Pb etc.) then the thermal diffusion into the contacts is absent because of the Andreev's reflection and the electron-phonon relaxation is the only mechanism for heat removal. The relaxation rate should

behave as T(sup 4)l at subkelvin temperatures (l is the electron elastic mean free path) and can be reduced by factor of 10-100 by decreasing l. Then an antenna- or waveguide-coupled bolometer with a time constant about 10(exp -3) to 10(exp -5) s at T approximately equals 0.1-0.3 K will exhibit photon-noise limited performance in millimeter and submillimeter range. The choice of the bolometer material is a tradeoff between a low electron heat capacity and fabrication. A state-of-the-art bolometer currently offers NEP = 10(exp -17) W(Square root of (Hz)) at 100 mK along with a approximately equals 2 msec time constant. The bolometer we propose will have a figure-of-merit, NEP(square root (r)), which is 10(exp 3) times smaller. This will allow for a tremendous increase in speed which will have a significant impact for observational mapping applications. Alternatively, the bolometer could operate at higher temperature with still superior sensitivity. This device can significantly increase a science return and reduce the cost for future observational missions. This research was performed by the Center for Space Microelectronics Technology, Jet Propulsion Laboratory, California Institute of Technology, and was sponsored by NASA, Office of Space Science.
Author
Bolometers; Far Infrared Radiation; Hot Electrons

20000074692 Natural Resources Canada, Geodetic Survey Div., Ottawa, Ontario Canada
VLBI Data Acquisition and Recorder Systems: A Summary and Comparison
Petrachenko, William T., Natural Resources Canada, Canada; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 76-85; In English; See also 20000074683; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A brief description of each VLBI data acquisition and recorder system currently in use for geodetic applications (Mk3a/4, VLBA, K4, S2) will be provided. The similarities and differences between systems will be discussed and summarized in tables under the headings IF processing, baseband conversion characteristics, baseband processing capabilities, formatter capabilities, recorder characteristics, data quality analysis features and control characteristics
Author
Very Long Base Interferometry; Data Acquisition; Data Recording; Ground Stations

20000074696 Northeast Radio Observatory Corp., Haystack Observatory, Westford, MA USA
Concept for an Affordable High-Data-Rate VLBI Recording and Playback System
Whitney, Alan R., Northeast Radio Observatory Corp., USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 103-110; In English; See also 20000074683; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Recent and continuing developments of magnetic-tape data-storage systems for the computer industry provide a basis on which to create a high-performance, affordable high-data-rate (HDR) recording and playback system. Such a system would be suitable for VLBI and other applications which demand sustained data rates of a gigabit/sec (Gbps) or higher. These systems should be based on mostly off-the-shelf hardware which will be readily available from the computer industry, with a minimum of custom design, and which can easily grow to higher data rates as the recording industry advances. Furthermore, they must be capable of unattended operation for at least 24 hours. Based on currently announced tape products and projected industry roadmaps, the cost per Gbps for such systems will drop from a Year 2000 cost of approx. $100,000/Gbps to approx. $14,000/Gbps by 2007. This suggests that HDR systems in the range of approx. 8 Gbps may be available for approx. $110,000 before the end of the next decade.
Author
Very Long Base Interferometry; Data Recording; Data Processing; Magnetic Tapes; Playbacks

20000074711 Naval Observatory, Washington, DC USA
Early Experiences with the Mark 4 Correlator
Kingham, Kerry A., Naval Observatory, USA; Martin, James O., Naval Observatory, USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 206-209; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

We detail the early operating experiences with the new Mark 4 Correlator at the Washington VLBI Correlator Facility. The emphasis is on the progress of operational efficiency since that area is of concern to the IVS members because of the resulting changes to the observational schedule. During the startup phase, NEOS Intensives were processed with an efficiency matching the previous experience with the Mark IIIA correlator; but the 6-station, 24 hour NEOS experiments took almost three times as

long. Later improvements cut the time required for NEOS processing with the Mark 4, but still have not equalled the mature Mark IIIA. A short analysis of the reasons for this, and some suggested improvements are offered.
Author
Correlators; Very Long Base Interferometry; Data Recording

20000074712 Max-Planck-Inst. fuer Radioastronomie, Bonn, Germany
The Bonn MK 4 Correlator Project
Alef, W., Max-Planck-Inst. fuer Radioastronomie, Germany; Graham, D. A., Max-Planck-Inst. fuer Radioastronomie, Germany; Zensus, J. A., Max-Planck-Inst. fuer Radioastronomie, Germany; Mueskens, A., Bonn Univ., Germany; Schlueter, W., Bundesamt fuer Kartographie und Geodaesie, Germany; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 210-214; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

We describe the present status of the VLBI correlator in Bonn. The old MK III correlator has been made Y2K compliant, but it is expected to be taken out of operation this year. We report our first experience with the new MK IV correlator, jointly operated by the MPIfR and the BKG, as well as our short-term and long-term plans, both with respect to astronomical and geodetic requirements.
Author
Correlators; Very Long Base Interferometry; Data Correlation

20000074715 Bonn Univ., Geodetic Inst., Germany
Instrumental Errors of Geodetic VLBI
Petrov, L., Bonn Univ., Germany; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 230-235; In English; See also 20000074683; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A model of VLBI observables includes effects of geometry, environment of signal propagation and delays in the data acquisition system itself. Imperfection of the model of instrumental effects can be a considerable source of errors in the estimates of the targeted parameters. Two effects are considered in detail: spurious signals in phase calibration and instrumental polarization. Methods of their detection, evaluation and calibration are outlined. Influence of these effects on the final results is shown.
Author
Geodesy; Very Long Base Interferometry; Instrument Errors; Polarization (Waves)

20000074734 Communications Research Lab., Kashima Space Research Center, Kashima, Japan
An Experimental Campaign for Evaluation of Wet Delay Variations Using Water Vapor Radiometers in the Kanto District, Central Japan
Ichikawa, Ryuichi, Communications Research Lab., Japan; Koyama, Y., Communications Research Lab., Japan; Kondo, T., Communications Research Lab., Japan; Okubo, H., Communications Research Lab., Japan; Hanado, H., Communications Research Lab., Japan; Aonashi, K., Meteorological Research Inst., Japan; Shoji, Y., Meteorological Research Inst., Japan; Hatanaka, Y., Geographical Survey Inst., Japan; Yamamoto, J., Chiba Univ., Japan; Takamura, T., Chiba Univ., Japan; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 329-333; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Anisotropic mapping functions are considered a powerful tool for removing the effects of atmospheric variability from GPS and VLBI analyses. However, the assumption of simple linear form of atmosphere is not always appropriate in the context of intense mesoscale phenomena. Thus, in June 1998 we initiated a field experiment for characterizing water vapor variations using water vapor radiometers (WVRs) in the Kanto district of central Japan. In spite of the relatively short distance between Tsukuba and Kashima (about 54 km) the atmospheric gradients solutions from WVR are significantly different. This result suggests that the mesoscale weather pattern caused these large differences.
Author
Anisotropy; Global Positioning System; Mesoscale Phenomena; Very Long Base Interferometry; Water Vapor; Time Lag; Atmospheric Moisture

20000074792 NASA Goddard Space Flight Center, Greenbelt, MD USA
A New ER-2 Lidar System and Implications for Doppler Lidar Simulation
McGill, M., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; Lidar Working Group Meeting, 21-23 Jun. 2000, Boulder, CO, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A new high-altitude remote sensing lidar is nearing completion at NASA-Goddard. The lidar will replace the existing Cloud Lidar System and will provide measurements of cloud and aerosol parameters at 1064, 532, and 355 nm. It is anticipated that the aerosol backscatter data from this instrument will be highly valuable for producing spaceborne simulations of Doppler lidar systems. Such simulations are possible, as has been previously demonstrated using data from the old Cloud Lidar System. The new lidar will allow improved simulation capability, particularly at 355 nm, which is a primary candidate wavelength for spaceborne Doppler systems. Descriptions of the new lidar will be shown, the science capabilities will be described, and the potential impact on future spaceborne simulations will be discussed.
Author
Doppler Radar; Remote Sensing; U-2 Aircraft; Computerized Simulation; Space Based Radar

20000075278 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Sub-Optical Lithography With Nanometer Definition Masks
Hartley, Frank T., Jet Propulsion Lab., California Inst. of Tech., USA; Malek, Chantal Khan, Louisiana State Univ., USA; Neogi, Jayant, Norsam Technologies, Inc., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Nanometer feature size lithography represents a major paradigm shift for the electronics and micro-electro-mechanical industries. In this paper, we discuss the capacity of dynamic focused reactive ion beam (FIB) etching systems to undertake direct and highly anisotropic erosion of thick evaporated gold coatings on boron-doped silicon X-ray mask membranes. FIB offers a new level of flexibility in micro fabrication, allowing for fast fabrication of X-ray masks, where pattern definition and surface alteration are combined in the same step which eliminates the whole lithographic process, in particular resist, resist development, electrodeposition and resist removal. Focused ion beam diameters as small as 7 nm can be obtained enabling fabrication well into the sub-20 nm regime. In preliminary demonstrations of this X-ray mask fabrication technique 22 nm width lines were milled directly through 0.9 microns of gold and a miniature mass spectrometer pattern was milled through over 0.5 microns of gold. Also presented are the results of the shadow printing, using the large depth of field of synchrotron high energy parallel X-ray beam, of these and other sub-optical defined patterns in photoresist conformally coated over surfaces of extreme topographical variation. Assuming that electronic circuits and/or micro devices scale proportionally, the surface area of devices processed with X-ray lithography and 20 nm critical dimension X-ray masks would be 0.5% that of contemporary devices (350 nm CD). The 20 CD mask fabrication represents an initial effort - a further factor of three reduction is anticipated which represents a further order-of-magnitude reduction in die area.
Derived from text
Lithography; Ion Beams; Circuits; Anisotropy; Erosion; Gold Coatings; Fabrication

20000076123 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Resonant atomic resolution X-ray/g-ray external source holography
Fonda, L.; Jul. 31, 1998; 6p; In English
Report No.(s): DE99-616017; IC/IR-98/12; No Copyright; Avail: Department of Energy Information Bridge

Stimulated by a recent paper reporting experimental results on (gamma)-ray external source holography, we have here provided the theoretical description of the process using relativistic quantum electrodynamical methods. The energy of the incoming photon is low enough to produce resonant scattering from the nuclei surrounding the nucleus absorber. The method applies of course also to the case of an x-ray external source with photons interacting in this case with the atoms of the material sample.
NTIS
X Ray Sources; Holography

20000076485 Rutherford Appleton Lab., Chilton UK
Calibration of the Electron Volt Spectrometer, a Deep Inelastic Neutron Scattering Spectrometer at the ISIS Pulsed Neutron Spallation Source
Fielding, A. L.; Mayers, J.; Apr. 2000; 44p; In English
Report No.(s): PB2000-106353; RAL-TR-2000-013; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The electron Volt spectrometer (eVS) is an inverse geometry filter difference spectrometer that has been optimized to measure the single atom properties of condensed matter systems using a technique known as neutron Comptom scattering (NCS) or deep inelastic neutron scattering (DINS). The spectrometer utilizes the high flux of epithermal neutrons that are produced by the ISIS neutron spallation source enabling the direct measurement of atomic momentum distributions and ground state kinetic energies. In this paper the procedure that is used to calibrate the spectrometer is described. This includes details of the method used to deter-

mine detector positions and neutron flight path lengths as well as the determination of the instrument resolution. Examples of measurements on 3 different samples are shown, ZrH2, He-4 and Sn which show the self-consistency of the calibration procedure.
NTIS
Calibrating; Electron Spectroscopy; Neutron Scattering; Spectrometers; Flight Paths; Enhanced Vision

36
LASERS AND MASERS

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

20000075549 NASA Goddard Space Flight Center, Greenbelt, MD USA
Gaussian Decomposition of Laser Altimeter Waveforms
Hofton, Michelle A., Maryland Univ., USA; Minster, J. Bernard, Scripps Institution of Oceanography, USA; Blair, J. Bryan, NASA Goddard Space Flight Center, USA; Aug. 23, 1999; 19p; In English
Contract(s)/Grant(s): NAS5-33019; NAG5-3001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We develop a method to decompose a laser altimeter return waveform into its Gaussian components assuming that the position of each Gaussian within the waveform can be used to calculate the mean elevation of a specific reflecting surface within the laser footprint. We estimate the number of Gaussian components from the number of inflection points of a smoothed copy of the laser waveform, and obtain initial estimates of the Gaussian half-widths and positions from the positions of its consecutive inflection points. Initial amplitude estimates are obtained using a non-negative least-squares method. to reduce the likelihood of fitting the background noise within the waveform and to minimize the number of Gaussians needed in the approximation, we rank the ”importance” of each Gaussian in the decomposition using its initial half-width and amplitude estimates. The initial parameter estimates of all Gaussians ranked ”important” are optimized using the Levenburg-Marquardt method. If the sum of the Gaussians does not approximate the return waveform to a prescribed accuracy, then additional Gaussians are included in the optimization procedure. The Gaussian decomposition method is demonstrated on data collected by the airborne Laser Vegetation Imaging Sensor (LVIS) in October 1997 over the Sequoia National Forest, California.
Author
Decomposition; Laser Altimeters; Waveforms; Remote Sensing; Random Noise

20000078387 Dartmouth Coll., Hanover, NH USA
Development of an Ultrafast Scanning Tunneling Microscope for Dynamic Surface Studies ***Final Report, 1 Aug. 1996-31 Jul. 1999***
Nunes, , Jr; Jul. 31, 1999; 5p; In English
Contract(s)/Grant(s): F49620-96-1-0396; AF Proj. 3484
Report No.(s): AD-A378387; AFRL-SR-BL-TR-00-0219; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

At the end of three years, we have met the majority of the project goals and made significant progress on the few remaining issues. As outlined in more detail below, we have designed and built a UHV system and incorporated a commercially made, custom designed STM. The microscope has demonstrated atomic resolution. We have a femtosecond laser system, optics for delivering ultrafast laser pulses to the STM, and a computer controlled delay line for time-resolved measurements. This project also has funding from the National Science Foundation, and work continues with that funding while we actively seek additional funds for continued work. We are actively working to develop the instrument as a probe-station for molecular electronics. to that end, we are collaborating with Prof. David Glueck in the Chemistry department on time-domain investigations of Coulomb-blockade effects in Au nanoparticles.
DTIC
Laser Applications; Scanning Electron Microscopy; Electron Tunneling; Pulsed Lasers

20000078404 Sandia National Labs., Albuquerque, NM USA
Laser Engineered Net Shaping (LENS(TM)): A Tool for Direct Fabrication of Metal Parts
Atwood, C.; Ensz, M.; Greene, D.; Griffith, M.; Harwell, L.; Nov. 05, 1998; 9p; In English
Report No.(s): DE00-001549; SAND98-2473C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

For many years, Sandia National Laboratories has been involved in the development and application of rapid prototyping and direct fabrication technologies to build prototype parts and patterns for investment casting. Sandia is currently developing

a process called Laser Engineered Net Shaping (LENS;) to fabricate fully dense metal parts directly from computer-aided design (CAD) solid models. The process is similar to traditional laser-initiated rapid prototyping technologies such as stereolithography and selective laser sintering in that layer additive techniques are used to fabricate physical parts directly from CAD data. by using the coordinated delivery of metal particles into a focused laser beam apart is generated. The laser beam creates a molten pool of metal on a substrate into which powder is injected. Concurrently, the substrate on which the deposition is occurring is moved under the beam/powder interaction zone to fabricate the desired cross-sectional geometry. Consecutive layers are additively deposited, thereby producing a three-dimensional part. This process exhibits enormous potential to revolutionize the way in which metal parts, such as complex prototypes, tooling, and small-lot production parts, are produced. The result is a comple; fully dense, near-net-shape part. Parts have been fabricated from 316 stainless steel, nickel-based alloys, H13 tool steel, and titanium. This talk will provide a general overview of the LENS; process, discuss potential applications, and display as-processed examples of parts.
NTIS
Laser Machining; Metal Working; Laser Applications; Fabrication

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.

20000074950 New Energy and Industrial Technology Development Organization, Tokyo, Japan
International research cooperation in fiscal 1997. Report on the results of researches for the development of tribo-materials
Mar. 31, 1998; 101p; In Japanese; In English
Report No.(s): DE99-714261; ETDE/JP-99714261; No Copyright; Avail: Department of Energy Information Bridge

Researches were conducted for the development of tribo-materials for the improvement of energy efficiency for equipment with slide members usable for example aboard automobiles, and the result is reported for fiscal 1997. In the research for the creation of substrate materials, some metals different in hardness, iron-base materials, titanium-base materials, etc., were selected, and experiments were conducted to disclose the effect of the substrate hardness/surface roughness on the critical load under which gas phase coatings fracture. In the research about surface treatment, the arc ion plating method is employed to produce TiN coatings on substrates of SKD11 and Ti-6Al-4V, and the critical loads were evaluated using a heavy duty, acoustic detection type adhesion evaluator and a sliding wear tester. Furthermore, the substrate/coating interface is subjected to observation under high-resolution transmission electron microscope. As for the evaluation of coating characteristics, the effects of the hardness of the coating itself, Young's modulus, and toughness on the fracture of the coating were investigated. During the international joint researches, information was exchanged with National Institute for Standards and Technology, US.
NTIS
Tribology; Energy Conservation

20000074955 Centre National de la Recherche Scientifique, Toulouse, France
Assistance to a car heat engine by a self-controlled synchronous machine: engine energy control enhancement and pollutant emission reduction
Kouadio, L.; Dec. 12, 1996; 144p; In French; In English
Report No.(s): DE99-713702; CNRS-LAAS-96472; No Copyright; Avail: Department of Energy Information Bridge

A new method for spark-ignition engine control, more especially in idle conditions, has been developed to prevent engine stalling and improve its idling performances in terms of fuel consumption and pollutant emissions: the car synchronous machine, traditionally operating as an alternator, is used in certain phases to provide an external supplementary torque on the engine shaft. Methods are proposed for optimizing the synchronous machine operation as a generator and as an engine, then the main engine control parameters are presented and a linear signal model is established around a nominal idling point, which is used for simulations. Experimental results show evident reductions of fuel consumption and a significant robustness improvement in the engine dynamics
NTIS
Heat Engines; Engine Control; Ignition Systems; Internal Combustion Engines; Spark Ignition

20000076013 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Fiscal 1997 report of the R and D result of industrial science and technology. R and D on synergy ceramics (R and D on an ultrahigh-temperature gas turbine for power generation)

Mar. 31, 1998; 219p; In Japanese; In English

Report No.(s): DE99-718336; ETDE/JP-99718336; No Copyright; Avail: Department of Energy Information Bridge

For development of high-efficiency power generation gas turbines using petroleum substituting energy, the process technology which can highly harmonize conflicting characteristics and various functions was developed for new ceramic materials. This paper summarizes the result in fiscal 1997. On design technology of the characteristics harmonizing process, the design and synthesis of ceramic precursors were made by using chemical reaction of metal organics. On analysis of fracture behavior by controlling microscopic and macroscopic particle shapes, orientations were observed by convergent ion beam. On control technology of a structure formation process, study was made on continuous pore shape control to form porous material with uni-directionally arranged pores in ceramic matrix, interface control between particles to decrease a plastic deformation temperature and improve a heat insulation, interface control between phases of a rare-earth silicate/silicon-carbide-based composite, boundary control between layers of piezoelectric ceramics, and boundary control of the composite where inorganic-organic hybrids occupy the interface between ceramic particles.

NTIS

Research and Development; Ceramics; Gas Turbines; Mechanical Engineering

20000076056 Naval Postgraduate School, Monterey, CA USA

Development of a Software Evolution Process for Military Systems Composed of Integrated Commercial off the Shelf Components

Hensley, Barry J.; Mar. 2000; 168p; In English

Report No.(s): AD-A377711; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Department of Defense (DoD) acquisition policy requires that military system acquisitions incorporate commercial-off-the-shelf (COTS) components into system architectures. Traditional DoD source code development and evolution methodologies do not effectively support COTS-intensive systems. to fully realize the benefits of COTS technologies and products, the DoD must adopt new ways to sustain system evolution in the face of a dynamic market environment subject to constant change. This thesis proposes a new software evolution methodology to effectively maintain COTS-intensive military systems. The integrated COTS component evolution (ICCE) model provides evolution processes designed to support the maintainer as a consumer of software instead of a source-code developer. The ICCE model affords proactive risk awareness, market awareness, and user awareness activities. The ICCE model also supports a three-tier test and evaluation process. A case study for the U.S. Navy/Marine Corps Meteorological Mobile Facility Replacement (METMF(R)) program demonstrates the effectiveness of the ICCE risk management process.

DTIC

Computer Programming; Computer Programs; Government Procurement; Armed Forces

20000078415 Lund Univ., Dept. of Heat and Power Engineering, Sweden

Scavenging processes in high speed two-stroke engines studied with laser diagnostics

Ekenberg, M.; Dec. 31, 1998; 69p; In English

Report No.(s): DE99-721567; LUTMDN-TMVK-98-7028; No Copyright; Avail: Department of Energy Information Bridge

The major problem with the carburetted two-stroke engine is the short-circuiting of fuel that occurs during the scavenging phase. This leads to large emissions of unburned hydrocarbons. The object of this thesis has been to map the flow behaviour in the cylinder during the scavenging phase, and to detect differences between different cylinder designs. The measurement techniques used has been Laser Doppler Velocimetry (LDV), Laser Induced Fluorescence (LIF) and Laser Sheet Droplet Illumination (LSDI). of these measurement methods, LDV and LSDI has been used inside the cylinder. LIF was used outside the exhaust port. All measurements were performed in engines running at their rated speeds, 9000 rpm for three of the designs and 5800 rpm for one design. All engines were run at full load with combustion. The LDV measurements inside the cylinder show that cylinders with cup handle transfer channels have a flow pattern inside the cylinder that gives less short-circuiting, and hence less emissions of hydrocarbons, than the cylinder with open transfer channels has. The LIF measurements outside the exhaust port show that the HC emissions that are caused by short-circuiting comes earlier in the scavenging phase for the cylinder with open transfer channels than is the case for the cylinders with cup handle transfer channels. The LSDI measurements in the cylinder give the transfer chan-

nel flow angle, for the cylinders with cup handle transfer channels. For the cylinder with open transfer channels, the results are not as useful; fuel droplet vaporization close to the exhaust port ruins the results.
NTIS
Scavenging; Internal Combustion Engines

20000078417 Swedish National Energy Administration, Eskilstuna, Sweden
Effusion cooling of combustion chamber walls - an experimental investigation of near-wall temperature-velocity correlations *Final Report*
Johansson, G.; Gustafsson, B.; Aug. 31, 1998; 12p; In English
Report No.(s): DE99-721589; STEM-FBT-98-5; No Copyright; Avail: Department of Energy Information Bridge

Effusion cooling has established itself as an efficient method to protect the walls of high performance combustion chambers used, e.g., in jet engines. Our knowledge of the flow and temperature fields in the wall region of such chambers is however not adequate for accurate computation of these fields and hence not for the analysis and design of effusion cooling systems. The long time goal of this project is to contribute to the development of improved turbulence models and computational procedures for flow fields where density fluctuations are of importance for the turbulence production and thus for the structure of the flow fields. A short term goal is to provide experimental data which can serve as an aid to the designers of practical effusion cooling systems. At an earlier stage of this project an investigation was completed in which the flow field around a single row of injection holes was measured. The main finding in this work was the identification of vortices formed around the injected jets. These vortices carry hot fluid towards the wall and thus counteract the intended functioning of the method. The interaction of jets from multiple rows of holes is therefore essential to effusion cooling systems. In the present phase of the project an experiment running, in which the cooling efficiency of different hole patterns and plate materials is studied. The result of this study will establish the design and operating conditions for which the effusion cooling technique is effective. IR-radiation measurement technique is being used in this study and the influence of hole distance, hole inclination, blow factors and temperature ratios is covered. The results of this study will provide designers of effusion cooling systems with an empirical data base useful for actual design work. Later, this investigation will be followed by an experiment in which the coupled velocity-density field will be studied. The development of the technique to do this is in progress. This later step will aid significantly to improve our understanding of the dynamics of the turbulence in this kind of flow fields and provide a basis for future improved turbulence models to be used in effusion cooling systems and similar applications. This, it is hoped, will form a significant further step towards the final goal to provide the designers of effusion cooling systems with reliable working tools to design efficient and optimized systems.
NTIS
Cooling; Cooling Systems; Correlation; Turbulence Models

38
QUALITY ASSURANCE AND RELIABILITY

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

20000075640 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Real-Time Leaky Lamb Wave Spectrum Measurement and Its Application to NDE of Composites
Lih, Shyh-Shiuh, Jet Propulsion Lab., California Inst. of Tech., USA; Bar-Cohen, Yoseph, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; Mechanical Engineering, 14-19 Nov. 1999, Nashville, TN, USA; Sponsored by American Society of Mechanical Engineers, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Numerous analytical and theoretical studies of the behavior of leaky Lamb waves (LLW) in composite materials were documented in the literature. One of the key issues that are constraining the application of this method as a practical tool is the amount of data that needs to be acquired and the slow process that is involved with such experiments. Recently, a methodology that allows quasi real-time acquisition of LLW dispersion data was developed. At each angle of incidence the reflection spectrum is available in real time from the experimental setup and it can be used for rapid detection of the defects. This technique can be used to rapidly acquire the various plate wave modes along various angles of incidence for the characterization of the material elastic properties. The experimental method and data acquisition technique will be described in this paper. Experimental data was used to examine a series of flaws including porosity and delaminations and demonstrated the efficiency of the developed technique.
Author
Data Acquisition; Detection; Elastic Properties; Lamb Waves; Nondestructive Tests

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.

20000075425 Norwegian Defence Research Establishment, Kjeller, Norway
A Summary of Project 711 ”Fiberoptisk Skrogovervakning” (Chess)
Pran, Karianne, Norwegian Defence Research Establishment, Norway; Havsgard, Geir Bjarte, Norwegian Defence Research Establishment, Norway; Wang, Gunnar, Norwegian Defence Research Establishment, Norway; Mar. 02, 2000; 26p; In English
Contract(s)/Grant(s): Proj. FFIE/711/116
Report No.(s): FFI/RAPPORT-2000/01298; ISBN 82-464-0419-9; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report summarizes the work done under project 711 ”Fiberoptisk skrogovervakning” Composite Hull Embedded Sensor System (CHESS) and cites the reports and papers that have been published as a part of the project. This includes the work of students that have been supervised on fibre Bragg gratings and signal processing techniques.
Author
Embedding; Hulls (Structures); Fiber Optics; Strain Gages; Composite Materials; Finite Element Method; Smart Structures; Ships

20000076635 Helsinki Univ. of Technology, Lab. for Mechanics of Materials, Espoo, Finland
Foundations of the J-Vector Theory
Santaoja, K.; 2000; 126p; In English
Report No.(s): PB2000-106111; TKK-LO-29; Copyright; Avail: National Technical Information Service (NTIS)
A new theory, the J-vector theory, for describing crack growth in materials in general is derived. The present formulation of the J-vector theory is for a rectilinear crack with a straight crack front. A vital part of the J-vector theory is its ability to predict the amount of crack growth. The first scalar component of the J-vector reduces to the J-integral when seven assumptions are made. These assumptions are the same as those made by Rice when he introduced the J-integral. Thus the J-vector theory is an extension to the J-integral concept. The fundamental idea of the J-vector theory is the mathematical separation of the body V(sup b) into two subdomains denoted by (omega(sup b))(t) and (gamma(sup b))(t). The latter encloses the crack tip and the fracture process zone. The subdomain (gamma(sup b))(t) is imagined to be attached to the crack tip and to move the growing crack.
NTIS
J Integral; Crack Propagation

20000076802 Forschungszentrum Rossendorf e.V., Dresden, Germany
Detection of ductile crack initiation by acoustic emission testing
Richter, H.; Boehmert, J.; Viehrig, H. W.; Valo, M.; Aug. 31, 1998; 38p; In German; In English
Report No.(s): DE99-719927; FZR-230; No Copyright; Avail: Department of Energy Information Bridge
A Charpy impact test equipment is described permitting simultaneous measurement of impact force, crack tip opening, acoustic emissions and magnetic emissions. The core of the equipment is an inverted pendulum ram impact testing machine and the tests have been performed with laterally notched, pre-fatigue ISO-V specimens made of steels of various strength and toughness properties. The tests are intended to ascertain whether the acoustic emission method is suitable for detecting steady crack initiation in highly ductile steels.
NTIS
Ductility; Crack Initiation

42
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see categories 41 through 48.

20000074683 NASA Goddard Space Flight Center, Greenbelt, MD USA
International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings
Vandenberg, Nancy R., Editor, NASA Goddard Space Flight Center, USA; Baver, Karen D., Editor, NASA Goddard Space Flight

Center, USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000; 442p; In English; 1st; General Meeting of the International VLBI Service for Geodesy and Astrometry, 21-24 Feb. 2000, Koetzing, Germany; See also 20000074684 through 20000074747
Report No.(s): NASA/CP-2000-209893; Rept-2000-02743-0; NAS 1.55:209893; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

This volume is the proceedings of the first General Meeting of the International Very Long Base Interferometry (VLBI) Service for Geodesy and Astrometry (IVS), held in Koetzting, Germany, February 21-24, 2000. The content of this volume also appears on the IVS web site at: http://ivscc.gsfc.nasa.gov/publications/gm2000. The goal of the program committee for the General Meeting was to provide an interesting and informative program for a wide cross section of IVS members, including station operators, program managers, and analysts. The program included reports, tutorials, invited and contributed papers, and poster presentations. The tutorial papers should be particularly useful references because each one provides an overview and introduction to a topic relevant to VLBI.
Author
Conferences; Geodesy; Very Long Base Interferometry; Astrometry

20000074684 Bonn Univ., Geodetic Inst., Germany
From Quasars to Benchmarks: VLBI Links Heaven and Earth
Campbell, James, Bonn Univ., Germany; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 19-34; In English; See also 20000074683; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Very Long Baseline Interferometry is able to provide a direct geometrical tie to the extragalactic radio sources which represent the best possible realization of an inertial system. by this token, VLBI can measure Earth rotation and orientation as well as precise station positions and their velocities without involving the gravity field of the Earth. In the broader context of Earth observation and the monitoring of geodynamic processes, these and many more unique features have allowed the VLBI technique to achieve pioneering feats such as the determination of present-day plate tectonic motions, post glacial rebound, sub-daily Earth rotation variations and parameters of general relativity. In this contribution, some of the highlights of the history of VLBI will be passed in review and directions of future developments will be pointed out.
Author
Very Long Base Interferometry; Radio Astronomy; Inertial Reference Systems

20000074685 Deutsches Geodaetisches Forschungsinstut, Munich, Germany
The Role of VLBI Among the Geodetic Space Techniques Within CSTG
Drewes, Hermann, Deutsches Geodaetisches Forschungsinstut, Germany; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 35-41; In English; See also 20000074683; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The main objectives of the Commission on International Coordination of Space Techniques for Geodesy and Geodynamics (CSTG) for the near future are the optimum integration of all geodetic observation techniques in a unique global network, the International Space Geodetic Network (ISGN), and the combined processing of all heterogeneous space geodetic measurements in a common data analysis procedure. The combination of different techniques will provide more reliability and a higher accuracy of the results. Each of the techniques plays an important role in this procedure and provides some unique tools for the geodetic parameter estimation. VLBI is not only unique in connecting the celestial and the terrestrial reference frames, but it gives also other indispensable information about geodetic parameters, which the satellite techniques cannot solve for independently. Only the inclusion of VLBI observations will guarantee the continuity and stability of geodetic reference systems.
Author
Very Long Base Interferometry; Data Processing; Geodesy

20000074688 Institut Geographique National, France
ITRF Status and Plans for ITRF2000
Altamimi, Zuheir, Institut Geographique National, France; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 57-61; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The status of the International Terrestrial Reference Frame (ITRF) and the procedure of its implementation are presented. We will focus on VLBI contributions to ITRF and their relationships to the other IERS techniques in terms of TRF definition as well as quality assessment. Future plans for ITRF2000 will be outlined.
Author
Very Long Base Interferometry; Reference Systems; Position (Location); Velocity

20000074691 NVI, Inc., Greenbelt, MD USA
Network Coordinator Report
Himwich, Ed, NVI, Inc., USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 73-74; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

This report summarizes the IVS Network Coordination activities during the past six months, since the publication of the Annual Report.
Author
Very Long Base Interferometry; Geodesy; Coordination; Ground Stations

20000074693 NASA Goddard Space Flight Center, Greenbelt, MD USA
Introduction to the Field System for Non-Users
Himwich, Ed, NASA Goddard Space Flight Center, USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 86-90; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

This report provides a brief description of the Field System (FS) for non-users. The Field System (FS) is a suite of programs that provides the coordinating control of VLBI data acquisition at many stations. The basic features of the FS and experiment operations are described. Areas for future development axe listed.
Author
Data Acquisition; Very Long Base Interferometry; Applications Programs (Computers); Ground Stations

20000074694 Northeast Radio Observatory Corp., Haystack Observatory, Westford, MA USA
Technology Coordinator Report
Whitney, Alan R., Northeast Radio Observatory Corp., USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 93-97; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Much progress has been made over the last year in defining a ”VLBI Standard Interface” specification. This specification, a joint effort between the geodetic and astronomy VLBI communities, is being developed in an effort to specify standard interfaces to/from a VLBI ”data transmission system” so that data collected on inhomogeneous systems can be processed together at a correlator. The first step of defining a hardware interface is almost complete, and efforts at software standardization are planned. This presentation will explain the philosophy of the VSI as well as some of the details of the interface specification. Though it will take some years before all VLBI systems adhere to VSI, this step should lead to an eventual major improvement in worldwide VLBI compatibility.
Author
Very Long Base Interferometry; Data Correlation; Geodesy; Human-Computer Interface

20000074695 Communications Research Lab., Kashima Space Research Center, Kashima, Japan
Geodetic VLBI Observations Using the Giga-Bit VLBI System
Koyama, Yasuhiro, Communications Research Lab., Japan; Kondo, Tetsuro, Communications Research Lab., Japan; Nakajima, Junichi, Communications Research Lab., Japan; Sekido, Mamoru, Communications Research Lab., Japan; Ichikawa, Ryuichi, Communications Research Lab., Japan; Kawai, Eiji, Communications Research Lab., Japan; Okubo, Hiroshi, Communications Research Lab., Japan; Osaki, Hiro, Communications Research Lab., Japan; Takaba, Hiroshi, Gifu Univ., Japan; Yoshida, Minoru, Gifu Univ., Japan; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 98-102; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Abstract A series of geodetic VLBI experiments have been performed with the giga-bit VLBI system using a baseline between Kashima and Koganei stations in the Key Stone Project VLBI Network, and a baseline between the 34-m antenna station at Kashima and a mobile VLBI station at Gifu University. The baseline vector was successfully estimated from the first test experiment on October 19, 1999. The results are still preliminary, but the challenge became the first success of the geodetic VLBI experi-

ment at the recording speed of 1024 Mbps. Details of the giga-bit VLBI system and the geodetic VLBI experiments using the system are reported in this paper.
Author
Geodesy; Very Long Base Interferometry; Data Recording; Data Correlation; Data Processing

20000074697 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Importance of Local Surveys for Tying Techniques Together
Long, James L., Honeywell Technology Solutions Inc., USA; Bosworth, John M., NASA Goddard Space Flight Center, USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 113-117; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The synergistic benefits of combining observations from multiple space geodesy techniques located at a site are a main reason behind the proposal for the establishment of the International Space Geodetic and Gravimetric Network (ISGN). However, the full benefits of inter-comparison are only realized when the spatial relationships between the different space geodetic systems are accurately determined. These spatial relationships are best determined and documented by developing a local reference network of stable ground monuments and conducting periodic surveys to tie together the reference points (for example: the intersection of rotation axes of a VLBI antenna) of the space geodetic systems and the ground monument network. The data obtained from local surveys is vital to helping understand any systematic errors within an individual technique and to helping identify any local movement or deformation of the space geodetic systems over time.
Author
Very Long Base Interferometry; Intercalibration; Geodetic Surveys; Ground Stations

20000074698 Hartebeesthoek Radio Astronomy Observatory, Johannesburg, South Africa
Local Surveys of VLBI Telescopes
Combrinck, Ludwig, Hartebeesthoek Radio Astronomy Observatory, South Africa; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 118-127; In English; See also 20000074683; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

With geodetic VLBI techniques we are able to determine station coordinates and displacement rates at millimetre accuracy levels. These results are very sensitive to local telescope displacements caused by natural phenomena or by man-made modifications. In order to separate the local effects from those which are of interest like crustal movements, land uplift and subsidence, we need to measure the position of the telescopes in the local vicinity. Local networks in walking distance of the telescope should be complemented by extended networks which provide links to geologically stable areas. In this paper we introduce the holistic approach to footprints and geodetic monuments. In order to achieve millimetre precision, local effects such as slope movement, weathering and thermal effects can no longer be ignored. The geodesist must recognise and be aware of potential instabilities caused by such factors.
Author
Very Long Base Interferometry; Geodesy; Geodetic Surveys; Radio Telescopes; Ground Stations

20000074702 Bonn Univ., Geodetic Inst., Germany
The European VLBI Project
Campbell, J., Bonn Univ., Germany; Haas, R., Onsala Space Observatory, Sweden; Nothnagel, A., Bonn Univ., Germany; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 146-150; In English; See also 20000074683
Contract(s)/Grant(s): SCI-CT92-0829; FMRX-CT96-0071; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The European geodetic VLBI project in its current phase aims at determining present-day vertical crustal motions by measuring relative vertical positions at regular intervals between the fixed VLBI stations in Europe. The VLBI observations have been carried out between 1990 and 1999 at a rate of six experiments per year with slightly different station configurations. The vertical site motions derived in the analysis of a 9-year time series are showing significant trends relative to Wettzell: at the station of Medicina we found a subsidence rate of 4.8 mm/y, probably related to groundwater and gas withdrawal in the Po plains. At Onsala and Ny Alesund small uplifts of about 1 to 2 mm/y were detected. These may be associated with the postglacial uplift in Scandinavia. The uplift of 2.3 mm/y at Madrid may be due to local effects which are also seen in the GPS data from the nearby IGS station. More extensive comparisons and combinations with the results from the GPS permanent stations in Europe are planned.
Author
Global Positioning System; Vertical Motion; Very Long Base Interferometry; Position Errors; Geodesy

20000074703 Joint Inst. for VLBI in Europe, Dwingeloo, Netherlands

Current Activities in the EVN

vanLangevelde, Huib Jan, Joint Inst. for VLBI in Europe, Netherlands; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 151-154; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

This report describes the current (February 2000) technical developments in the (astronomical) European VLBI Network (EVN). The EVN has switched over to observing in MkIV and VLBA modes mostly and is currently in the process of upgrading VLBA type terminals to the MkIV standard. The new observing formats, replacing the MkIII modes, have proven to work reliably. Other new developments have been the advent of UHF and 5 cm receivers and progress on frequency agility of the telescopes. It is noteworthy that more and more observing programs use phase referencing techniques. The situation with correlators for the EVN is tight. Using the MkIV/VLBA modes initially has been made possible through the VLBA correlator. The EVN MkIV correlator at JIVE is now also operational, albeit for a limited number of observing modes and with limited throughput.

Author

Very Long Base Interferometry; Data Correlation; Networks; Space Observations (From Earth); Radio Astronomy

20000074704 National Radio Astronomy Observatory, Socorro, NM USA

Overview of Observations on the VLBA

Walker, R. Craig, National Radio Astronomy Observatory, USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 155-159; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The VLBA is a dedicated instrument for VLBI that includes 10 antennas, a 20 station correlator, and an operations center. The capabilities of the instrument are reviewed along with the operating style. The current usage, in terms of amount of time spent observing, the distribution of observing by frequency band, and correlator usage, are summarized. Some of the current and desired upgrade projects are described.

Author

Very Long Base Interferometry; Very Long Baseline Array (VLBA); Radio Antennas; Correlators; Frequencies

20000074706 Naval Observatory, Washington, DC USA

A Southern Hemisphere Observing Program to Strengthen the ICRF

Fey, Alan L., Naval Observatory, USA; Johnston, Kenneth J., Naval Observatory, USA; Jauncey, David L., Australia Telescope National Facility, Australia; Reynolds, John E., Australia Telescope National Facility, Australia; Tzioumis, Anastasios, Australia Telescope National Facility, Australia; Lovell, James E. J., Australia Telescope National Facility, Australia; McCulloch, Peter M., Tasmania Univ., Australia; Costa, Marco E., Tasmania Univ., Australia; Ellingsen, Simon J., Tasmania Univ., Australia; Nicolson, George D., Hartebeesthoek Radio Astronomy Observatory, South Africa; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 164-167; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

We outline a program of planned Southern Hemisphere astrometry and imaging observations aimed specifically toward improvement of the International Celestial Reference Frame.

Author

Southern Hemisphere; Celestial Reference Systems; Astrometry; Imaging Techniques; Very Long Base Interferometry

20000074708 Natural Resources Canada, Geodetic Survey Div., Ottawa, Ontario Canada

The S2 Geodetic VLBI Program in Canada: System Validation Experiments and Results

Klatt, Calvin, Natural Resources Canada, Canada; Berube, Mario, Natural Resources Canada, Canada; Bujold, Marc, Natural Resources Canada, Canada; Cannon, Wayne H., York Univ., Canada; Feil, Georg H., CRESTech, Canada; Novikov, Alexander, CRESTech, Canada; Petrachenko, William T., Natural Resources Canada, Canada; Popelar, Josef, Natural Resources Canada, Canada; Feil, Georg H., CRESTech, Canada; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 173-179; In English; See also 20000074683; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In this report we discuss a number of S2 geodetic system validation experiments and their results. These experiments are those in which we use one or more VLBI baselines, observe a number of geodetic radio sources (full sky coverage) and use frequency-switching to achieve bandwidth synthesis. The experiments performed to date used the three geodetic antennas in Canada: ALGOPARK, YEL07296 and the Canadian Transportable VLBI Antenna (CTVA). ALGOPARK and YEL07296 are IVS Network stations, while the CTVA is a 3.6 m antenna being operated as part of the development center activities. Each of the three antennas

is equipped with an S2 RT, an S2 DAS, a PC Field System computer and a hydrogen maser frequency standard. The S2 Recording Terminal (RT) is a well established VLBI recording system utilizing an array of eight commercial video cassette recorder (VCR) transports to record at rates of up to 128 Mbits/sec. The focus of much recent activity is the frequency-switching S2 Data Acquisition System (DAS). Currently the DAS systems in use utilize two baseband converters and switch frequencies in order to synthesize a larger bandwidth. Correlation is done at the Canadian S2 Correlator, which is currently configured with six playback terminals.
Author
Very Long Base Interferometry; Geodesy; Data Acquisition; Frequency Converters; Data Correlation; Radio Antennas

20000074709 NASA Goddard Space Flight Center, Greenbelt, MD USA
New Uses for the VLBI Network
Clark, Tom, NASA Goddard Space Flight Center, USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 180-184; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

This paper suggests some potential new uses for the existing VLBI network. It seems that every VLBI group in the world faces some common problems: We do not have enough money to operate! We do not have enough money to make improvements!! In this contribution I discuss several possibilities for new business that might help to support the network stations without causing serious impacts on the primary VLBI programs.
Author
Very Long Base Interferometry; Networks; Ground Stations

20000074710 Northeast Radio Observatory Corp., Haystack Observatory, Westford, MA USA
How Do VLBI Correlators Work?
Whitney, Alan R., Northeast Radio Observatory Corp., USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 187-205; In English; See also 20000074683; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The VLBI correlator is the ”glue” that brings the data from separate antennas together and processes it to form the basic observables used in astronomy and geodesy. In this introductory tutorial, we will examine the operations that the correlator executes by following through a set of simple examples from raw data to multi-band delay estimates. What we will find is that the operations performed inside a correlator are really quite simple and understandable. What is not so simple are the practical realities of dealing with tapes, the precise control of huge torrents of data from tape, and the complicated bookkeeping to keep track of everything. For our purposes, however, we will completely ignore these difficulties and examine the correlator as a simple machine.
Author
Correlators; Very Long Base Interferometry; Data Recording; Data Correlation; Data Processing

20000074713 Bonn Univ., Geodetic Inst., Germany
Report of the IVS Analysis Coordinator
Nothnagel, A., Bonn Univ., Germany; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 217-218; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

On October 1, 1999, the author took over the tasks of the IVS Analysis Coordinator. On the basis of the preparations made by the Acting Analysis Coordinators a number of topics were addressed in the first five months. Regular submissions of the Analysis Centers are being received and have to be monitored. First comparisons are available and can be checked by the users on a special Analysis Coordinator web site. The first IVS Analysis Workshop took place at Koetzting, Germany, on February 24, 2000.
Author
Very Long Base Interferometry; Data Processing; Data Storage; Coordination

20000074714 Technische Univ., Inst. fuer Geodaesie und Geophysik, Vienna, Austria
Geodetic Analysis Overview
Schuh, Harald, Technische Univ., Austria; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 219-229; In English; See also 20000074683; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

For the VLBI data analysis the best presently available knowledge is used to mathematically recreate, as closely as possible, the situation at the time of observation. The goal is to determine precise values of the parameters geodesists, geophysicists and

astronomers are interested in, e.g. baseline components, radio source positions or Earth orientation parameters. A general overview about data analysis of geodetic/astrometric VLBI experiments is given. The procedure of data analysis is explained and the geophysical, environmental and instrumental effects which have to be taken into account are presented. A sample of the most interesting results is presented.
Author
Very Long Base Interferometry; Data Processing; Data Recording; Data Reduction; Astrometry; Earth Orientation; Geodesy

20000074718 Bonn Univ., Geodetic Inst., Germany
Optimal Estimation of the Earth Orientation Parameters Using VLBI
Petrov, L., Bonn Univ., Germany; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 243-246; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The problem of the best strategy for estimation of the Earth orientation parameters using VLBI is considered. The present strategy for evaluation of six parameters for each session, UT1, UT1 rate, pole coordinates, nutation offsets, contains internal contradictions and it has known deficiencies. An alternative parameterization is presented. The ways of its implementation and some results are discussed.
Author
Earth Orientation; Parameterization; Very Long Base Interferometry; Estimating

20000074719 NASA Goddard Space Flight Center, Greenbelt, MD USA
Improvement of VLBI EOP Accuracy and Precision
MacMillan, Daniel, NVI, Inc., USA; Ma, Chopo, NASA Goddard Space Flight Center, USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 247-251; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

In the CORE program, EOP measurements will be made with several different networks, each operating on a different day. It is essential that systematic differences between EOP derived by the different networks be minimized. Observed biases between the simultaneous CORE-A and NEOS-A sessions are about 60-130 micro(as) for PM, UT1 and nutation parameters. After removing biases, the observed rms differences are consistent with an increase in the formal precision of the measurements by factors ranging from 1.05 to 1.4. We discuss the possible sources of unmodeled error that account for these factors and the biases and the sensitivities of the network differences to modeling errors. We also discuss differences between VLBI and GPS PM measurements.
Author
Error Analysis; Global Positioning System; Very Long Base Interferometry; Earth Orientation; Parameterization

20000074720 Bonn Univ., Geodetic Inst., Germany
First Results of the 1999 Tsukuba-Wettzell UT1 Test Series
Nothnagel, A., Bonn Univ., Germany; Engelhardt, G., Bundesamt fuer Kartographie und Geodaesie, Germany; Hase, H., Bundesamt fuer Kartographie und Geodaesie, Germany; Kilger, R., Forschungseinrichtung Satellitengeodaesie, Germany; Ogi, S., Geographical Survey Inst., Japan; Takashima, K., Geographical Survey Inst., Japan; Thorandt, V., Bundesamt fuer Kartographie und Geodaesie, Germany; Ullrich, D., Bundesamt fuer Kartographie und Geodaesie, Germany; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 252-256; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

In May and June 1999 the radio telescopes of the Wettzell Geodetic Fundamental Station in Germany and of the Geographical Survey Institute of Japan at Tsukuba, observed a series of quasi-daily VLBI sessions of short duration for precise determination of UT1-UTC. Similar to routine UT1 observations on the Wettzell-Green Bank baseline this long east-west baseline is ideal for the accurate determination of UT1. For the first time a K4 data acquisition terminal was used for this type of observation. First analyses produce one-sigma formal errors of +/-12 microsec with a bias of -55 microsec relative to the IERS C04 Earth orientation parameter series.
Author
Data Acquisition; Earth Orientation; Geodesy; Very Long Base Interferometry; Position Errors

20000074729 Bern Univ., Astronomical Inst., Bern, Switzerland
Common Interests of the IGS and the IVS
Springer, T. A., Bern Univ., Switzerland; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 296-305; In English; See also 20000074683; No Copyright; Avail: CASI; A02, Hardcopy; A04, Micro-

fiche

With the advent of the International Laser Ranging Service (ILRS) and the International VLBI Service (IVS) all three major space geodetic techniques, CPS, SLR, and VLBI, have a dedicated service. The availability of these three services, IGS, ILRS, and IVS, will simplify the cooperation and exchange of information amongst the three services. The routine availability of reference frame products, station coordinates and Earth rotation parameters with their full covariance matrix, from all three techniques will enable an accurate combination of the reference frames from the different techniques. This is very important because it has become clear over the last few years that there are biases between the techniques at the several centimeter level, e.g., a 5 cm. bias has been observed between the SLR range observations from the CPS satellites and the computed ranges based on IGS orbits and ITRF SLR station positions. Each of the three techniques has its own unique capability and none of the three techniques can provide all the answers we are looking for. Already each technique profits from the other, e.g., GPS and SLR rely on the VLBI based UT1, SLR may use the CPS and VLBI based X- and Y-polar motion, and CPS heavily relies on SLR based models like, e.g., the Earth's gravity field. When combining the three techniques we should be able to get the best out of each technique. Last but not least the availability of products from different techniques may help understanding and resolving technique dependent problems.
Derived from text

Global Positioning System; Laser Range Finders; Very Long Base Interferometry

20000074730 Academy of Sciences (USSR), Inst. of Applied Astronomy, Saint Petersburg, USSR

EOP Determination with OCCAM and ERA Packages

Sokolskaya, Maria, Academy of Sciences (USSR), USSR; Skurikhina, Elena, Academy of Sciences (USSR), USSR; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 309-313; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The EOP series were obtained with OCCAM v. 3.5 and ERA v. 7 packages from VLBI NEOS-A and CORE-A measurements for the period 1997-1999. The EOP estimations provided by OCCAM were compared with those provided by ERA. The correlations of OCCAM and ERA results with the EOP(IERS)C04 were studied. It was found that the results obtained with OCCAM agree satisfactorily with the results obtained with ERA. The differences between the EOP estimated from NEOS-A and CORE-A observations were also calculated with OCCAM and ERA. These differences were verified to be similar and of significant correlation.
Author

Very Long Base Interferometry; Earth Orientation; Geodesy; Data Processing; Applications Programs (Computers)

20000074739 Academy of Sciences (USSR), Inst. of Applied Astronomy, Saint Petersburg, USSR

EOP and Station Positions Determined with OCCAM Package

Skurikhina, Elena, Academy of Sciences (USSR), USSR; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 350-354; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The preliminary results of Earth Orientation Parameter (EOP) [Pole coordinates, UT1 and corrections to nutation angles (delta psi and delta epsilon)] and station positions determination from NEOS-A, CORE-A, CORE-B and IRIS-A observation programs using package OCCAM version 3.5 in IAA RAS are reported in this paper. The EOP series for period 1984-1999 were obtained from these four programs. Comparison of the series with EOP(IERS)C04 shows both bias and rate in Xp pole coordinate arise from one in IRIS-A series. Station positions were estimated for every observational session. Station positions at epoch 1997.0 and velocities for 23 stations were derived from station positions time series by LSM estimations.
Author

Earth Orientation; Ground Stations; Position (Location); Applications Programs (Computers)

20000074740 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

VLBI in the Deep Space Network: Challenges and Prospects

Altunin, Valery I., Jet Propulsion Lab., California Inst. of Tech., USA; Resch, George M., Jet Propulsion Lab., California Inst. of Tech., USA; Rogstad, David H., Jet Propulsion Lab., California Inst. of Tech., USA; Wolken, Pamela R., Honeywell, Inc., USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 355-360; In English; See also 20000074683; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The purpose of this paper is to highlight the current status and prospects for VLBI in the NASA Deep Space Network (DSN). Although the prime purpose of the DSN is to support spacecraft operations and space research in deep space, this unique facility is also used on a noninterference basis with flight projects to support ground-based science experiments. The DSN VLBI capabilities are an integral part of a number of space- and ground-based projects. They include support of experiments at major radio

astronomy VLBI networks (e.g., VLBA, EVN, APT), space VLBI co-observing, as well as VLBI geodesy and astrometry programs. The paper will describe for the potential DSN VLBI users 1) DSN VLBI objectives, 2) the current organizational structure and 3) current and projected capabilities.
Author
Deep Space Network; Very Long Base Interferometry; NASA Programs

20000074741 Naval Observatory, Washington, DC USA
VLBI Baseline Rates from Baseline Measurements of Collocated Antennas Using Composite Models
Iz, H. B., Naval Observatory, USA; Archinal, Brent A., Naval Observatory, USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 362-367; In English; See also 20000074683; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

At a given site, occasionally a new VLBI antenna has replaced an older one for operational use. Large-scale VLBI solutions account for these situations by assuming the motion of the old and new antenna is the same. We alternatively used composite models in which the common baseline rates are represented directly and estimated from collocated baseline measurements. Because the baseline lengths are invariant under rotations and translations, the baseline models are less prone to the common systematic effects and consequently simpler than those of large-scale solutions. We investigated the compatibility of the baseline measurements from different nearby antennas and compared the composite model solutions with the single baseline solutions for baseline measurements from the a) ALGOPARK to NRA085-3 and NRAO20, b) GILCREEK to NRA085-3 and NRA020, and c) HARTRAO to KAUAI and KOKEE antennas. We have found data that contribute significantly to the estimated rates and calculate solutions that are more robust. We also evaluate the gain in efficiency in estimating baseline rates because of the increased number of observations in the composite models.
Author
Radio Antennas; Very Long Base Interferometry; Mathematical Models; Position (Location)

20000074742 Shanghai Astronomical Observatory, Joint Radio Astronomy Research Lab., China
Polar Motion from VLBI Measurements
Li, Jin-Ling, Shanghai Astronomical Observatory, China; Wang, Guang-Li, Shanghai Astronomical Observatory, China; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 368-372; In English; See also 20000074683; Sponsored in part by Chinese National Major Basic Research
Contract(s)/Grant(s): NNSFC-19833030; KJ951-1-304; CNMBR-970231003; CNMBR-95-13-03-02; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

From the reduction of 2893 globally distributed astrometric and geodetic VLBI sessions from August 1979 to December 1998, coordinates of 722 radio sources at J2000.0, coordinates and velocities of 128 stations at J1997.0 and about 20 years Earth Orientation Parameters were estimated. From the analysis of polar motion series the following are demonstrated: (1) During the VLBI data span the Markowitz wobble does not appear. (2) The amplitudes of both annual and Chandler wobble show temporal variations, with the former being more obvious than the latter. (3) Wavelet analysis shows that all the signals in the polar motion series are characterized by temporal variation in amplitudes. If we take any signal as strictly periodic, it is impossible to remove it completely from the polar motion series by least-squares fit because the hypothesis of a constant amplitude conflicts with VLBI measurements. (4) by applying a low-pass filter the secular polar motion was found to be 2.74 +/- 0.01 mas/yr towards 83.9 +/- 0.3 deg W longitude, which is smaller in rate and more westward in direction compared with those determined from optical observations.
Author
Astrometry; Chandler Wobble; Earth Orientation; Geodesy; Polar Wandering (Geology); Very Long Base Interferometry

20000074744 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The S2 VLBI Systems: DAS, RT/PT and Correlator
Petrachenko, William T., Natural Resources Canada, Canada; Bujold, Marc, Natural Resources Canada, Canada; Cannon, Wayne H., York Univ., Canada; Carlson, Brent R., Dominion Astrophysical Observatory, Canada; Dewdney, Peter E., Dominion Astrophysical Observatory, Canada; Feil, Georg H., Centre for Research in Earth and Space Technology, Canada; Newby, Paul, Centre for Research in Earth and Space Technology, Canada; Novikov, Alexander, Centre for Research in Earth and Space Technology, Canada; Popelar, Josef, Natural Resources Canada, Canada; Wietfeldt, Richard D., Jet Propulsion Lab., California Inst. of Tech., USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 378-382; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The S2 VLBI system synthesizes wide IF bandwidths by rapidly switching the local oscillator (LO) frequency in a small (1-4) number of baseband converters (BBC's). Data are recorded on video cassettes using an array of 8 VHS transports. Characteristics of the S2 Data Acquisition System (DAS), the S2 Record and Playback Terminals (RT and PT) and the S2 Correlator are summarized. The bandwidth synthesis (BWS) frequency switching sequence used in a series of system validation experiments is presented.
Author (revised)
Data Correlation; Data Acquisition; Tape Recorders; Very Long Base Interferometry; Switching

20000075548 Naval Research Lab., Ocean Sciences Branch, Bay Saint Louis, MS USA
2000 Innovation Collection Case Study - Smithsonian's Permanent Research Collection
Hurlburt, Harley; Jun. 2000; 8p; In English
Report No.(s): AD-A378436; NRL/PU/7320--99-396; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Computer models have formed the basis for weather forecasting for more than 35 years. Global atmospheric models are run daily on the largest available supercomputers, dedicated to this single task, by national governments and super-national consortia. First the previous forecast and all available observations are blended in a data assimilation phase to form "nowcast" of the current state of the atmosphere, and then this state is advanced in time to form a 3-10 day forecast. This must all be performed under real time constraints, typically within a 4-6 hour window. The results are then used directly for general weather forecasting and as input to higher resolution local models (e.g. for storm forecasting). Ocean forecasting is in principle similar to atmospheric forecasting, but with two major complications: (a) ocean eddies, at about 60 miles across, are typically 20 to 30 times smaller than comparable atmospheric highs and lows which means that roughly four orders of magnitude more computer time and three orders of magnitude more computer memory are required; and (b) there are relatively few observations below the ocean surface so data assimilation is effectively confined to using satellite observations of the surface. The duration of forecast skill for the ocean is not restricted to the 10 to 14 day limit for atmospheric highs and lows. We have demonstrated at least 30-day predictive skill for ocean eddies and the meandering of ocean currents and fronts, given sufficient ocean model resolution and satellite altimeter data from ERS-2 and TOPEX/POSEIDON. Forecasts of several months, or even years, are possible for some ocean phenomena.
DTIC
Computerized Simulation; Atmospheric Models; Weather Forecasting; Real Time Operation; Oceanographic Parameters; Ocean Models

20000075643 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The New Millenium Program: Serving Earth and Space Sciences
Li, Fuk K., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only
NASA has exciting plans for space science and Earth observations during the next decade. A broad range of advanced spacecraft and measurement technologies will be needed to support these plans within the existing budget and schedule constraints. Many of these technology needs are common to both NASA's Office of Earth Science (OES) and Office of Space Sciences (OSS). Even though some breakthrough technologies have been identified to address these needs, project managers have traditionally been reluctant to incorporate them into flight programs because their inherent development risk. to accelerate the infusion of new technologies into its OES and OSS missions, NASA established the New Millennium Program (NMP). This program analyzes the capability needs of these enterprises, identifies candidate technologies to address these needs, incorporates advanced technology suites into validation flights, validates them in the relevant space environment, and then proactively infuses the validated technologies into future missions to enhance their capabilities while reducing their life cycle cost. The NMP employs a cross-enterprise Science Working Group, the NASA Enterprise science and technology roadmaps to define the capabilities needed by future Earth and Space science missions. Additional input from the science community is gathered through open workshops and peer-reviewed NASA Research Announcement (NRAs) for advanced measurement concepts. Technology development inputs from the technology organizations within NASA, other government agencies, federally funded research and development centers (FFRDC's), U.S. industry, and academia are sought to identify breakthrough technologies that might address these needs. This approach significantly extends NASA's technology infrastructure. to complement other flight test programs that develop or validate of individual components, the NMP places its highest priority on system-level validations of technology suites in the relevant space environment. This approach is not needed for all technologies, but it is usually essential to validate advanced system architectures or new measurement concepts. The NMP has recently revised its processes for defining candidate validation flights, and selecting technologies for these flights. The NMP now employs integrated project formulation teams, 'Which include scientists, technologists, and mission planners, to incorporate technology suites into candidate validation flights. These teams develop competing concepts, which can be rigorously evaluated prior to selection for flight. The technology providers for each concept are

selected through an open, competitive, process during the project formulation phase. If their concept is selected for flight, they are incorporated into the Project Implementation Team, which develops, integrates, tests, launches, and operates the technology validation flight. Throughout the project implementation phase, the Implementation Team will document and disseminate their validation results to facilitate the infusion of their validated technologies into future OSS and OES science missions. The NMP has successfully launched its first two Deep Space flights for the OSS, and is currently implementing its first two Earth Orbiting flights for the OES. The next OSS and OES flights are currently being defined. Even though these flights are focused on specific Space Science and Earth Science themes, they are designed to validate a range of technologies that could benefit both enterprises, including advanced propulsion, communications, autonomous operations and navigation, multifunctional structures, microelectronics, and advanced instruments. Specific examples of these technologies will be provided in our presentation. The processes developed by the NMP also provide benefits across the Space and Earth Science enterprises. In particular, the extensive, nationwide technology infrastructure developed by the NMP enhances the access to breakthrough technologies for both enterprises.
Derived from text
Aerospace Environments; Autonomous Navigation; Research and Development; Earth Sciences; Flight Tests; Life Cycle Costs; Schedules; Space Missions; Technologies

20000076803 Deutscher Wetterdienst, Zentrale Agrarmeteorologische Forschungsstelle, Brunswick, Germany
Delivery of parameterization schemes for the determination of the regional evapotranspiration of different land surfaces *Final Report*
Haenel, H. D.; Loepmeier, F. J.; Mar. 31, 1998; 115p; In German; In English
Report No.(s): DE99-720231; ETDE-DE-733; No Copyright; Avail: Department of Energy Information Bridge

The task was the delivery of parameterization schemes for the calculation of the regional evapotranspiration of different land surfaces. The main weight was on the discussion of existing approaches and on the development of new ones for the calculation of evapotranspiration. After consideration of different concepts the well-known Penman-Monteith equation proved to the optimal basis of calculation. The surface resistance, respectively the related bulk-stomata resistance, is an important part of the resistance pattern (analogous to Ohm's law) on which the Penman-Monteith equation is based. Under consideration of the dependence of these resistances of the spatial scale (leaf, canopy) as well as of the time scale (hour, day) possibilities for their estimation were discussed. An important step to determine the surface resistances from literature data of vegetation evapotranspiration was the development of a converting scheme of Haude's factors to surface resistances. For bare soil an approach was developed which allows approximately to give a new interpretation to surface resistances from evapotranspiration courses, described in literature as proportional to the square root of time.
NTIS
Parameterization; Evapotranspiration; Regional Planning

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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.

20000074244 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Effect of Medium Symmetries in Limiting the Number of Parameters Estimated with Polarimetric Interferometry
Moghaddam, Mahta, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; Polarimetric Effects in Interferometry, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

The addition of interferometric backscattering pairs to the conventional polarimetric SAR data over forests and other vegetated areas increases the dimensionality of the data space, in principle enabling the estimation of a larger number of vegetation parameters. Without regard to the sensitivity of these data to vegetation scattering parameters, this paper poses the question: Will increasing the data channels as such result in a one-to-one increase in the number of parameters that can be estimated, or do vegetation and data properties inherently limit that number otherwise? In this paper, the complete polarimetric interferometric covariance matrix is considered and various symmetry properties of the scattering medium are used to study whether any of the correlation pairs can be eliminated. The number of independent pairs has direct consequences in their utility in parameter estimation schemes, since the maximum number of parameters that can be estimated cannot exceed the number of unique measurements. The independent components of the polarimetric interferometric SAR (POL/INSAR) data are derived for media with reflection, rotation, and azimuth symmetries, which are often encountered in vegetated surfaces. Similar derivations have been carried out before for sim-

ple polarimetry, i.e., zero baseline. This paper extends those to the interferometric case of general nonzero baselines. It is shown that depending on the type of symmetries present, the number of independent available measurements that can be used to estimate medium parameters will vary. In particular, whereas in the general case there are 27 mathematically independent measurements possible from a polarimetric interferometer, this number can be reduced to 15, 9, and 6 if the medium has reflection, rotation, or azimuthal symmetries, respectively. The results can be used in several ways in the interpretation of SAR data and the development of parameter estimation schemes, which will be discussed at the presentation. Recent POL/INSAR data from the JPL AIRSAR over a forested area will be used to demonstrate the results of this derivation. This work was performed by the Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, under contract from the National Aeronautics and Space Administration. Author

Estimating; Interferometry; Polarimetry; Symmetry; Vegetation; Independent Variables

20000074251 NASA Goddard Space Flight Center, Greenbelt, MD USA

NASA's Earth Observation Program: Past, Present and Future

King, Michael D., NASA Goddard Space Flight Center, USA; Hasler, Arthur F., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; 28th; Remote Sensing of Environment, 27-31 Mar. 2000, Somerset West, Johannesburg, Pretoria, South Africa, South Africa, South Africa; No Copyright; Avail: Issuing Activity; Abstract Only

The Earth Observing System (EOS) is a space-based observing system comprised of a series of satellite sensors by which scientists can monitor the Earth, a Data and Information System (EOSDIS) enabling researchers worldwide to access the satellite data, and an interdisciplinary science research program to interpret the satellite data. In this electronic theater presentation I will illustrate how scientists can learn about the Earth's atmosphere, land, oceans, and cryosphere from the vantage point of space-based global observations. This presentation will emphasize, but will not be limited to, Earth observations from space that highlight the ecosystem and environment of southern Africa, including: (i) dynamic geosynchronous satellite observations of southern Africa and nearby Indian Ocean, (ii) vegetation dynamics (normalized difference vegetation index and leaf area index), (iii) sea surface temperature, ocean topography, and surface winds over the Benguela and Agulhas Currents, (iv) LANDSAT 7 imagery of Cape Town, Etosha Pan, and other regions of southern Africa (v) fire distribution and dynamics in the Miombo woodland of Zambia, Angola, and Malawi, (vi) aerosol and cloud properties in southern Africa, and (vii) ice sheet distribution in and around Antarctica. We will illustrate these and other topics with a dynamic theater-style presentation, along with animations of satellite launch deployments and orbital mapping to highlight aspects of Earth observations from space.
Author

Earth Observing System (EOS); NASA Programs; Satellite Instruments; Earth Observations (From Space); Ecosystems

20000074255 NASA Goddard Space Flight Center, Greenbelt, MD USA

Earth Observing System (EOS) Moderate Resolution Imaging Spectroradiometer (MODIS) Global Snow-Cover Maps

Hall, Dorothy K., NASA Goddard Space Flight Center, USA; Riggs, George A., Research and Data Systems, Inc., USA; Salomonson, Vincent V., NASA Goddard Space Flight Center, USA; Scharfen, Greg R., Colorado Univ., USA; [2000]; 1p; In English; Hydrology, 3-7 Apr. 2000, Santa Fe, NM, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Following the 1999 launch of the Earth Observing System (EOS) Moderate Resolution Imaging Spectroradiometer (MODIS), the capability exists to produce global snow-cover maps on a daily basis at 500-m resolution. Eight-day composite snow-cover maps will also be available. MODIS snow-cover products are produced at Goddard Space Flight Center and archived and distributed by the National Snow and Ice Data Center (NSIDC) in Boulder, Colorado. The products are available in both orbital and gridded formats. An online search and order tool and user-services staff will be available at NSIDC to assist users with the snow products. The snow maps are available at a spatial resolution of 500 m, and 1/4 degree x 1/4 degree spatial resolution, and provide information on sub-pixel (fractional) snow cover. Pre-launch validation work has shown that the MODIS snow-mapping algorithms perform best under conditions of continuous snow cover in low vegetation areas, but can also map snow cover in dense forests. Post-launch validation activities will be performed using field and aircraft measurements from a February 2000 validation mission, as well as from existing satellite-derived snow-cover maps from NOAA and LANDSAT-7 Enhanced Thematic Mapper Plus (ETM+).
Author

Earth Observing System (EOS); Imaging Techniques; Snow Cover; Spectroradiometers; Thematic Mapping; Remote Sensing

20000074261 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Pearson-Readhead Survey from Space

Preston, R. A., Jet Propulsion Lab., California Inst. of Tech., USA; Tingay, S. J., Jet Propulsion Lab., California Inst. of Tech., USA; Jones, D. L., Jet Propulsion Lab., California Inst. of Tech., USA; Lister, M., Jet Propulsion Lab., California Inst. of Tech.,

USA; Piner, G., Jet Propulsion Lab., California Inst. of Tech., USA; Murphy, D. W., Jet Propulsion Lab., California Inst. of Tech., USA; Meier, D. L., Jet Propulsion Lab., California Inst. of Tech., USA; Pearson, T. J., California Inst. of Tech., USA; Readhead, A. C. S., California Inst. of Tech., USA; Hirabayashi, H., Tokyo Univ., Japan; Kobayashi, H., Tokyo Univ., Japan; Inoue, M., Nobeyama Radio Observatory, Japan; [1988]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The VSOP Space VLBI mission uses the HALCA spacecraft, launched from Japan in February 1997, in conjunction with ground radio observatories around the world to create a high resolution radio-wave length imaging facility. We are using this unique facility to observe a complete sample of Pearson-Readhead Survey sources at 4.8 GHz to determine core brightness temperatures and pc-scale jet properties. The Pearson-Readhead sample has been used for extensive ground-based VLBI survey studies. This sample is ideal for a VSOP survey because the sources are strong, the VSOP u-v coverages are especially good above +350 declination, and multi-epoch ground-based VLBI data and other existing supporting data on these sources exceeds that of any other possible sample. We have chosen to observe a complete subset of this sample that is most likely to show fringes on space-earth baselines. to date we have imaged a majority of the 31 sources in our sample. In addition, we are obtaining matched- resolution 15 GHz observations using the VLBA at epochs close in time to the space VLBI observations to investigate the spectral indices of the source components at high resolution. We gratefully acknowledge the VSOP Project, which is led by the Japanese Institute of Space and Astronautical Science in cooperation with many organizations and radio telescopes around the world. This research was performed in part at the Jet Propulsion Laboratory, California Institute of Technology, under contract to NASA.
Author

Very Long Base Interferometry; Space Technology Experiments; Radio Waves; Imaging Techniques; Declination; Time Measurement

20000074486 NASA Goddard Space Flight Center, Greenbelt, MD USA

Dependence of Photosynthetic Capacity, Photosynthetic Pigment Allocation, and Carbon Storage on Nitrogen Levels in Foliage of Aspen Stands

Middleton, Elizabeth M., NASA Goddard Space Flight Center, USA; Sullivan, Joseph H., Maryland Univ., USA; Papagno, Andrea J., Raytheon Information Technology and Scientific Services, USA; [2000]; 1p; In English, 8-12 May 2000, Edmonton, Alberta, Canada; No Copyright; Avail: Issuing Activity; Abstract Only

The role of foliar nitrogen (N) in the seasonal dynamics and vertical canopy distribution of photosynthetic pigments, photosynthetic capacity, and carbon (C) storage was investigated in boreal broadleaved species. The study was conducted at two different aged stands (60 y and 15 y) in 1994 and 1996 in SASkatchewan, Canada as part of the Boreal Ecosystem-Atmosphere Study (BOREAS). Foliage in upper and lower strata was examined for aspen (Populus tremuloides Michx.) and its associated hazelnut shrub (Corylus americana Walt.). We determined that C accumulation, expressed as dry mass per unit leaf area (mg C cm (exp -2)), was linearly dependent on N content (approximately 0.3- 3.5 mg N cm (exp -2))(r (exp 2) = 0.93, n=383, P less than 0.001) when eleven foliage groups were defined according to species, site, and developmental stage. C assembly was greatest in the upper aspen strata of both sites (seasonal average, 40.1 plus or minus 0.6 mg C cm (exp -2)), intermediate in the lower aspen strata (32.7 plus or minus 0.6), and considerably lower, and similar, in the hazelnut shrub layers (23.7 plus or minus 0.6) and in expanding aspen leaves (23.8 plus or minus 0.5); the lowest C assembly per unit N occurred in the two youngest, emerging leaf groups (17.1 plus or minus 0.6). Other relationships among physiological and biochemical variables were typically non-linear and were confounded by inclusion of the three groups of young (i.e., emerging or expanding) leaves, unless these were separately identified. Net C uptake, measured as photosynthetic capacity (A (sub max), micromole CO2 m (exp -2) s (exp -1)), was greater in aspen throughout the season, and optimal in mid-summer at a C:N ratio of approximately 18 (approximately 2.3 %N). When young leaves were excluded and logarithms of both variables were used, A (sub max) was approximately linearly dependent on N (mg N cm (exp-2) (r (exp 2) = 0.85, n= 193, P less than 0.001), attributed to incorporation of N into photosynthetic complexes and enzymes. In mature leaves, differences in pigment content vs. N among canopy strata were accentuated when N was expressed per unit leaf area (Mg cm (exp -2)) . However, the simplest log-linear relationship between a pigment variable and N was obtained for a ratio describing the relative allocation of photosynthetic pigment to Chl a (Chl a/[Chl b + carotenoids], microgram cm (exp -2)/ microgram cm-2) vs. %N (r (exp 2) = 0.90, n=343, P less than 0.001). Attainment of comparable A (sub max) Chl a content and relative Chl a allocation per unit N (mg cm (exp -2)) was achieved at different foliar N levels per canopy group: the lowest N requirement was for hazelnut leaves in the lowest, shaded stratum at the older, closed canopy site; the highest N requirement was in aspen leaves of the upper-most stratum at the younger, more open canopy site. These results highlight the differences in physiological responses between young and fully expanded leaves and show that sustaining those foliar constituents and processes important to C balance may require higher foliar N levels in leaves of establishing vs. mature aspen stands. There may be implica-

tions for remote-sensing assessments made for carbon balance in springtime, or over a landscape mosaic comprised of different aged stands.
Author
Carbon; Foliage; Nitrogen; Photosynthesis; Pigments; Remote Sensing

20000074634 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Wavelet and Fractal Analysis of Remotely Sensed Surface Temperature with Applications to Estimation of Surface Sensible Heat Flux Density
Schieldge, John, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Wavelet and fractal analyses have been used successfully to analyze one-dimensional data sets such as time series of financial, physical, and biological parameters. These techniques have been applied to two-dimensional problems in some instances, including the analysis of remote sensing imagery. In this respect, these techniques have not been widely used by the remote sensing community, and their overall capabilities as analytical tools for use on satellite and aircraft data sets is not well known. Wavelet and fractal analyses have the potential to provide fresh insight into the characterization of surface properties such as temperature and emissivity distributions, and surface processes such as the heat and water vapor exchange between the surface and the lower atmosphere. In particular, the variation of sensible heat flux density as a function of the change In scale of surface properties Is difficult to estimate, but - in general - wavelets and fractals have proved useful in determining the way a parameter varies with changes in scale. We present the results of a limited study on the relationship between spatial variations in surface temperature distribution and sensible heat flux distribution as determined by separate wavelet and fractal analyses. We analyzed aircraft imagery obtained in the thermal infrared (IR) bands from the multispectral TIMS and hyperspectral MASTER airborne sensors. The thermal IR data allows us to estimate the surface kinetic temperature distribution for a number of sites in the Midwestern and Southwestern USA (viz., San Pedro River Basin, Arizona; El Reno, Oklahoma; Jornada, New Mexico). The ground spatial resolution of the aircraft data varied from 5 to 15 meters. All sites were instrumented with meteorological and hydrological equipment including surface layer flux measuring stations such as Bowen Ratio systems and sonic anemometers. The ground and aircraft data sets provided the inputs for the wavelet and fractal analyses, and the validation of the results.
Author
Wavelet Analysis; Fractals; Remote Sensing; Surface Temperature; Heat Flux; Flux Density

20000074635 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Preliminary Assessment of JERS-1 SAR to Discriminating Boreal Landscape Features for the Boreal Forest Mapping Project
McDonald, Kyle, Jet Propulsion Lab., California Inst. of Tech., USA; Williams, Cynthia, Alaska Univ., USA; Podest, Erika, Jet Propulsion Lab., California Inst. of Tech., USA; Chapman, Bruce, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; IGARSS'99: JERS-1 Global Forest Mapping Project, 1999, Pasadena, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

This paper presents an overview of the JERS-1 North American Boreal Forest Mapping Project and a preliminary assessment of JERS-1 SAR imagery for application to discriminating features applicable to boreal landscape processes. The present focus of the JERS-1 North American Boreal Forest Mapping Project is the production of continental scale wintertime and summertime SAR mosaics of the North American boreal forest for distribution to the science community. As part of this effort, JERS-1 imagery has been collected over much of Alaska and Canada during the 1997-98 winter and 1998 summer seasons. to complete the mosaics, these data will be augmented with data collected during previous years. These data will be made available to the scientific community via CD ROM containing these and similar data sets compiled from companion studies of Asia and Europe. Regional landscape classification with SAR is important for the baseline information it will provide about distribution of woodlands, positions of treeline, current forest biomass, distribution of wetlands, and extent of major rivercourses. As well as setting the stage for longer term change detection, comparisons across several years provides additional baseline information about short-term landscape change. Rapid changes, including those driven by fire, permafrost heat balance, flooding, and insect outbreaks can dominate boreal systems. We examine JERS-1 imagery covering selected sites in Alaska and Canada to assess quality and applicability to such relevant ecological and hydrological issues. The data are generally of high quality and illustrate many potential applications. A texture-based classification scheme is applied to selected regions to assess the applicability of these data for distinguishing distribution of such landcover types as wetland, tundra, woodland and forested landscapes.
Author
Synthetic Aperture Radar; Satellite-Borne Radar; Radar Detection; Thematic Mapping; Topography

20000074640 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Application of Spaceborne Scatterometer for Mapping Freeze-Thaw State in Northern Landscapes as a Measure of Ecological and Hydrological Processes

McDonald, Kyle, Jet Propulsion Lab., California Inst. of Tech., USA; Kimball, John, Montana Univ., USA; Zimmermann, Reiner, Bayreuth Univ., Germany; Way, JoBea, Jet Propulsion Lab., California Inst. of Tech., USA; Frolking, Steve, New Hampshire Univ., USA; Running, Steve, Montana Univ., USA; [1999]; 1p; In English; IGARSS'99: Radar Remote Sensing for Borel Forest Mapping, 1999, Pasadena, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Landscape freeze/thaw transitions coincide with marked shifts in albedo, surface energy and mass exchange, and associated snow dynamics. Monitoring landscape freeze/thaw dynamics would improve our ability to quantify the interannual variability of boreal hydrology and river runoff/flood dynamics. The annual duration of frost-free period also bounds the period of photosynthetic activity in boreal and arctic regions thus affecting the annual carbon budget and the interannual variability of regional carbon fluxes. In this study, we use the NASA scatterometer (NSCAT) to monitor the temporal change in the radar backscatter signature across selected ecoregions of the boreal zone. We have measured vegetation tissue temperatures, soil temperature profiles, and micrometeorological parameters in situ at selected sites along a north-south transect extending across Alaska from Prudhoe Bay to the Kenai Peninsula and in Siberia near the Yenisey River. Data from these stations have been used to quantify the scatterometer's sensitivity to freeze/thaw state under a variety of terrain and landcover conditions. Analysis of the NSCAT temporal response over the 1997 spring thaw cycle shows a 3 to 5 dB change in measured backscatter that is well correlated with the landscape springtime thaw process. Having verified the instrument's capability to monitor freeze/thaw transitions, regional scale mosaicked data are applied to derive temporal series of freeze/thaw transition maps for selected circumpolar high latitude regions. These maps are applied to derive areal extent of frozen and thawed landscape and demonstrate the utility of spaceborne radar for operational monitoring of seasonal freeze-thaw dynamics and associated biophysical processes for the circumpolar high latitudes.
Author

Satellite-Borne Instruments; Scatterometers; Thematic Mapping; Terrain; Freezing

20000074659 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Fusion of AIRSAR and TM Data for Parameter Classification and Estimation in Dense and Hilly Forests

Moghaddam, Mahta, Jet Propulsion Lab., California Inst. of Tech., USA; Dungan, J. L., NASA Ames Research Center, USA; Coughlan, J. C., NASA Ames Research Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The expanded remotely sensed data space consisting of coincident radar backscatter and optical reflectance data provides for a more complete description of the Earth surface. This is especially useful where many parameters are needed to describe a certain scene, such as in the presence of dense and complex-structured vegetation or where there is considerable underlying topography. The goal of this paper is to use a combination of radar and optical data to develop a methodology for parameter classification for dense and hilly forests, and further, class-specific parameter estimation. The area to be used in this study is the H. J. Andrews Forest in Oregon, one of the Long-Term Ecological Research (LTER) sites in the US. This area consists of various dense old-growth conifer stands, and contains significant topographic relief. The Andrews forest has been the subject of many ecological studies over several decades, resulting in an abundance of ground measurements. Recently, biomass and leaf-area index (LAI) values for approximately 30 reference stands have also become available which span a large range of those parameters. The remote sensing data types to be used are the C-, L-, and P-band polarimetric radar data from the JPL airborne SAR (AIRSAR), the C-band single-polarization data from the JPL topographic SAR (TOPSAR), and the Thematic Mapper (TM) data from LANDSAT, all acquired in late April 1998. The total number of useful independent data channels from the AIRSAR is 15 (three frequencies, each with three unique polarizations and amplitude and phase of the like-polarized correlation), from the TOPSAR is 2 (amplitude and phase of the interferometric correlation), and from the TM is 6 (the thermal band is not used). The range pixel spacing of the AIRSAR is 3.3m for C- and L-bands and 6.6m for P-band. The TOPSAR pixel spacing is 10m, and the TM pixel size is 30m. to achieve parameter classification, first a number of parameters are defined which are of interest to ecologists for forest process modeling. These parameters include total biomass, leaf biomass, LAI, and tree height. The remote sensing data from radar and TM are used to formulate a multivariate analysis problem given the ground measurements of the parameters. Each class of each parameter is defined by a probability density function (pdf), the spread of which defines the range of that class. High classification accuracy results from situations in which little overlap occurs between pdfs. Classification results provide the basis for the future work of class-specific parameter estimation using radar and optical data. This work was performed in part by the Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, and in part by the NASA Ames Research Center, Moffett Field, CA, both under contract from the National Aeronautics and Space Administration.
Author

Biomass; Classifications; Forests; Leaf Area Index; Remote Sensing; Topography; Image Classification

20000074722 Northeast Radio Observatory Corp., Haystack Observatory, Westford, MA USA

Improved Mapping Functions for GPS and VLBI

Niell, Arthur, Northeast Radio Observatory Corp., USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 263-266; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

New atmospheric mapping functions have been developed which make use of in situ data available from numerical weather prediction or analysis. At mid-latitudes the hydrostatic component appears to be about a factor of two better at five degrees elevation than previous versions, while the wet component may be as little as twenty-five percent better. The improvement comes at the expense of simplicity.

Author

Global Positioning System; Hydrostatics; Very Long Base Interferometry; Mapping; Atmospheric Models; Functions (Mathematics)

20000074793 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Preview of AMSR: Airborne C-band Microwave Radiometer (ACMR) Observations from SGP99

Kim, Edward, NASA Goddard Space Flight Center, USA; Doiron, Terence, NASA Goddard Space Flight Center, USA; Principe, Caleb, NASA Goddard Space Flight Center, USA; Gong, Lei, NASA Goddard Space Flight Center, USA; Shiue, James, NASA Goddard Space Flight Center, USA; Jan. 01, 2000; 1p; In English; International Geoscience and Remote Sensing Symposium (IGARSS), 24-28 Jul. 2000, Honolulu, HI, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Although L-band is generally considered ideal for passive microwave sensing of soil moisture, near-future satellite observing systems such as Advanced Mechanically Scanned Radiometer (AMSR) will provide C-band data for several years before any L-band data might become available. The Southern Great Plains'99 (SGP99) Experiment was designed to generate C-band observations suitable for testing and refinement of AMSR-era soil moisture retrieval algorithms. C-band data collected using the Airborne C-band Microwave Radiometer (ACMR), a new high-accuracy NASA/GSFC instrument, clearly demonstrated a strong response to a 9-day drydown event as well as to differences between the northern (cooler & wetter) and southern (warmer & dryer) areas covered by the P-3 flights. For example, the H-polarized brightness temperatures observed during the first three days of the drydown increased up to 50 K in the northern areas. These observations represent a preview of what we can expect from AMSR, albeit at 3-km spatial resolution vs. approximately 60 km for AMSR. Initial results of soil-vegetation microwave modeling will also be presented to estimate the relative contributions of soil physical temperature, canopy physical temperature, soil moisture, and canopy moisture. Significant radio-frequency interference (RFI) was evident during the experiment, and amelioration strategies will be discussed. The net effect of RFI (an upward bias in brightnesses) when averaged over an AMSR footprint is expected to be more subtle.

Author

Airborne Equipment; C Band; Microwave Radiometers; Satellite Observation

20000075269 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

GeoSAR: A Radar Terrain Mapping System for the New Millennium

Thompson, Thomas, Jet Propulsion Lab., California Inst. of Tech., USA; vanZyl, Jakob, Jet Propulsion Lab., California Inst. of Tech., USA; Hensley, Scott, Jet Propulsion Lab., California Inst. of Tech., USA; Reis, James, Calgis, Inc., Cambodia; Munjy, Riadh, Calgis, Inc., Cambodia; Burton, John, California Dept. of Conservation, USA; Yoha, Robert, California Dept. of Conservation, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

GeoSAR Geographic Synthetic Aperture Radar) is a new 3 year effort to build a unique, dual-frequency, airborne Interferometric SAR for mapping of terrain. This is being pursued via a Consortium of the Jet Propulsion Laboratory (JPL), Calgis, Inc., and the California Department of Conservation. The airborne portion of this system will operate on a Calgis Gulfstream-II aircraft outfitted with P- and X-band Interferometric SARs. The ground portions of this system will be a suite of Flight Planning Software, an IFSAR Processor and a Radar-GIS Workstation. The airborne P-band and X-band radars will be constructed by JPL with the goal of obtaining foliage penetration at the longer P-band wavelengths. The P-band and X-band radar will operate at frequencies of 350 Mhz and 9.71 Ghz with bandwidths of either 80 or 160 Mhz. The airborne radars will be complemented with airborne laser system for measuring antenna positions. Aircraft flight lines and radar operating instructions will be computed with the Flight Planning Software The ground processing will be a two-step step process. First, the raw radar data will be processed into radar images and interferometer derived Digital Elevation Models (DEMs). Second, these radar images and DEMs will be processed with a Radar GIS Workstation which performs processes such as Projection Transformations, Registration, Geometric Adjustment, Mosaicking, Merging and Database Management. JPL will construct the IFSAR Processor and Calgis, Inc. will construct the Radar GIS Workstation. The GeoSAR Project was underway in November 1996 with a goal of having the radars and laser

systems fully integrated onto the Calgis Gulfstream-II aircraft in early 1999. Then, Engineering Checkout and Calibration-Characterization Flights will be conducted through November 1999. The system will be completed at the end of 1999 and ready for routine operations in the year 2000.
Author
Airborne Radar; Interferometers; Interferometry; Radar Maps; Synthetic Aperture Radar; Radar Imagery

20000075711 NASA Goddard Space Flight Center, Greenbelt, MD 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 Goddard Space Flight Center, USA; Rabine, D. L., NASA Goddard Space Flight Center, USA; Bufton, J. L., NASA Goddard Space Flight Center, USA; Remote Sensing of Active Volcanism; [1999], pp. 249-264; In English
Contract(s)/Grant(s): NAS5-33019; NAG5-3001; 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 GPS 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 GPS 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; Calderas; Laser Altimeters; Remote Sensing; Topography; Structural Properties (Geology)

20000075712 NASA Goddard Space Flight Center, Greenbelt, MD USA
An Airborne Scanning Laser Altimetry Survey of Long Valley, California
Hofton, M. A., Scripps Institution of Oceanography, USA; Blair, J. B., NASA Goddard Space Flight Center, USA; Minster, J.-B., NASA Goddard Space Flight Center, USA; Ridgway, J. R., NASA Goddard Space Flight Center, USA; Williams, N. P., NASA Goddard Space Flight Center, USA; Bufton, J. L., NASA Goddard Space Flight Center, USA; Rabine, D. L., NASA Goddard Space Flight Center, USA; International Journal of Remote Sensing; 1999; ISSN 0143-1161; Volume 20, No. 0, pp. 1-24; In English
Contract(s)/Grant(s): NAS5-33019; NAG5-3001; Copyright; Avail: Issuing Activity

Between 28 September and 7 October 1995, we conducted an airborne laser altimetry experiment over the Long Valley caldera, California, in which each of two scanning laser altimeters (dubbed SLICER and RASCAL) were flown in a NASA T-39 jet aircraft. Operating concurrently were a Global Positioning System (GPS) guidance system and dual frequency receivers for precise navigation and post-flight calculation or the airplane trajectory relative to a ground station, and an inertial navigation system (INS) for attitude determination. Reduction of raw laser ranges requires merging the differential kinematic GPS aircraft trajectory and the INS data with the laser data, and determination of the atmospheric delay. Data geolocation consists of obtaining the centre location and the mean elevation within each footprint in a geodetic coordinate system. The elevation of Crowley Lake is recovered to an accuracy of approximately 3 cm or better from 3 km above ground level and crossover analysis indicates that the elevation estimates are consistent from pass to pass. We test our geolocation procedures by comparing laser-derived elevations with those determined in situ for recognizable ground features. A comparison of laser and GPS-derived positions shows that the horizontal accuracy is better than the diameter of the footprint and vertical accuracy is within the error inherent in the range measurement. A comparison of SLICER elevation data with digital elevation models (DEMs) of the region shows that the DEM data provides surface topography to within stated accuracy limits. Although research continues to utilize the full potential of laser alti-

metry data, our results constitute a successful demonstration that the technique may be used to perform geodetic monitoring of surface topographic changes.
Author
Airborne Lasers; Laser Altimeters; Geodetic Surveys; Calderas; Topography

20000075713 NASA Goddard Space Flight Center, Greenbelt, MD USA
Using 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; Blair, J. B., NASA Goddard Space Flight Center, USA; Rabine, D. L., NASA Goddard Space Flight Center, USA; Bufton, J. L., NASA Goddard Space Flight Center, USA; Williams, N. P., Scripps Institution of Oceanography, USA; SPIE; [1997]; ISSN 0277-786X; Volume 3222, pp. 295-306; In English
Contract(s)/Grant(s): NAS5-33019; NAG5-3001; Copyright; Avail: Issuing Activity

Long Valley caldera, California, is a site of extensive volcanism, persistent seismicity, and uplift of a resurgent dome, currently at a rate of approximately 3 cm/year. Airborne laser altimetry was used to determine the surface topography of the region in 1993. A repeat mission occurred in 1995. Three different laser altimeters were flown, dubbed ATLAS, SLICER and RASCAL. Data processing consists of the combination of the aircraft trajectory and attitude data with the laser range, the determination of an atmospheric delay, laser pulse timing errors, laser system biases, and data geolocation to obtain the position of the laser spot on the ground. Results showed that using the ATLAS and SLICER instruments, the elevation of an overflown lake is determined to precisions of 3.3 cm and 2.9 cm from altitudes of 500 m and 3 km above the ground, and approximately 10 cm using the RASCAL instrument from 500 m above ground. Comparison with tide gauge data showed the laser measurements are able to resolve centimeter-level changes in the lake elevation over time. Repeat pass analysis of tracks over flat surfaces indicate no systematic biases affect the measurement procedure of the ATLAS and SLICER instruments. Comparison of GPS and laser-derived elevations of easily-identifiable features in the caldera confirm the horizontal accuracy of the measurement is within the diameter of the laser footprint, and vertical accuracy is within the error inherent in the measurement. Crossover analysis shows that the standard error of the means at track intersection points within the caldera and dome (i.e., where zero and close to the maximum amount of uplift is expected) are about 1 cm, indicating elevation change at the 3 cm/year level should be detectable. We demonstrate one of the powerful advantages of scanning laser altimetry over other remote sensing techniques; the straightforward creation of precise digital elevation maps of overflown terrain. Initial comparison of the 1993-1995 data indicates uplift occurred, but filtering is required to remove vegetation effects. Although research continues to utilize the full potential of laser altimetry data, the results constitute a successful demonstration that the technique may be used to perform geodetic monitoring of surface topographic change.
Author
Laser Altimeters; Topography; California; Volcanology; Airborne Lasers; Remote Sensing; Seismology; Calderas

20000076133 Technical Univ. of Budapest, Hungary
Periodica Polytechnica Civil Engineering, Volume 43, No. 1, 1999 ***Annual Report***
1999; 134p; In Mixed; In English
Report No.(s): PB2000-106323; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Contents include the following: Fundaments of Basic Maps for the Digital Documentation of Public Utilities and Municipalities; The Development of Automatic Mapping Technology at the Department of Surveying; The Testing of Structural Element Movements and Deformations, Its Geodetic Measuring Instruments and Measuring Equipment; Role of the Geometry in GPS Positioning; Training for the Architecture Students in Surveying at the Technical University of Budapest; GIS Functions - Interpolation; GIS Function; GIS Data Exchange Programs, Solutions; New Developments in the Training Programs of the Department of Surveying.
NTIS
Structural Engineering; Research and Development; Global Positioning System; Mapping; Surveys

20000078390 Army Cold Regions Research and Engineering Lab., Hanover, NH USA
Glacial Geology and Stratigraphy of Fort Richardson, Alaska. A Review of Available Data on the Hydrogeology
Hunter, Lewis E.; Lawson, Daniel E.; Bigl, Susan R.; Robinson, Peggy B.; Schlagel, Joel D.; Apr. 2000; 77p; In English
Report No.(s): AD-A378398; ERDC/CRREL-TR-00-3; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The surficial geology and glacial stratigraphy of Fort Richardson are extremely complex. Recent mapping by the USGS shows the general distribution of surficial deposits, but details on the underlying stratigraphy remain poorly known, leaving a critical gap in the understanding of ground water conditions below Fort Richardson. A conceptual model of the subsurface stratigraphy

was developed on the basis of results of recent surficial mapping, current knowledge of the glacial history studies of modern glaciers, and limited subsurface data. A confining layer below the southern half of the cantonment is likely the northern extension of an ”older” ground moraine that crops out further to the south. Below the cantonment, this moraine is buried below about 15 m of outwash and fan deposits, but it appears to be absent to the north, where the confined and unconfined aquifers are hydraulically connected. The northern limit of the ”continuous” ground moraine is roughly below the cantonment and parts of Operable Unit D. Buried silt horizons in the fan probably create the locally perched aquifers; however, erosional remnants of the ground moraine and interfingering of debris flow deposits along the Elmendorf Moraine are plausible alternatives. These deposits are composed of finer-grained materials that slow ground water infiltration and cause water to accumulate.
DTIC
Glacial Drift; Glaciers; Sediments

20000078391 Amsterdam Univ., Netherlands
Unsupervised Spatial Feature and Change Detection in RS Imaging
Mokken, R. J.; Jan. 2000; 6p; In English
Contract(s)/Grant(s): N68171-98-C-9012
Report No.(s): AD-A378417; BAA-RM-IV-6; ARDSG-R/D-8444-EN-01; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This is a conclusive report. Pending possible further funding it was decided to continue further R&D development of the system within the limited means of the University of Amsterdam with the UNSUP software as is. Target is to experiment with the UNSUP software in its present state (see previous report) with data sets in various user contexts, in order to determine the most promising lines for completing this promising state-of-the art module of unsupervised classification of multispectral remote sensing images. We investigated other related European studies to which we had access. It suggested a focus on the interface of RS (rasterized) to GIS (vectorized) processing and analysis, i.e. best practice method for mapping unsupervised class features in RS imagery to land cover classes for an area; effective mapping of signature based land cover classes to best fitting (local) geo-administrative land use classification for that area; associated methods of change detection on short/long term intervals; associated methods of disaster residuals or pollution detection. We shall exploit the competitive edge of UNSUP by applied experiments with UNSUP together with other users in the US or Europe. The emphasis of this research will be on the applied methodology in the context of prevailing GIS processing environments (interfaces to GIS packages, S-Plus environment, Arcinfo). This might best pave the way for final funding to achieve the system for general use.
DTIC
Neural Nets; Remote Sensing; Geographic Information Systems; Imagery; Software Engineering

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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.

20000074673 Electricite de France, Direction des Etudes et Recherches, Clamart, France
Future technologies for decentralized power generation. Prospective aspects
Marquet, A.; Meyer, J. L.; Jul. 31, 1997; 14p; In French; In English
Report No.(s): DE99-723895; EDF-97-NB-000942; No Copyright; Avail: Department of Energy Information Bridge

Due to a favorable context (fuel costs, environmental concerns, deregulation...), decentralized power production, and more especially cogeneration, is presently developing in many countries, notably in France. An overlook on the main decentralized power generation technologies that may shows a likely commercial development in the near future, and their performance enhancement programs, are presented: combustion turbines, advanced gas turbines, micro gas turbines, regenerative gas turbines, cogeneration fuel cells, Stirling engines and solar dish Stirling systems, natural gas driven alternative engines, and wind turbines. Their development for on site power production in large commercial and small industrial sites, for collective or insular power networks, or for cogeneration in interconnected or large industrial sites, are discussed, and issues related to network management due to the abundance of power injection points in the low-voltage network are outlined.
NTIS
Technology Assessment; Fuel Cell Power Plants; Cogeneration; Energy Technology

20000074678 Energistyrelsen, Copenhagen, Denmark

Recommendation for basic tests according to the technical criteria for type approval and certification of wind turbines in Denmark

Jan. 31, 1997; 39p; In English

Report No.(s): DE99-725982; NEI-DK-3313; No Copyright; Avail: Department of Energy Information Bridge

The purpose of Basic Test is to document the specific properties of a wind turbine with regard to its energy production and protection. The starting point for the description is a three-bladed, horizontal-axis, asynchronous electricity-generating wind turbine. The recommendations can be applied as well to other types of wind turbines, provided account is taken for those points where the wind turbine deviates from the concept described above.

NTIS

Wind Turbines; Certification; Quality Control

20000074679 Energistyrelsen, Copenhagen, Denmark

Technical criteria for the Danish approval scheme for wind turbines

Aug. 31, 1996; 64p; In English

Report No.(s): DE99-725983; NEI-DK-3312; No Copyright; Avail: Department of Energy Information Bridge

This document comprises the Technical Criteria for the Danish approval scheme for wind turbines. The rules have been drawn up in concert with users and manufacturers and will be harmonised with European and international rules, codes and standards for the area. The Technical Criteria explain approval principles and procedures of applicants and others involved in the scheme. Technical requirements have been drawn up for areas that are not a present covered by standards. The technical requirements for obtaining the necessary approvals and certificates for quality assurance systems for production and assembly which the wind turbine manufacturer/supplier must document compliance with are included in the regulations. Included in Annexes 3, 4 and 5 are definitions as well as current standards and recommendations for the wind turbine area. The technical Criteria are updated regularly and can be obtained from the Test Station for Wind Turbines. The regulations and correction sheets are sent automatically to subscribers. A deadline for entering into force will be given for amendments. It should be noted that wind turbines with a rotor diameter of between 2 and 13 meters can, should the manufacturer/supplier wish it, be approved according to 'Godkendelsesregler for husstandsmoeller' ('Approval regulations for small domestic wind turbines').

NTIS

Quality Control; Wind Turbines; Certification

20000074680 Risoe National Lab., Wind Energy and Atmospheric Physics Dept., Roskilde, Denmark

Design of the wind turbine airfoil family RISOe-A-XX

Dahl, K. S.; Fuglsang, P.; Dec. 31, 1998; 30p; In English

Report No.(s): DE99-725998; RISO-R-1024(EN); ISBN 87-550-2356-8; No Copyright; Avail: Department of Energy Information Bridge

A method for design of wind turbine airfoils is presented. The design method is based on direct numerical optimization of a B-spline representation of the airfoil shape. For flexibility, the optimization algorithm relies on separate, stand alone tools for the analysis of aerodynamic and structural properties. The panel method based XFOIL is used during the optimization whereas the Navier-Stokes solver EllipSys2D is used in the evaluation of the results. The method is demonstrated by the design of an airfoil family composed of 7 airfoils ranging in thickness from 12% to 30%. The design is based on Reynolds and Mach numbers representative of a 600 kW wind turbine. The airfoils are designed to have maximum lift-drag ratio until just below stall, a design lift coefficient of about 1.55 at an angle of attack of 10 deg. and a maximum lift coefficient of 1.65. The airfoils are made insensitive to leading edge roughness by securing that transition from laminar to turbulent flow on the suction side occurs close to the leading edge for post stall angles of attack. The design method and the airfoil family provides a sound basis for further enhancing the characteristics of airfoils for wind turbines and to tailor airfoils for specific rotor sizes and power regulation principles.

NTIS

Wind Turbines; Airfoils; Design Analysis; Aircraft Design; Structural Design; Aircraft Parts; Aircraft Structures

20000074952 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Results of load-leveling capacitor system demonstration tests. Report on the results of a NEDO-commissioned work for fiscal 1997 (book of characteristic test data)

Mar. 31, 1998; 139p; In Japanese; In English

Report No.(s): DE99-714252; IAE-C-9746; No Copyright; Avail: Department of Energy Information Bridge

Tests are conducted on a capacitor system unit cell built for power leveling and data are collected, to be outlined below. Enumerated in the report are, concerning the unit cell capacitor, the target specifications, external shape, capacity/resistance distribution in the manufactured capacitor, and a photograph showing the appearance; concerning the charge/discharge capacity and internal resistance characteristics, the method of testing static capacity and internal resistance characteristics, test result, test data, and the analysis of the test data; concerning the energy density, volume energy density and weight energy density; concerning the charge/discharge efficiency, the method of testing charge/discharge efficiency, test result, and the test data; concerning the self-discharge characteristics, the method for testing self-discharge characteristics, test result, and the test data; and, concerning changes in characteristics in response to different ambient temperatures, the temperature-dependent characteristics of static capacity and internal resistance, test data about the temperature-dependent characteristics of capacity and resistance, and the temperature-dependent characteristics of self-discharge and the test data.
NTIS
Leveling; Loads (Forces); Capacitors

20000074953 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Verification and research for load-leveling capacitor systems. Report on the result of NEDO-commissioned work for fiscal 1997
Mar. 31, 1998; 77p; In Japanese; In English
Report No.(s): DE99-714251; IAE-C-9745; No Copyright; Avail: Department of Energy Information Bridge

Research, review, manufacture, and tests were conducted with respect to high energy density capacitor systems intended for electric power load leveling. In the report, studies are made about the position of capacitor systems in the power storage technology, comparison between capacitor systems and secondary storage batteries, case studies about application, optimum operation patterns, etc. In the designing of the power storage capacitor system, a rectangular structure is employed for the enhancement of energy density per unit installation area, and constants for the respective parts of the capacitors are set on conditions of a 1-liter container and internal resistance of approximately 150 ohmF. As for cell configuration, a lamination is built in a rectangular film container for the construction of electrodes, and multilayer laminate films that include aluminum foil are used. In fiscal 1997, 35 unit cells were manufactured, and various examinations were conducted for them, involving charge/discharge tests, internal resistance measurements, energy density measurements, charge/discharge efficiency characteristics, self-discharge characteristics, and changes in characteristics in response to different ambient temperatures.
NTIS
Leveling; Loads (Forces); Capacitors

20000076007 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 report on the verification survey of geothermal exploration technology, 5-1, Development of the reservoir variation survey method (technology of prediction of reservoir variation)
Mar. 31, 1998; 209p; In Japanese; In English
Report No.(s): DE99-718330; ETDE/JP-99718330; No Copyright; Avail: Department of Energy Information Bridge

For the reservoir evaluation at an initial developmental stage and stabilization/maintenance of power after the start of operation, the fiscal 1997 result is described of the study of technology of prediction of reservoir variation. Using the conventional post processor, feasibilities were computed of reservoir models and behavior after the development, and gravity/self potential/resistivity variation. Variation in the seismic wave speed structure was large in travel time change distribution. The measuring accuracy of 1 m/sec is required to get enough detection resolving power. A conceptual design of the post processor development was conducted to study a system operated on Windows. Based on the reservoir numerical simulation technology, by taking in variation parameters such as gravity and self potentials as new model constraint conditions, the reservoir modeling technology which increased in accuracy by history matching was trially developed. Using the conventional reservoir model in the Oguni area, predictably computed were reservoir behaviors during 50 years which simulated a 20 MW development. Effectiveness of the post processor were able to be shown though influenced by characteristics such as permeability and resistivity.
NTIS
Geothermal Technology; Reservoirs; Variations; Geological Surveys

20000076032 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Survey report of FY 1996 on the feasibility model study of introduction of photovoltaic power generation system into Kinki district. Special photovoltaic power generation diffusion Action Plan 17
Mar. 31, 1997; 76p; In Japanese; In English
Report No.(s): DE99-718315; NEDO-P-9623; No Copyright; Avail: Department of Energy Information Bridge

The photovoltaic (PV) power generation system has been put into a diffusion stage from the viewpoint of its technology due to its progressive technology innovation. However, it is not widely diffused in the whole society due to its high cost. Systematic investigation for the future PV power generation was conducted through the verification of factors obstructing the diffusion promotion and the investigation of the problems. A concrete activity plan was proposed for the diffusion of PV power generation. This survey was conducted to propose an activity guideline for the promotion of introduction into the Kinki district. Advantage of PV power generation and negative opinions are shown. Based on the verification, essential introduction significance of PV power generation was discussed. Then, current status of PV power generation and its future trends for the promotion of diffusion were arranged. Potential in the Kinki district was arranged, and examples of the diffusion policy were illustrated. Expectation of the introduction and problems were arranged in each user to be introduced. Thus, a scenario was made for the diffusion and expansion. Finally, a concrete action plan was provided for the diffusion and expansion.
NTIS
Surveys; Photovoltaic Conversion; Diffusion; Energy Policy; Energy Consumption; Electric Power Plants

20000076033 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Survey report of FY 1996 on the questionnaires related to new energies for local governments in Kinki district
Mar. 31, 1997; 133p; In Japanese; In English
Report No.(s): DE99-718322; NEDO-NP-9624; No Copyright; Avail: Department of Energy Information Bridge
The photovoltaic (PV) power generation system having a lot of merits for environment and energy has been put into a diffusion stage from the viewpoint of its technology due to its progressive technology innovation. Systematic investigation for the future PV power generation was conducted through the verification of factors obstructing the diffusion promotion and the investigation of the problems. Then, questionnaires were conducted for local governments in the Kinki district. Proportion of the local governments positively promoting the introduction of PV power generation was 3.4%. Among new energies, 45.7% of the governments were interested in solar heat utilization, and 43.1% were interested in PV power generation. Proportion of the local governments understanding the subsidy system of MITI was 57.7%. At the discussion meeting of new energy introduction promotion, 55.4% of the local governments wanted to participate. Among the interesting themes, 61.0% were interested in the introduction examples, 52.4% were in the introduction support, 52.1% were in the introduction of fundamental knowledge, and 30.0% were in the latest technology trends and in the guide for introduction.
NTIS
Photovoltaic Conversion; Technology Assessment; Electric Power Plants

20000076034 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Survey report of FY 1997 on the feasibility of diffusing photovoltaic power generation systems in Hokkaido
Mar. 31, 1998; 93p; In Japanese; In English
Report No.(s): DE99-718324; NEDO-NP-9702; No Copyright; Avail: Department of Energy Information Bridge
Effects of snow accumulation and coldness on photovoltaic (PV) power generation were significant where an angle was less than 30 deg. Accumulated snow often slides down naturally when an angle is between 35 deg and 45 deg and fresh snow is exposed to solar radiation. If the angle is between 55 deg and 60 deg, snow accumulation has little effect as snow slides down naturally. The effect of snow accumulation on costs is not significant. In Obihiro and Kushiro where there is not much snow, solar cells directed due south with an angle between 40 deg and 60 deg may be more beneficial than in Tokyo and Fukuoka regardless of the snow accumulation. Even in Sapporo, Hakodate and Abashiri where there is snow, it is expected to obtain generated output which is not much less than that in Tokyo or Fukuoka with an angle of 50 deg. Even if an azimuth is 30 deg, the generated output of Obihiro and Kushiro will not be at a disadvantage compared with those of Tokyo and Fukuoka. When the PV power generation system is introduced in households, more than 80% of electricity rate can be paid by the PV power generation.
NTIS
Photovoltaic Conversion; Surveys; Diffusion; Solar Generators; Solar Cells

20000076035 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 report on the verification survey of geothermal exploration technology. 2. Development of the reservoir variation survey method (development of the gravity survey method), 2
Mar. 31, 1998; 200p; In Japanese; In English
Report No.(s): DE99-718327; ETDE/JP-99718327; No Copyright; Avail: Department of Energy Information Bridge
Among technology developments such as the reservoir evaluation at initial developmental stage and stabilization/maintenance of power after the start of operation, the fiscal 1997 result is described for the development of the gravity survey method. The paper discusses the installation of gravity measuring points outside the existing monitoring range, introduction of CG-3M

gravimeter/GPS measuring system, drilling of ground water level monitoring well, etc. for the setup of a system for new gravity monitoring. Moreover, regular measurement of gravity was made for the first fiscal year, and at the same time the continued observation of ground water level, precipitation, atmospheric pressure, and temperature was started. It is necessary to study the effects on gravity variation such as gravity gradient and tidal correction. Conducted were collection/arrangement of the existing data and database construction for history matching/variation prediction in the Yanaizu Nishiyama area. The paper contains surveys of the trends/literature. In the future, the computation using density models of geothermal reservoirs and test use of EDCON's downhole gravimeter will be needed.
NTIS
Geothermal Technology; Geological Surveys; Reservoirs; Gravitation; Variational Principles

20000076036 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 report on the survey of verification of geothermal exploration technology, etc., 1, Development of the reservoir variation exploration method (development of the fracture hydraulic exploration method)
Mar. 31, 1998; 386p; In Japanese; In English
Report No.(s): DE99-718326; ETDE/JP-99718326; No Copyright; Avail: Department of Energy Information Bridge
The paper described the fiscal 1997 result of the fracture hydraulic exploration method as the variation exploration method of geothermal reservoirs. By elucidating hydraulic characteristics of the fracture system forming reservoir, technologies are established which are effective for the reservoir evaluation in early stages of development, maintenance of stable power after operational start-up, and extraction of peripheral reservoirs. As for the pressure transient test method, a test supporting system was basically designed to obtain high accuracy hydraulic parameters. As to the tiltmeter fracture monitoring method, a simulation was made for distribution of active fractures and evaluation of hydraulic constants without drilling wells. In relation to the two-phase flow measuring method, for stable steam production, the use of the orifice plate, the existing flow measuring method, etc. was forecast as a simple measuring method of the two-phase state of reservoir. Concerning the hydrophone VSP method, a feasibility study was made of the practical VSP for high temperature which can analyze hydraulic characteristics and geological structures around the well at the same time which the existing methods were unable to grasp, and brought the results. Moreover, to make high accuracy reservoir modeling possible, Doppler borehole televiewer was made in each reservoir.
NTIS
Geothermal Technology; Reservoirs; Fractures (Materials); Fracturing; Geology; Geological Surveys; Exploration

20000076059 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Survey report of FY 1997 on the demand creation of photovoltaic power generation in the regional development project in Kinki district
Mar. 31, 1998; 95p; In Japanese; In English
Report No.(s): DE99-718323; NEDO-NP-9701; No Copyright; Avail: Department of Energy Information Bridge
In this survey, the intention of introduction of PV power generation was analyzed for the regional development project in Kinki district, to investigate the marketability and introduction policy. The marketing scale of PV power generation in the regional development project in Kinki district was estimated to around 6 million sq m as the panel area, around 680 MW as the power generation capacity, and more than 680 billion yen in total value. It was revealed that the basis of marketing including the enhancement of information dispatch, enhancement of diffusion system, reduction/leveling of introduction cost and consolidation of construction/after-care system is not still sufficient for realizing the introduction of PV power generation. For the measures to be taken, multilateral investigations were proposed, which included the enhancement of information dispatch by making pamphlets for persons in charge of the project and by holding inspection tours, consolidation of total selling system including construction and distribution, and the cost reduction.
NTIS
Photovoltaic Conversion; Surveys; Marketing; Information Systems

20000076060 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1996 report on the survey for making a manual for introduction of the photovoltaic power system
Mar. 31, 1997; 329p; In Japanese; In English
Report No.(s): DE99-718320; NEDO-NP-9615; No Copyright; Avail: Department of Energy Information Bridge
Photovoltaic power systems for residential use are small in scale and comparatively easy in installation, and procedures for the introduction are standardized on a certain level. However, photovoltaic power systems introduced by local public organizations, etc. are larger in scale than residential use ones and are installed on various shapes of building and roof. Therefore, the flow from planning to installation, the system configuration, etc. are diversified, and the economical efficiency is also low. Further,

the increasing power generation capacity takes a lot of procedures and forces persons in charge of local public organizations to take a lot of time/labor. to help them in introducing photovoltaic power systems, in the light of the actual results having been obtained from the photovoltaic power generation field test projects, the survey arranged an outline of the power system and examples of introduction, general information for introduction such as the subsidy system, procedures taken for planning/design, how to introduce systems such as the related rules/regulations and various procedures, etc., and presented examples of plans, data on the field test projects already carried out, data on the quantity of solar radiation, etc., for reference.
NTIS
Photovoltaic Conversion; Manuals

20000076061 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 report on the development of new hydrogen atomic energy demonstrative technology
Jun. 30, 1998; 267p; In Japanese; In English
Report No.(s): DE99-718312; NHE-9701; No Copyright; Avail: Department of Energy Information Bridge
In this validation study, phenomena of excess heat which are said to be generated by electrolysis of deuterium using palladium metal, etc. as electrode are taken as 'new hydrogen atomic energy,' and to clarify a possibility of using them as a future energy source, the abnormal heating phenomenon was validated and the mechanism was elucidated. The study targeted quantitative control of heat emissions. The study was finished in 1997, the fifth year from the start. The excess heat measurement could partially be reproduced; however, when conducting a confirmation experiment on the excess heat by another more reliable method under the same condition, it was found that the value of excess heat was not an absolute value exceeding measuring sensitivity and errors of the system. If the excess heat of 0.1 W order is to be emitted in nuclear reaction, any reactive product should be detected in a substantial quantity. However, the product of a large quantity was not found. A possibility was found out of an increase in nuclear reaction ratio inside solid by low energy deuterium irradiation. From the above, it was concluded that the use of new hydrogen atomic energy was negative.
NTIS
Hydrogen; Energy Technology; Nuclear Electric Power Generation; Thermal Analysis

20000076811 Entech, Inc., Keller, TX USA
Ultralightweight Fresnel Lens Solar Concentrators for Space Power ***Final Report, 1 Apr. - 31 Jul. 2000***
ONeill, M. J., Entech, Inc., USA; McDanal, A. J., Entech, Inc., USA; August 2000; 14p; In English
Contract(s)/Grant(s): NAS8-99133
Report No.(s): NAS8-99133-FTR-02(Mod.1); No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The first phase of this project was completed in March 2000, and included the successful technology demonstration of a new ultralightweight photovoltaic concentrator array at the fully functional panel level. The new array is called the Stretched Lens Aurora (SLA) array, and uses deployable, flexible, thin-film silicone rubber Fresnel lenses to focus sunlight onto high efficiency multijunction solar cells, which are mounted to a composite radiator surface for waste heat dissipation. A prototype panel was delivered to NASA Marshall in March 2000, and comprised four side-by-side lenses focussing sunlight onto four side-by-side photovoltaic receivers. This prototype panel was tested by NASA Glenn prior to delivery to NASA Marshall. The best of the four lens/receiver modules achieved 27.4% efficiency at room temperature in the NASA Glenn solar simulator tests. This performance equates to 375 W/sq.m. areal power and 378 W/kg specific power at the fully functional panel level. We believe this to be the first space solar array of any kind to simulataneously meet the two long-standing NASA goals of 300 W/sq.m. and 300 W/kg at the functional panel level. Key results for the first phase of the program have been documented by ENTECH in a Draft Final Technical Report, which is presently being reviewed by NASA, and which should be published in the near future.
Author
Concentrators; Fresnel Lenses; Photovoltaic Cells; Solar Cells; Solar Simulators; Solar Arrays

45
ENVIRONMENT POLLUTION

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

20000074248 NASA Goddard Space Flight Center, Greenbelt, MD USA
An Assessment of Our Ability to Model the Upper Troposphere and Lower Stratosphere in Interactive Climate Models
Pawson, Steven, NASA Goddard Space Flight Center, USA; Jan. 04, 2000; 1p; In English, 16-23 Jul. 2000, Warsaw, Poland; Sponsored by Committee on Space Research, Unknown

Contract(s)/Grant(s): NAS5-98181; No Copyright; Avail: Issuing Activity; Abstract Only

The physics of the upper troposphere is dominated by the different phases of water, while the lower stratosphere is governed by the presence of ozone. The tropopause may be regarded as the layer which separates the regions where stratospheric and tropospheric processes dominate the physics, but it is clearly not a smooth transition level. Modelling this region in comprehensive climate models is complicated, partly because of the constraints inherent in numerical methods (such as the finite resolution used in models) and partly because of our incomplete knowledge of the physical and chemical interactions which occur (such as the phase transitions of water and the composition of aerosols). However, studies of stratospheric impacts on climate change clearly require the tropopause region to be modelled with a high degree of accuracy. This paper will examine how well we can currently model the structure and dynamics of the tropopause region; this includes some comparisons of the simulated atmospheric composition with observational estimates of these species, some studies of discrepancies between forecasts and observations in the Data Assimilation System of the Data Assimilation office, and inferences for sparsely observed quantities. The analysis will focus on meteorological quantities, physical forcing mechanisms, and the transport and interactions of trace species.
Author

Climate Models; Stratosphere; Troposphere; Tropopause; Atmospheric Composition

20000074249 NASA Goddard Inst. for Space Studies, New York, NY USA

Global Warming in the 21st Century: An Alternate Scenario

Hansen, James E., NASA Goddard Inst. for Space Studies, USA; [2000]; 1p; In English, 30 Oct. 2000, OH, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Evidence on a broad range of time scales, from Proterozoic to the most recent periods, shows that the Earth's climate responds sensitively to global forcings. In the past few decades the Earth's surface has warmed rapidly, apparently in response to increasing anthropogenic greenhouse gases in the atmosphere. The conventional view is that the current global warming rate will continue or accelerate in the 21st century. I will describe an alternate scenario that would slow the rate of global warming and reduce the danger of dramatic climate change. But reliable prediction of future climate change requires improved knowledge of the carbon cycle and global observations that allow interpretation of ongoing climate change.
Author

Climate Change; Global Warming; Earth Surface

20000074250 NASA Goddard Inst. for Space Studies, New York, NY USA

Late Holocene Environmental Changes from NY-NJ Estuaries

Peteet, Dorothy M., NASA Goddard Inst. for Space Studies, USA; Wong, Jennifer K., Columbia Univ., USA; [2000]; 1p; In English, 13-15 Mar. 2000, New Brunswick, NJ, USA; Sponsored by Geological Society of America, USA; No Copyright; Avail: Issuing Activity; Abstract Only

High-resolution records of environmental change in the lower Hudson estuary are quite rare. We present preliminary data from several marshes in the New York- New Jersey region in order to understand the late Holocene environmental history of this region. Our project includes salt marsh cores from Hackensack, Piermont, Staten Island, and Jamaica Bay. Our preliminary research has focused on a 11.15 m. sediment core from Piermont Marsh, New York (40 N, 74 W) in an attempt to document the Holocene environmental history of the region. Lithology, loss-on-ignition (LOI), pollen, plant macrofossils, charcoal, and foraminifera were analyzed. Core lithology consists of peat, silts, and clays that vary in color and texture. The base of the core is AMS C-14 dated to 4190 yr BP. Preliminary low-resolution analysis of the core to date includes sampling at the 1-meter interval throughout the core. LOI of the sediments ranges from 1% to 85%. Average rate of deposition is about .26 cm/yr. Major changes in pollen percentages are visible throughout the core.
Author

Estuaries; New York; New Jersey; Lithology; Earth Environment

20000074253 NASA Goddard Space Flight Center, Greenbelt, MD USA

Troposphere-Stratosphere Connections in Recent Northern Winters in NASA GEOS Assimilated Datasets

Pawson, Steven, NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; Western Pacific Geophysics, 27-30 Jun. 2000, Tokyo, Japan

Contract(s)/Grant(s): NAS5-98181; No Copyright; Avail: Issuing Activity; Abstract Only

The northern winter stratosphere displays a wide range of interannual variability, much of which is believed to result from the response to the damping of upward-propagating waves. However, there is considerable (growing) evidence that the stratospheric state can also impact the tropospheric circulation. This issue will be examined using datasets generated in the Data Assimilation Office (DAO) at NASA's Goddard Space Flight Center. Just as the tropospheric circulation in each of these years was

dominated by differing synoptic-scale structures, the stratospheric polar vortex also displayed different evolutions. The two extremes are the winter 1998/1999, when the stratosphere underwent a series of warming events (including two major warmings), and the winter 1999/2000, which was dominated by a persistent, cold polar vortex, often distorted by a dominant blocking pattern in the troposphere. This study will examine several operational and research-level versions of the DAO's systems. The 70-level-TRMM-system with a resolution of 2-by-2.5 degrees and the 48-level, 1-by-l-degree resolution ''Terra'' system were operational in 1998/1999 and 1999/2000, respectively. Research versions of the system used a 48-level, 2-by-2.5-degree configuration, which facilitates studies of the impact of vertical resolution. The study includes checks against independent datasets and error analyses, as well as the main issue of troposphere-stratosphere interactions.
Author
Stratosphere; Troposphere; Winter; GEOS Satellites (ESA); Data Systems

20000074482 NASA Goddard Space Flight Center, Greenbelt, MD USA
Isotopic NO as a Chemical Tracer in the Global Stratosphere
Aikin, A. C., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; 25th, 24-29 Apr. 2000, Nice, France; Sponsored by European Geophysical Society, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

Stratospheric NO originates from nitrous oxide reacting with O(1D) and ion-molecule reactions. Most ionic reactions take place in the mesosphere and lower thermosphere. The resulting NO is transported into the stratosphere at high latitudes. Cosmic radiation and tropospheric lightning also produce nitric oxide. This NO originates from ion reactions involving N2. Ionic reactions preserve the N(15)/N(14) ratio present in atmospheric N2. Nitrous oxide has a mass-dependent sink that varies with altitude so that there is an altitude-dependent isotopic distinction in nitrous oxide. This difference will appear in NO formed from N2O. The expected NO isotopic distribution under different conditions will be a combination of NO derived from nitrous oxide with different masses and NO from ion reactions. The expected NO isotopic distribution will be presented talking into account the different processes, including particle events and downward transport in winter.
Author
Ionic Reactions; Nitrogen Oxides; Stratosphere; Isotopes; Trace Elements

20000074484 NASA Goddard Space Flight Center, Greenbelt, MD USA
Characterization of Vertical Ozonesonde Measurements in Equatorial Regions Utilizing the Cooperative Enterprise SHADOZ
Schmidlin, F. J., NASA Goddard Space Flight Center, USA; Thompson, A. M., NASA Goddard Space Flight Center, USA; Holdren, D. H., NASA Goddard Space Flight Center, USA; Northam, E. T., NASA Goddard Space Flight Center, USA; Witte, J. C., NASA Goddard Space Flight Center, USA; Oltmans, S. J., National Oceanic and Atmospheric Administration, USA; Hoegger, B., Swiss Meteorological Inst., Switzerland; Levrat, G. M., Swiss Meteorological Inst., Switzerland; Kirchhoff, V., Instituto Nacional de Pesquisas Espacias, Brazil; [2000]; 1p; In English, 24-29 Apr. 2000, Nice, France; Sponsored by European Geophysical Society, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

Vertical ozone profiles between the Equator and 10 S latitude available from the Southern Hemisphere Additional Ozone (SHADOZ) program provide consistent data Ozone sets from up to 10 sounding locations. SHADOZ designed to provide independent ozone profiles in the tropics for evaluation of satellite ozone data and models has made available over 600 soundings over the period 1998-1999. These observations provide an ideal data base for the detailed description of ozone and afford differential comparison between sites. TOMS total ozone when compared with correlative integrated total ozone overburden from the sondes is found to be negatively biased when using the classical constant mixing ratio procedure to determine residual ozone. On the other hand, the climatological method proposed by McPeters and Labow appears to give consistent results but is positively biased. The longer then two years series of measurements also was subjected to harmonic analysis to examine data cycles. These will be discussed as well.
Author
Equatorial Regions; Ozone; Sondes; Southern Hemisphere; Tropical Regions

20000074633 Joensuu Univ., Finland
Response of Sphagnum mosses to increased CO2 concentration and nitrogen deposition
Jauhiainen, J.; Dec. 31, 1998; 107p; In English
Report No.(s): DE99-749097; JOY-LT-48; ISBN 951-708-676-8; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The main objective of this work was to study the effects of different CO2 concentration and N deposition rates on Sphagna adapted to grow along a nutrient availability gradient (i.e. ombrotrophy-mesotrophy-eutrophy). The study investigated: (i) the

effects of various longterm CO2 concentrations on the rate of net photosynthesis in Sphagna, (ii) the effects of the CO2 and N treatments on the moss density, shoot dry masses, length increment and dry mass production in Sphagna, (iii) the concentrations of the major nutrients in Sphagna after prolonged exposure to the CO2 and N treatments, and (iv) species dependent differences in potential NH4(+) and NO3(-) uptake rates.
NTIS
Carbon Dioxide Concentration; Nitrogen; Air Pollution; Atmospheric Composition; Atmospheric Effects; Bryophytes

20000074637 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
What we Hope to Learn about Global Mineral Dust Aerosols from EOS Multi-Angle Imaging SpectroRadiometer (MISR)
Kahn, Ralph, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

On global scales, just a few broad atmospheric aerosol compositional groups are commonly observed. of these, ”mineral dust” is the only group which both contains non-spherical particles, and typically has size distributions with enough large particles for particle shape to affect its visible-light-scattering properties. The MISR instrument is scheduled for launch into a 10:30 AM sun-synchronous, polar orbit aboard the EOS Terra satellite in 1999. MISR will measure the upwelling visible radiance from Earth in 4 spectral bands centered at 446, 558, 672, and 866 nm, at each of 9 emission angles spread out in the forward and aft directions along the flight path at +/-70.5 deg, +/-60.0 deg, +/-45.6 deg, +/-26.1deg, and nadir. Over a period of 7 minutes, as the spacecraft flies along, a 360 km wide swath of Earth will successively be viewed by each of the cameras, allowing MISR to sample a very large range of scattering angles; in mid latitudes, the instrument will observe scattering angles between about 60 deg and 160 deg. Global coverage will be acquired about once in 9 days at the equator; the nominal mission lifetime is 6 years. The distinction in single scattering phase function between natural distributions of spherical and randomly oriented, non-spherical particles, with a broad range of aspect ratios, shows up strongly for scattering angles ranging from about 90 deg to near 180 deg. For non-spherical particle distributions, single scattering phase functions tend to be much flatter in this region than for spherical particles. Since MISR samples the relevant range of scattering angles very well, we expect to be able to make critical distinctions between natural distributions of spherical and randomly oriented, non-spherical particles with MISR data. We anticipate that the new multiangle, multispectral data from MISR will also contain other information about particle properties, a major step beyond current spacecraft remote sensing retrievals, which obtain aerosol optical depth based on entirely assumed particle microphysical properties. According to simulations over cloud-free, calm ocean, for pure particles with natural ranges of optical depth, particle size, and indices of refraction, MISR should retrieve column optical depth for all but the darkest particles, to an uncertainty of at most 0.05 or 20%, whichever is larger, even if the particle properties are poorly known. For one common particle type, soot, constraints on the optical depth over dark ocean are very poor. The simulated measurements also should allow us to separate two to four compositional groups based on indices of refraction, and to identify three to four distinct size groups between 0.1 and 2.0 microns characteristic radius at most latitudes. The technique is most sensitive to particle microphysical properties in the ”accumulation mode” sizes. where particle scattering undergoes the transition from Rayleigh to large-particle regimes for the MISR wavelengths. Based on these results, we expect to distinguish air masses containing different aerosol types, routinely and globally, with multiangle remote sensing data. Such data complements in situ and field data, which can provide details about aerosol size and composition locally that are needed to assess the radiative effects of aerosols quantitatively. Both field data and correlations in space and time with likely source and sink regions will also be helpful in developing a global picture of mineral dust aerosol budgets. Further work on the expected sensitivity of MISR to natural mixtures of pure particles, including climatologically likely mineral dust components, is currently underway.
Author
Aerosols; Remote Sensing; Spectroradiometers; Dust; Particulates

20000074641 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Mapping Environmental Contaminants at Ray Mine, AZ
McCubbin, Ian, Jet Propulsion Lab., California Inst. of Tech., USA; Lang, Harold, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Airborne Visible and InfraRed Imaging Spectrometer (AVIRIS) data was collected over Ray Mine as part of a demonstration project for the Environmental Protection Agency (EPA) through the Advanced Measurement Initiative (AMI). The overall goal of AMI is to accelerate adoption and application of advanced measurement technologies for cost effective environmental monitoring. The site was selected to demonstrate the benefit to EPA in using advanced remote sensing technologies for the detection of environmental contaminants due to the mineral extraction industry. The role of the Jet Propulsion Laboratory in this pilot study is to provide data as well as performing calibration, data analysis, and validation of the AVIRIS results. EPA is also interested in developing protocols that use commercial software to perform such work on other high priority EPA sites. Reflectance retrieval

was performed using outputs generated by the MODTRAN radiative transfer model and field spectra collected for the purpose of calibration. We are presenting advanced applications of the ENVI software package using n-Dimensional Partial Unmixing to identify image-derived endmembers that best match target materials reference spectra from multiple spectral libraries. Upon identification of the image endmembers the Mixture Tuned Match Filter algorithm was applied to map the endmembers within each scene. Using this technique it was possible to map four different mineral classes that are associated with mine generated acid waste.
Author
Thematic Mapping; Contaminants; Environmental Quality; Environmental Monitoring; Environment Protection

20000074677 Bayerisches Landesamt fuer Umweltschutz, Munich, Germany
Air quality annual report 1997
Dec. 31, 1998; 289p; In German; In English
Report No.(s): DE99-724885; ETDE-DE-749; No Copyright; Avail: Department of Energy Information Bridge
The Bavarian Agency for Environmental Protection (LfU) is monitoring the air quality is several bavarian regions. The daily and monthly data of concentration ration of sulfur dioxide, nitrogen oxides, carbon monoxide, ozone and other pollutants are published in yearly reports, most often as diagrams with further statistics information.
NTIS
Air Quality; Environment Protection; Air Pollution; Pollution Monitoring

20000074689 Massachusetts Inst. of Tech., MA USA
Geophysical Applications of Earth Rotation Measurements
Herring, Thomas A., Massachusetts Inst. of Tech., USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 62-68; In English; See also 20000074683; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche
Measurements of the variations in Earth rotation have improved dramatically over the last few decades. These measurements are usually viewed in three separate ways: (a) The motions of the Earth's rotation axis with respect to the crust (polar motion); (b) the variations in the rate of rotation (length-of-day, LOD); and (c) motions of the Earth's rotation axis in space (nutations). VLBI is the only technique available that can make reliable measurements of all of these components over long periods of time. The requirements for such stability are for (a) a stable terrestrial reference frame and for (b) and (c) a stable inertial reference frame with the latter being unique to VLBI. We discuss the relationship between and the accuracy of different space geodetic techniques for making measurements of Earth rotation variations and the geophysical applications of each of the measurement types.
Author
Earth Rotation; Nutation; Very Long Base Interferometry; Polar Wandering (Geology); Periodic Variations

20000074701 NASA Goddard Space Flight Center, Greenbelt, MD USA
CORE: Continuous Observations of the Rotation of the Earth
Thomas, Cynthia C., NVI, Inc., USA; Ma, Chopo, NASA Goddard Space Flight Center, USA; Vandenberg, Nancy R., NVI, Inc., USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 141-145; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche
Various aspects of the Continuous Observations of the Rotation of the Earth (CORE) program are presented, including the science goals, validation strategy, and evolutionary plan.
Author
Earth Rotation; Very Long Base Interferometry; Data Correlation

20000074954 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Research report of FY 1997 on the influence of insulation materials on global warming
Mar. 31, 1998; 126p; In Japanese; In English
Report No.(s): DE99-714227; NEDO-GET-9709; No Copyright; Avail: Department of Energy Information Bridge
This report describes the influence of insulation materials on global warming. In this study, extrusion polystyrene foam and rigid foam urethane have been selected for review. These were reviewed with both discharge of foaming agent and CO2 reduction produced by energy conservation as a result of the application of insulation material to houses by assuming what conditions would be applied for future foaming agent and thermal insulation. Discharge of CO2 was also considered through manufacturing process of insulation materials. The result was used for judgment of applicability of foamed plastic type insulation materials from the global warming viewpoint. In this study, the influence of insulation materials on the global warming was calculated in each district

through their life cycle. It was found that the extruded polystyrene foam second-b and rigid foam urethane are effective to reduce the global warming in Sapporo, Morioka and Sendai in case of a detached house, except a detached house located in the southern district where requires less heat load. In case of a multiple dwelling house, any insulation material reviewed in the study showed that they could reduce CO2 in all districts.
NTIS
Global Warming; Thermal Insulation; Technology Assessment; Construction Materials

20000075207 NASA Goddard Space Flight Center, Greenbelt, MD USA
History of NASA/Native People Native Homelands Initiative
Maynard, Nancy, NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; Gathering 2000: Climate Change and Native Peoples, 26-27 Apr. 2000, Rapid City, SD, USA; Sponsored by North Dakota Univ., USA; No Copyright; Avail: Issuing Activity; Abstract Only

This workshop is one of the follow-on local assessment activities from the US National Assessment on the Impact of Climate Change on the US. N. Maynard (for NASA) helped create and get under way an initiative which brought together climate change scientists from around the US with Native Americans to bring together classic Western European scientists with knowledge from native peoples - from such sources as oral histories of drought, major fires, etc. The purpose of this was to encourage not only joint science but also bring NASA resources and education materials to Tribal schools and encourage joint preparation of educational and training materials. N. Maynard's talk will provide history of that process and discuss possible ways to collaborate in the future, building on this effort.
Author
Climate Change; Histories; USA; Europe

20000075649 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Measurements and Model Calculations of HNO4: Implications for HO(x)
Osterman, G. B., Jet Propulsion Lab., California Inst. of Tech., USA; Salawitch, R. J., Jet Propulsion Lab., California Inst. of Tech., USA; Sen, B., Jet Propulsion Lab., California Inst. of Tech., USA; Toon, G. C., Jet Propulsion Lab., California Inst. of Tech., USA; Margitan, J. J., Jet Propulsion Lab., California Inst. of Tech., USA; Blavier, J.-F., Jet Propulsion Lab., California Inst. of Tech., USA; Wennberg, P. O., California Inst. of Tech., USA; [1998]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Establishing a quantitative understanding of the abundance of peroxynitric acid (HNO4) is of interest because the reaction of OH with HNO4 is believed to be a significant sink for HO(x) in the lower stratosphere and upper troposphere. We present concentration profiles of KNO4 obtained by the MkIV Fourier transform infrared spectrometer using the solar occultation technique during two flights, one at 35 N on 25 September 1993 (930925) and the other near 66 N on 7 May 1997 (970507). The observations of HN04 present an apparent dilemma: the calculated profile for HNO4 found using standard kinetics is in relatively good agreement with the mid-latitude observations, but the calculated profile for HNO4 found using the same kinetics overestimates the high-latitude summer observations by nearly a factor of two. Resolution of this dilemma is the focus of our investigation. We show that introduction into our photochemical model of a speculative long-wave (lambda greater than 650 nm) photolytic pathway for HNO4 leads to good agreement between theory and observation of HN04 for both the mid-latitude and high-latitude regions. Implications for the budget of HO(x) are also discussed.
Author
Photochemical Reactions; Hydrogen Compounds; Infrared Spectra

20000075710 Centre National de la Recherche Scientifique, Geosciences Azur, Valbonne, France
Ionospheric Signature of Surface Mine Blasts from Global Positioning System Measurements
Calais, Eric, Centre National de la Recherche Scientifique, France; Minster, J. Bernard, Scripps Institution of Oceanography, USA; Hofton, Michelle A., Scripps Institution of Oceanography, USA; Hedlin, Michael A. H., Scripps Institution of Oceanography, USA; Geophysical Journal International; 1998; Volume 132, pp. 191-202; In English
Contract(s)/Grant(s): NAG5-1910; Copyright; Avail: Issuing Activity

Sources such as atmospheric or buried explosions and shallow earthquakes are known to produce infrasonic pressure waves in the atmosphere. Because of the coupling between neutral particles and electrons at ionospheric altitudes, these acoustic and gravity waves induce variations of the ionospheric electron density. The Global Positioning System (GPS) provides a way of directly measuring the total electron content in the ionosphere and, therefore, of detecting such perturbations in the upper atmosphere. In July and August 1996, three large surface mine blasts (1.5 Kt each) were detonated at the Black Thunder coal mine in eastern Wyoming. As part of a seismic and acoustic monitoring- experiment, we deployed five dual-frequency GPS receivers at

distances ranging from 50 to 200 km from the mine and were able to detect the ionospheric perturbation caused by the blasts. The perturbation starts 10 to 15 min after the blast, lasts for about 30 min, and propagates with an apparent horizontal velocity of 1200 meters per second. Its amplitude reaches 3 x 10 (exp 14) el per square meters in the 7-3 min period band, a value close to the ionospheric perturbation caused by the M = 6.7 Northridge earthquake. The small signal-to-noise ratio of the perturbation can be improved by slant-stacking the electron content time-series recorded by the different GPS receivers taking into account the horizontal propagation of the perturbation. The energy of the perturbation is concentrated in the 200 to 300 second period band, a result consistent with previous observations and numerical model predictions. The 300 second band probably corresponds to gravity modes and shorter periods to acoustic modes, respectively. Using a 1-D stratified velocity model of the atmosphere we show that linear acoustic ray tracing fits arrival times at all GPS receivers. We interpret the perturbation as a direct acoustic wave caused by the explosion itself. This study shows that even relatively small subsurface events can produce ionospheric perturbations that are above the detection threshold of the GPS technique. by sensing derivative signals, which can be detected over a relatively broad region, it appears that GPS might be particularly useful for source characterization within the first acoustic quiet zone where infrasound would probably be ineffective. This suggests that dual-frequency GPS monitoring could contribute to Comprehensive Nuclear Test Ban Treaty verification.
Derived from text
Global Positioning System; Ionospheric Electron Density; Signatures; Mines (Excavations); Earth Surface; Blast Loads

20000076131 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Lime Manufacturing Industry Fourier Transform Infrared Spectroscopy, Martin Marietta Magnesia Specialties, Woodville, Ohio. Final Report
May 2000; 116p
Report No.(s): PB2000-106438; EPA/454/R-00/007; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The purpose of this testing program is to: (1) quantify hydrogen chloride (HCl) emission levels; and (2) gather screening data on other hazardous air pollutants (HAP) emissions from lime production plants to support a national emission standard for hazardous air pollutants (NESHAP). Three measurement methods were conducted at this facility: Fourier Transform Infrared Spectroscopy (FTIR) (EPA Draft Method 320); Gas Filter Correlation-Infrared (GFC-IR)(EPA Method 322); and Dioxin/furan manual trains (EPA Method 23). Testing was conducted at the Martin Marietta Magnesia Specialties facility located in Woodville, Ohio. Testing was performed on the inlet and outlet of two kilns: Kiln no. 1, which was outfitted with an Electrostatic Precipitator (ESP), and Kiln no. 2, which utilizes a baghouse.
NTIS
Air Pollution; Pollution Monitoring; Fourier Transformation; Infrared Spectroscopy; Exhaust Emission; Exhaust Gases; Hydrochloric Acid; Manufacturing; Calcium Oxides

20000076132 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Lime Manufacturing Industry Fourier Transform Infrared Spectroscopy, National Lime and Stone Company, Carey, Ohio. Final Report
Mar. 2000; 106p; In English
Report No.(s): PB2000-106436; EPA/454/R-00/009; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The purpose of this testing program is to: (1) quantify hydrogen chloride (HCl) emission levels; and (2) gather screening data on other hazardous air pollutants (HAP) emissions from lime production plants to support a national emission standard for hazardous air pollutants (NESHAP). Three measurement methods were conducted at this facility: Fourier Transform Infrared Spectroscopy (FTIR) (EPA Draft Method 320); Gas Filter Correlation-Infrared (GFC-IR)(EPA Method 322); and Dioxin/furan manual trains (EPA Method 23). Testing was conducted at the Natural Lime and Stone Company in Carey, Ohio. Testing was performed on the inlet and outlet of a wet-scrubbing device on Kiln no. 1, a natural-gas fired 'doughnut' kiln.
NTIS
Air Pollution; Calcium Oxides; Exhaust Emission; Exhaust Gases; Hydrochloric Acid; Infrared Spectra; Infrared Spectroscopy; Manufacturing; Natural Gas; Pollution Monitoring

20000076608 Eastern Research Group, Inc., Lexington, MA USA
Report of the December 15, 1999 EPA Satellite Forum on Ozone Monitoring, Mapping, and Public Outreach
Feb. 2000; 44p; In English
Report No.(s): PB2000-106025; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report provides a summary of the U.S. Environmental Protection Agency's (EPA's) December 15, 1999 satellite forum on technology transfer tools for ozone monitoring, mapping, and public outreach. Chapter 1 provides information about the pur-

pose of the satellite broadcast, along with background information on the planning and production of the broadcast. Chapter 2 contains summaries of the presentations made during the satellite forum. Chapter 3 summarizes the live question-and-answer sessions held during the broadcast. Appendix A contains the agenda for the broadcast. Appendix B provides information about viewership, and Appendix C contains the satellite forum Workshop Guide, which was prepared by North Carolina State University. The Workshop Guide contains the presentation materials prepared by individual speakers.
NTIS
Air Pollution; Pollution Monitoring; Environment Protection; Ozone

20000076609 National Climatic Data Center, Asheville, NC USA
Climates of the World (Revised 1991)
Hacia, H.; Vitale, C. S.; Arkin, M. A.; 1991; 44p
Report No.(s): PB2000-106027; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The principle features of climates of the continents are discussed briefly. Worldwide temperatures and precipitation are illustrated by maps. Monthly and annual temperatures and precipitation, including extreme temperatures, are presented in tabular form for approximately 800 stations throughout the world.
NTIS
Climate; Climatology; Weather Stations; Meteorological Services; Weather Forecasting

20000076638 Rocky Mountain Research Station, Ogden, UT USA
Determining Atmospheric Deposition in Wyoming with IMPROVE and Other National Programs
Zeller, K.; Harrington, D. Y.; Fisher, R.; Donev, E.; May 2000; 46p; In English
Report No.(s): PB2000-106408; RMRS-GTR-52; No Copyright; Avail: National Technical Information Service (NTIS)
Atmospheric deposition is the result of air pollution gases and aerosols leaving the atmosphere as 'dry' or 'wet' deposition. In this study, we evaluate data from different rural air monitoring programs to determine whether or not they may have wider applications in resource monitoring and protection. This report analyzes location-specific data collected by three national programs: The CASTNET (NDDN) Network supported by the Environmental Protection Agency; the IMPROVE (Interagency Monitoring of Protected Visual Environments) network supported by federal land managers; and the NADP/NTN program supported by many agencies.
NTIS
Deposition; Environmental Monitoring; Environment Protection; Air Quality

20000076798 Texas Univ., Austin, TX USA
Presentation Slides for Review meeting on August 19, 1999 ***Topical Report, Sep. 1998 - Aug. 1999***
Nair, H. S.; Zhao, H.; Bhat, C. R.; Sep. 1999; 78p; In English
Report No.(s): PB2000-106378; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The report contains the slide presentation of a meeting on August 19, 1999.
NTIS
Air Pollution; Pollution Control; Traffic Control

20000076799 Rocky Mountain Research Station, Ogden, UT USA
Determining Atmospheric Deposition in Wyoming with IMPROVE and Other National Programs
Zeller, K.; Harrington, D. Y.; Fisher, R.; Donev, E.; May 2000; 1p; In English
Report No.(s): PB2000-106408; RMRS-GTR-52; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Atmospheric deposition is the result of air pollution gases and aerosols leaving the atmosphere as 'dry' or 'wet' deposition. In this study, we evaluate data from different rural air monitoring programs to determine whether or not they may have wider applications in resource monitoring and protection. This report analyzes location-specific data collected by three national programs: The CASTNET (NDDN) Network supported by the Environmental Protection Agency; the IMPROVE (Interagency Monitoring of Protected Visual Environments) network supported by federal land managers; and the NADP/NTN program supported by many agencies.
NTIS
Air Pollution; Aerosols; Pollution Monitoring; Air Quality; Pollution Control; Environment Protection; Environmental Monitoring

20000076822 Texas Univ., Austin, TX USA

Review of the Current Dallas-Fort Worth Regional Travel Demand Model ***Topical Report, Sep. 1998 - Aug. 1999***

Zhao, H.; Bhat, C. R.; Aug. 1999; 28p; In English

Report No.(s): PB2000-106377; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report discusses each of the forecasting steps - trip generation, trip distribution, mode choice, and assignment - of the current Dallas-Fort Worth Regional Travel Model (DFWRTM).

NTIS

Automobiles; Air Pollution; Exhaust Gases; Exhaust Emission; Pollution Transport; Ozone

20000076823 Texas Univ., Austin, TX USA

Review of 1990 Mobile-Source Emissions Modeling Procedure for the Dallas-Fort Worth Nonattainment Area ***Topical Report, Sep. 1998 - Aug. 1999***

Nair, H. S.; Bhat, C. R.; Aug. 1999; 30p; In English

Report No.(s): PB2000-106376; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Dallas-Fort Worth (D-FW) metropolitan area in Texas includes all of Collin, Dallas, Denton, Rockwall, and Tarrant Counties and portions of Ellis, Johnson, Kaufman, and Parker Counties. The North Central Texas Council of Governments (NCTCOG), the metropolitan planning organization (MPO) for D-FW, is responsible for developing and maintaining the mobile-source emissions inventories in the area. Within the D-FW planning area, the counties of Collin, Dallas, Denton, and Tarrant are designated as serious ozone nonattainment areas by the U.S. Environmental Protection Agency (EPA). The NCTCOG models mobile-source emissions for these counties using EPA's MOBILE5 Emission Factor model. Emission factors are generated for carbon monoxide (CO), nitrogen oxides (NOx), and for volatile organic compounds (VOCs). The rest of this report discusses the NCTCOG emissions modeling process in detail and is structured as follows: Section 1 identifies the steps involved in computing pollutant-specific emission factors using the MOBILE5 model. Section 2 then discusses the steps followed to apply the emission factors generated from the MOBILE5 model to compute the net emissions for the D-FW nonattainment area.

NTIS

Pollution Transport; Exhaust Gases; Exhaust Emission; Air Pollution; Pollution Monitoring; Automobiles

20000076824 Texas Univ., Austin, TX USA

Description of Data Acquisition Efforts ***Topical Report, Sep. 1998 - Aug. 1999***

Nair, H. S.; Zhao, H.; Bhat, C. R.; Sep. 1999; 20p; In English

Report No.(s): PB2000-106375; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As part of the overall strategy of refining and improving the existing transportation and air-quality modeling framework, the current project focuses extensively on acquiring disaggregate and reliable data for analysis. In this report, we discuss the data obtained thus far from various state and local agencies for use in the project. The data obtained may be classified into three broad categories: (1) zonal level data, (2) link level data, and (3) household level data. These categories are discussed in three sections. In each section, we describe the data sets, the agency from which the data was obtained, and the reason for obtaining the data.

NTIS

Data Acquisition; Traffic; Transportation; Models; Traffic Control

20000076827 Istituto Superiore di Sanita, Rome, Italy

Symposium on Spectrochemistry (9th Italian Hungarian). Urban Health: A Challenge for the Third Millennium

Caroli, S.; Menditto, A.; 1999; 148p; In English

Report No.(s): PB2000-106326; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

In the frame of the bilateral governmental program for scientific and technical cooperation existing between Italy and Hungary a successful series of biennial Symposia were undertaken since the early 1980s. These were designed to provide scientists of both countries with a permanent forum for the evaluation of ongoing joint projects the exchange of views on future priorities and the proposal of novel initiatives. On the other hand, the transboundary nature of the problems dealt with by these Symposia always made the participation of prominent scientists from other countries a necessary complement substantially enhancing the international characteristics of such events. Each Symposium features a specific theme of primary importance within the general context of human health and environmental protection. In this respect, the ninth edition of this series of Symposia focuses on the major concerns raised by chemical pollution on all aspects of urban life. More than one half of the world population live today

in big cities, with all the attendant problems as regards air, water and soil quality, safe disposal of urban waste, occupational exposure, in one word, the physical, mental and cultural welfare of citizens at large.
NTIS
Conferences; Spectroscopic Analysis

20000078424 NASA Langley Research Center, Hampton, VA USA
A Comparison of Aircraft and Ground-Based Measurements at Mauna Loa Observatory, Hawaii, During GTE PEM-West and MLOPEX 2
Atlas, E., National Center for Atmospheric Research, USA; Ridley, B., National Center for Atmospheric Research, USA; Walega, J., National Center for Atmospheric Research, USA; Greenberg, J., National Center for Atmospheric Research, USA; Kok, G., National Center for Atmospheric Research, USA; Staffelbach, T., National Center for Atmospheric Research, USA; Schauffler, S., National Center for Atmospheric Research, USA; Lind, J., National Center for Atmospheric Research, USA; Huebler, G., National Oceanic and Atmospheric Administration, USA; Norton, R., National Oceanic and Atmospheric Administration, USA; Journal of Geophysical Research; Jun. 20, 1996; ISSN 0148-0227; Volume 101, No. D9, pp. 14,599-14,612; In English
Report No.(s): Paper 96JD00213; Copyright; Avail: Issuing Activity

During October 19-20, 1991, one flight of the NASA Global Tropospheric Experiment (GTE) Pacific Exploratory Mission (PEM-West A) mission was conducted near Hawaii as an intercomparison with ground-based measurements of the Mauna Loa Observatory Photochemistry Experiment (MLOPEX 2) and the NOAA Climate Modeling and Diagnostics Laboratory (CMDL). Ozone, reactive nitrogen species, peroxides, hydrocarbons, and halogenated hydrocarbons were measured by investigators aboard the DC-8 aircraft and at the ground site. Lidar cross sections of ozone revealed a complex air mass structure near the island of Hawaii which was evidenced by large variation in some trace gas mixing ratios. This variation limited the time and spatial scales for direct measurement intercomparisons. Where differences occurred between measurements in the same air masses, the intercomparison suggested that biases for some trace gases was due to different calibration scales or, in some cases, instrumental or sampling biases. Relatively large uncertainties were associated with those trace gases present in the low parts per trillion by volume range. Trace gas correlations were used to expand the scope of the intercomparison to identify consistent trends between the different data sets.
Author
Ground Based Control; Aircraft Control; DC 8 Aircraft; Photochemical Reactions; Climate Models

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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.

20000074257 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Glacier and Ice Shelves Studies Using Satellite SAR Interferometry *Etudes de Glaciers et de Calotte Glacieres avec L'Interferometrie Radar Spatiale*
Rignot, Eric, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; UMR Seminar, 7 Jan. 1999, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Satellite radar interferometry is a powerful technique to measure the surface velocity and topography of glacier ice. On ice shelves, a quadruple difference technique separates tidal motion from the steady creep flow deformation of ice. The results provide a wealth of information about glacier grounding lines , mass fluxes, stability, elastic properties of ice, and tidal regime. The grounding line, which is where the glacier detaches from its bed and becomes afloat, is detected with a precision of a few tens of meters. Combining this information with satellite radar altimetry makes it possible to measure glacier discharge into the ocean and state of mass balance with greater precision than ever before, and in turn provide a significant revision of past estimates of mass balance of the Greenland and Antarctic Ice Sheets. Analysis of creep rates on floating ice permits an estimation of basal melting at the ice shelf underside. The results reveal that the action of ocean water in sub-ice-shelf cavities has been largely underestimated by oceanographic models and is the dominant mode of mass release to the ocean from an ice shelf. Precise mapping of grounding line positions also permits the detection of grounding line migration, which is a fine indicator of glacier change, independent of our knowledge of snow accumulation and ice melting. This technique has been successfully used to detect the rapid retreat of Pine

Island Glacier, the largest ice stream in West Antarctica. Finally, tidal motion of ice shelves measured interferometrically provides a modern, synoptic view of the physical processes which govern the formation of tabular icebergs in the Antarctic.
Author
Glaciers; Ice; Interferometry; Topography

20000074258 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Calibrating Atmospheric Delay for the Cassini Gravitational Wave Experiment
Resch, G. M., Jet Propulsion Lab., California Inst. of Tech., USA; Keihm, S. J., Jet Propulsion Lab., California Inst. of Tech., USA; Naudet, C. J., Jet Propulsion Lab., California Inst. of Tech., USA; Riley, A. L., Jet Propulsion Lab., California Inst. of Tech., USA; Tanner, A. B., Jet Propulsion Lab., California Inst. of Tech., USA; Teitelbaum, L. P., Jet Propulsion Lab., California Inst. of Tech., USA; Linfield, R. P., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Cassini spacecraft together with one of the stations of the Deep Space Network (DSN) have been instrumented to carry out extremely precise Doppler tracking that will be used to search for the direct evidence of Gravitational radiation passing through our solar system. The two-way communications link between the ground antenna and the spacecraft constitute an ”antenna” for gravitational waves that would perturb the phase of the RF signal in the link. The experiments will be carried out during the long cruise phase of the spacecraft on its journey to Saturn and will be sensitive to gravitational wave perturbations larger than the noise level fluctuations of 3 x 10(exp -15) as measured in the Allan Standard Deviation domain. The use of simultaneous, coherent X- and Ka-Band up and down signals will reduce the errors associated with charged particle fluctuations in the interplanetary medium and Earth’s ionosphere to a negligible level. The primary fluctuations in the phase of the signals both to and from the spacecraft are expected to be caused by fluctuations in water vapor in the Earth’s atmosphere We have designed and are testing a new atmospheric calibration system (with duplicate components) to sense line-of-sight water vapor and its physical temperature with a goal of calibrating 95% or more of tropospheric path delay fluctuations during the Cassini Gravitational Wave Experiment (GWE). The critical component of the calibration system consists of a newly designed water vapor radiometer having a I degree sensing beamwidth and 0.01 K brightness temperature stability over hour time scales. Auxiliary instrumentation includes a microwave temperature profiler to retrieve the vertical distribution of the vapor physical temperature, and surface meteorology. A detailed error budget has been developed to account for all of the possible sources of error during calibration of the GWE and will be discussed. Two identical calibration systems have been constructed in order to provide capability as well as backup during the actual GWE experiment. We will report on side-by-side testing of the vapor and temperature sensing components of this calibrations system as well as a comparison with a short baseline radio interferometric measurement at our Goldstone complex.
Author
Cassini Mission; Gravitational Waves; Calibrating; Deep Space Network; Doppler Radar; Communication Networks

20000074266 NASA Marshall Space Flight Center, Huntsville, AL USA
Behavior of the Aurora During the 10-12 May, 1999 When the Solar Wind Nearly Disappeared
Parks, G. K., NASA Marshall Space Flight Center, USA; Brittnacher, M., NASA Marshall Space Flight Center, USA; Chua, D., NASA Marshall Space Flight Center, USA; Fillingim, M., NASA Marshall Space Flight Center, USA; Germany, G., NASA Marshall Space Flight Center, USA; Spann, J., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We show that die aurora was still active with occasional pseudo breakup events when die solar wind density diminished to unusually small densities during May 10-12, 1999. The aurora was observed at high magnetic latitudes indicating that the electron precipitation source moved northward as die soar wind and geomagnetic activities decreased. These features are well known and seen at other times when the geomagnetic activities are weak. Intense auroral events accompanied other periods of low solar wind density (for example, February 10, 1997 and May 5,1998) indicating that the solar wind density alone is not die primary parameter that controls die auroral activity. However, a new auroral feature was observed on May, 11, 1999 during approx. 09-20 LIT hours. The electron precipitation was energetic, uniform and covered the polar latitudes commonly identified as die polar cap region. This precipitation lasted form ore that 10 hours and was stable over time scales of tens of minutes. On May 12, as the solar wind began to recover, a prolonged period of dayside activity occurred and was subsequently followed by a ”typical” aurora at approx. 05 UT. All of the auroral activities occurred accompanying weak auroral electrojet activity (approx. 150 nT maximum).
Author
Solar Wind; Geomagnetism; Electron Precipitation; Auroras

20000074490 NASA Goddard Space Flight Center, Greenbelt, MD USA

SST Variation Due to Interactive Convective-Radiative Processes

Tao, W.-K., NASA Goddard Space Flight Center, USA; Shie, C.-L., NASA Goddard Space Flight Center, USA; Johnson, D., NASA Goddard Space Flight Center, USA; Simpson, J., NASA Goddard Space Flight Center, USA; Li, X., NASA Goddard Space Flight Center, USA; Sui, C.-H., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; 10th; Interaction of the Sea and Atmosphere, 29 May - 2 Jun. 2000, Fort Lauderdale, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The recent linking of Cloud-Resolving Models (CRMs) to Ocean-Mixed Layer (OML) models has provided a powerful new means of quantifying the role of cloud systems in ocean-atmosphere coupling. This is due to the fact that the CRM can better resolve clouds and cloud systems and allow for explicit cloud-radiation interaction. For example, Anderson (1997) applied an atmospheric forcing associated with a CRM simulated squall line to a 3-D OML model (one way or passive interaction). His results suggested that the spatial variability resulting from the squall forcing can last at least 24 hours when forced with otherwise spatially uniform fluxes. In addition, the sea surface salinity (SSS) variability continuously decreased following the forcing, while some of the SST variability remained when a diurnal mixed layer capped off the surface structure. The forcing used in the OML model, however, focused on shorter time (8 h) and smaller spatial scales (100-120 km). In this study, the 3-D Goddard Cumulus Ensemble Model (GCE; 512 x 512 x 23 cu km, 2-km horizontal resolution) is used to simulate convective active episodes occurring in the Western Pacific warm pool and Eastern Atlantic regions. The model is integrated for seven days, and the simulated results are coupled to an OML model to better understand the impact of precipitation and changes in the planetary boundary layer upon SST variation. We will specifically examine and compare the results of linking the OML model with various spatially-averaged outputs from GCE simulations (i.e., 2 km vs. 10-50 km horizontal resolutions), in order to help understand the SST sensitivity to multi-scale influences. This will allow us to assess the importance of explicitly simulated deep and shallow clouds, as well as the subgrid-scale effects (in coarse-model runs) upon SST variation. Results using both 1-D and 2-D OML models will be evaluated to assess the effects of horizontal advection.

Author

Sea Surface Temperature; Convection; Ocean Models; Variability; Clouds (Meteorology); Atmospheric Radiation

20000074653 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Inversion of Gravity Fields From the Spacecraft Orbital Data Using an Adjoint Operator Approach

Ustinov, E. A., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English, 1999, The Hague, Netherlands; Sponsored by European Geophysical Society, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

In perturbation approximation, the forward problem of orbital dynamics (equations with initial conditions) is linear with respect to variations of coordinates and/or velocities of the spacecraft and to corresponding variations of the gravity field in the models used. The linear operator adjoint to the linear operator of such forward problem turns out to be instrumental in inversion of differences between observed and predicted coordinates/velocities in terms of the updates of harmonics in the initial gravity field model. Based on this approach, the solution of resulting adjoint problem of orbital dynamics can be used to directly evaluate the matrix of partial derivatives of observable differences with respect to the gravity field harmonics. General discussion of the adjoint problem of orbital dynamics is given and an example of a mathematical formalism for the practical retrieval algorithm is presented.

Author

Gravitational Fields; Orbital Mechanics; Spacecraft Orbits; Orbit Perturbation

20000074676 Deutsches Klimarechenzentrum G.m.b.H., Modellbetreuungsgruppe, Hamburg, Germany

Portable University Model of the Atmosphere (PUMA)

Fraedrich, K.; Kirk, E.; Lunkeit, F.; Oct. 31, 1998; 41p; In English

Report No.(s): DE99-724809; DKRZ-TR-16; No Copyright; Avail: Department of Energy Information Bridge

The Portable University Model of the Atmosphere (PUMA) is based on the Reading multi-level spectral model SGCM (Simple Global Circulation Model) described by Hoskins and Simmons (1975) and James and Gray (1986). Originally developed as a numerical prediction model, it was changed to perform as a circulation model. For example, James and Gray (1986) studied the influence of surface friction on the circulation of a baroclinic atmosphere, James and James (1992), and James et al. (1994) investigated ultra-low-frequency variability, and Mole and James (1990) analyzed the baroclinic adjustment in the context of a zonally varying flow. Frisius et al. (1998) simulated an idealized storm track by embedding a dipole structure in a zonally symmetric forcing field and Lunkeit et al. (1998) investigated the sensitivity of GCM (General Circulation Model) scenarios by an adaption technique applicapable to SGCMs. (orig.).

NTIS

Atmospheric General Circulation Models; Earth Atmosphere

20000074723 Onsala Space Observatory, Sweden

Atmospheric Parameters Derived from Simultaneous Observations with Space Geodetic and Remote Sensing Techniques at the Onsala Space Observatory

Haas, Ruediger, Onsala Space Observatory, Sweden; Gradinarsky, Lubomir P., Onsala Space Observatory, Sweden; Elgered, Gunnar, Onsala Space Observatory, Sweden; Johansson, Jan M., Onsala Space Observatory, Sweden; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 269-273; In English; See also 20000074683
Contract(s)/Grant(s): FMRX-CT96-0071; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

We compare estimates of zenith wet delay and horizontal delay gradients from 54 days of simultaneous observations with independent collocated space geodetic and remote sensing techniques at the Onsala Space Observatory. The impact of the choice of the constraints for the atmospheric parameters used in the analysis of the space geodetic data on the comparison with water vapour radiometer results is studied. We find estimated weighted RMS differences below the 10 millimetre level and correlation coefficients between 0.73 and 0.87 for the zenith wet delays derived from the different techniques while the agreement for the estimated horizontal delay gradients is less clear.

Author

Geodesy; Meteorological Parameters; Atmospheric Moisture; Atmospheric Correction; Parameterization

20000074796 NASA Goddard Space Flight Center, Greenbelt, MD USA

Tropospheric Chemistry from Space

Gleason, James, NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; Telluride Academy Conference, 6-12 Aug. 2000, Telluride, CO, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Measuring tropospheric chemical constituents from space has been only of the ”Holy Grails” of remote sensing. Tropospheric remote sensing has been done in two phases, extracting troposheric constituent information from satellite instruments designed for other purposes and constituent measurements with instruments optimized for tropospheric detection. Examples from the first phase, tropospheric ozone and aerosols from Total Ozone Mapping Spectrometer (TOMS) and Global Ozone Monitoring Experiment (GOME) will be presented. Expected results from upcoming instruments and missions, Atmospheric Ultraviolet Radiance Analyzer (AURA), Ozone Monitoring Instrument (OMI), GOME2, and Scanning Imaging Spectrometer for Atmospheric Chartography (SCIAMACHY) will be presented.

Author

Atmospheric Chemistry; Chemical Composition; Remote Sensing; Troposphere; Satellite Instruments

20000075646 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Surface Displacement Field of the November 8, 1997, Mw7.6 Manyi (Tibet) Earthquake Observed with ERS InSAR Data

Peltzer, G., Jet Propulsion Lab., California Inst. of Tech., USA; Crampe, F., Jet Propulsion Lab., California Inst. of Tech., USA; [1998]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

ERS2 radar data acquired before and after the Mw7.6, Manyi (Tibet) earthquake of November 8, 1997, provide geodetic information about the surface displacement produced by the earthquake in two ways. (1) The sub-pixel geometric adjustment of the before and after images provides a two dimensional offset field with a resolution of approx, 1m in both the range (radar line of sight) and azimuth (satellite track) directions. Comparison of offsets in azimuth and range indicates that the displacement along the fault is essentially strike-slip and in a left-lateral sense. The offset map reveals a relatively smooth and straight, N78E surface rupture that exceeds 150 km in length, consistent with the EW plane of the Harvard CMT solution. The rupture follows the trace of a quaternary fault visible on satellite imagery (Tapponnier and Molnar, 1978; Wan Der Woerd, pers. comm.). (2) Interferometric processing of the SAR data provides a range displacement map with a precision of a few millimeters. The slip distribution along the rupture reconstructed from the range change map is a bell-shaped curve in the 100-km long central section of the fault with smaller, local maxima near both ends. The curve shows that the fault slip exceeds 2.2 m in range, or 6.2 in strike-slip, along a 30-km long section of the fault and remains above 1 m in range, approx. 3 m strike-slip, along most of its length. Preliminary forward modeling of the central section of the rupture, assuming a uniform slip distribution with depth, indicates that the slip occur-red essentially between 0 and the depth of 10 km, consistent with a relatively shallow event (Velasco et al., 1998).

Author

Satellite Imagery; Radar Data; Geological Faults; Displacement; Earthquakes

20000075709 Scripps Institution of Oceanography, La Jolla, CA USA

GPS, Earthquakes, the Ionosphere, and the Space Shuttle

Calais, Eric, Scripps Institution of Oceanography, USA; Minster, J. Bernard, Scripps Institution of Oceanography, USA; Physics of the Earth and Planetary Interiors; 1998; ISSN 0031-9201; Volume 105, pp. 167-181; In English

Contract(s)/Grant(s): NAG5-1910; Copyright; Avail: Issuing Activity

Sources such as atmospheric or buried explosions and shallow earthquakes producing strong vertical ground displacements are known to produce infrasonic pressure waves in the atmosphere. Because of the coupling between neutral particles and electrons at ionospheric altitudes, these acoustic waves induce variations of the ionospheric electron density. The Global Positioning System provides a way of directly measuring the Total Electron Content in the ionosphere and, therefore. of detecting such perturbations in the upper atmosphere. In this work, we demonstrate the capabilities of the GPS technique to detect ionospheric perturbations caused by the January 17. 1994, M (sub w) =6.7, Northridge earthquake and the STS-58 Space Shuttle ascent. In both cases, we observe a perturbation of the ionospheric electron density lasting for about 30 m, with periods less than 10 m. The perturbation is complex and shows two sub-events separated by about 15 m. The phase velocities and waveform characteristics of the two sub-events lead us to interpret the first arrival as the direct propagation of 2 free wave, followed by oscillatory guided waves propagating along horizontal atmospheric interfaces at 120 km altitude and below.

Author

Earthquakes; Global Positioning System; Space Shuttles; Earth Ionosphere; Space Transportation System

20000076008 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Fiscal 1997 report of the verification research on geothermal prospecting technology, Theme 5-2, Development of a reservoir change prospecting method reservoir change prediction technique (modeling support technique

Mar. 31, 1998; 108p; In Japanese; In English

Report No.(s): DE99-718331; ETDE/JP-99718331; No Copyright; Avail: Department of Energy Information Bridge

To evaluate geothermal reservoirs in the initial stage of development, to keep stable output in service operation, and to develop a technology effective for extraction from peripheral reservoirs, a study was done on a reservoir variation prediction technique, in particular, a modeling support technique. This paper describes the result in fiscal 1997. Underground temperature estimation technique using homogenization temperatures of fluid inclusions among core fault system measurement systems was applied to Wasabizawa field. The effect of stretching is important to estimate reservoir temperatures, and use of a minimum homogenization temperature of fluid inclusions in quartz was suitable. Even in the case of no quartz in hydrothermal veins, measured data of quartz (secondary fluid inclusion) in parent rocks adjacent to hydrothermal veins well agreed with measured temperature data. The developmental possibility of a new modeling support technique was confirmed enough through collection of documents and information. Based on the result, measurement equipment suitable for R and D was selected, and a measurement system was established through preliminary experiments.

NTIS

Geothermal Technology; Reservoirs; Variations

20000076058 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Fiscal 1997 report on the verification research on geothermal prospecting technology, Theme 4, Development of a reservoir variation prospecting meDevelopment of a reservoir variation prospecting method (development of a micro-earthquake monitoring system (MEMS))

Mar. 31, 1998; 181p; In Japanese; In English

Report No.(s): DE99-718329; ETDE/JP-99718329; No Copyright; Avail: Department of Energy Information Bridge

To evaluate geothermal reservoirs in the initial stage of development and keep stable output in service operation, the application of MEMS is under development. This paper describes the result in fiscal 1997. Installation of 3-component velocity type seismometers in bore holes is desirable for permanent monitoring sites. Digital seismic data at the permanent sites are transmitted to a center through cables, while temporary data are recorded on site. For MEPAS, a Windows program of basic functions was developed. 3-D seismic velocity analysis and array monitoring system were also studied. A P-wave velocity of rocks decreased by 25% by formed two-phase region, and increased by 10% by decrease in reservoir temperature from 200 to 100 C. The velocity can be detected by change in travel time of direct waves due to considerable variation in reservoir environment. VSP technique using a vibrator or air gun as artificial hypocenter is effective for MEMS.

NTIS

Geothermal Technology; Reservoirs; Variational Principles; Earthquakes

20000076804 Norsk Petroleumsforening, Oslo, Norway
Integrated geophysical techniques in seismic interpretation. Abstracts
Dec. 31, 1998; 130p; In English
Report No.(s): DE99-721549; NEI-NO-995; No Copyright; Avail: Department of Energy Information Bridge

This report includes a collection of papers from a conference on seismic interpretation by the integration geophysical techniques. A number of 21 papers are prepared.
NTIS
Geophysics; Technology Assessment; Seismology

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification

20000074254 NASA Goddard Space Flight Center, Greenbelt, MD USA
Monthly Oceanic Rainfall Derived from Space-Borne Microwave Data
Chang, Alfred T. C., NASA Goddard Space Flight Center, USA; Chiu, Long, George Mason Univ., USA; [2000]; 1p; In English; Hydrology, 3-7 Apr. 2000, Santa Fe, NM, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A technique for estimating monthly oceanic rainfall rate using multi-channel microwave measurements has been developed. This technique is applied to the Special Sensor Microwave Imager (SSM/I) data since 1987 to infer monthly rainfall for the Global Precipitation Climatology Project (GPCP). A modified version of this algorithm is now being applied to the TRMM Microwave Imager (TMI) data. There are three prominent features of this algorithm. First, the knowledge of the form of the rainfall intensity probability density function used to augment the measurements. Second, utilizing a linear combination of the 19.35 and 22.235 GHz channels to deemphasize the effect of water vapor. Third, an objective technique has been developed to estimate the rain layer thickness from the 19.35 and 22.23 5 GHz brightness temperature histograms, TMI data with better spatial resolution and 24 hour sampling (vs. sun-synchronized sampling, which is limited to two narrow intervals of local solar time for DMSP satellites) prompt us to study the similarity and difference between these two rainfall estimates. One year of rainfall data (January to December 1998) are used in this study. The mean differences of these two rain estimates are typically less than 15%. Statistical tests are administrated to evaluate the differences between rainfall estimates from SSM/I and TMI data. Differences between TMI and SSM/I rain estimates are discussed in the context of radiative transfer calculations and rainfall estimate algorithm.
Author
Microwave Imagery; Rain; Oceanography; Climatology; Precipitation (Meteorology); Remote Sensing; Data Acquisition

20000074483 NASA Goddard Space Flight Center, Greenbelt, MD USA
Noctilucent Clouds and Corresponding Meteorological Conditions
Schmidlin, F. J., NASA Goddard Space Flight Center, USA; Goldberg, R. A., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English, 24-29 Apr. 2000, Nice, France; Sponsored by European Geophysical Society, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

Temperature measurements obtained using the passive falling sphere technique in 1991, 1993, and again in 1999 are being used to study the relationship between the neutral atmosphere and Noctilucent Clouds (NLC) The earlier NLC studies provided useful information on the behavior of the neutral atmosphere. The recent study program, the Distribution and Role of Particles in the Polar Summer Mesosphere (DROPPS) produced additional significant information of the neutral atmosphere and Noctilucent Cloud (NLC) association. Temperature lapse rates from seven rocket observations that were generally monatonic indicated changes at the mesopause during the NLC event of 5 July. Between 5 July, 2313 UTC and 6 July 0209 UTC, the temperature lapse rate between about 85 and 92 km was different and the altitude of the minimum temperature changed by 5 km. Furthermore, change in wind direction and speed, although not yet fully analyzed, may be associated with the change of the temperature structure, possibly due to advection. Comparisons are made between the meteorological conditions during the NLC events of 1991, 1993, and 1999.
Author
Noctilucent Clouds; Meteorological Parameters; Neutral Atmospheres; Atmospheric Temperature

20000074485 NASA Goddard Space Flight Center, Greenbelt, MD USA
Microwave Sensing of Ocean Winds Including the Use of SAR Imagery
Vandemark, Douglas, NASA Goddard Space Flight Center, USA; [2000]; 1p; In English, 4-5 Apr. 2000, Rochester, NY, USA; No Copyright; Avail: Issuing Activity; Abstract Only

This paper presents aircraft measurements of near-surface atmospheric boundary layer wind roll signatures and radar-derived sea surface roughness. These data are completely coincident in space and time and this unique feature supports attempts to definitively link SAR backscatter signatures to boundary layer roll impacts. The open-ocean data were collected at an altitude of 20 m from NOAA's Long-EZ aircraft using its turbulence probe and down-looking Ka-band radar scatterometer. Several flight legs of 20-30 km were flown with a heading across the wind direction, which is also roughly perpendicular to the roll vortices. We find remarkable correlation between measured modulations in the along-wind component of wind speed and radar backscatter for the spatial scale of 1 to 1.5 km. Close agreement between normalized modulation amplitudes suggests the radar-inferred surface slope variance is changing linearly with wind speed. These data were collected within 30 minutes of a RADARSAT SAR overpass where apparent boundary layer impacts of the same orientation and spatial dimension are prevalent in the SAR backscatter image. Quantitative comparison between modulations in the aircraft and satellite radar data will be discussed.
Author
Radar Imagery; Synthetic Aperture Radar; Microwaves; Radarsat; Oceans; Wind (Meteorology)

20000074487 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Tropical Rainfall Measuring (TRMM) - What Have We Learned and What Does the Future Hold?
Kummerow, C., NASA Goddard Space Flight Center, USA; Hong, Y., Caelum Research Corp., USA; Olsen, W. S., Maryland Univ. Baltimore County, USA; [2000]; 1p; In English; 25th, 24-29 Apr. 2000, France; Sponsored by European Geophysical Society, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

Rainfall is important in the hydrological cycle and to the lives and welfare of humans. In addition to being a life-giving resource, rainfall processes also plays a crucial role in the dynamics of the global atmospheric circulation. Three-fourths of the energy that drives the atmospheric wind circulation comes from the latent heat released by tropical precipitation. It varies greatly in space and time. The rain-producing cloud systems may last several hours or days. Their dimensions range from 10 km to several hundred km. This makes it difficult to incorporate rainfall directly large-scale weather and climate models. Until the end of 1997, precipitation in the global tropics was not known to within a factor of two. Regarding "global warming", the various large-scale models differed among themselves in the predicted magnitude of the warming and in the expected regional effects of these temperature and moisture changes. The Tropical Rainfall Measuring Mission (TRMM) satellite has yielded important interim results related to rainfall observations, data assimilation and model forecast skills when rainfall data is assimilated. This talk will summarize where the TRMM science team is with regards to answering some of these important scientific challenges, as well as discuss the future Global Precipitation Mission which will provide 3 hourly rainfall coverage and offers some unique collaborative potential for NOAA and NASA.
Author
Rain; Trmm Satellite; Tropical Regions; Atmospheric Circulation

20000074488 NASA Goddard Space Flight Center, Greenbelt, MD USA
On the Origin of Monsoon
Chao, Winston C., NASA Goddard Space Flight Center, USA; Chen, Baode, Universities Space Research Association, USA; [2000]; 1p; In English; 24th; Hurricanes, 29 May - 2 Jun. 2000, Fort Lauderdale, FL, USA; Sponsored by Army Map Service, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The notion that the continental-scale land-sea contrast is the main reason that monsoon circulation exists has been a long-held belief. The purpose of this paper is to point out that this notion should be substantially modified. The central idea of this notion states that in summer, radiative heating of the continent, say Asia, gives rise to a continental-scale thermal low and surrounding the thermal low in its southeast direction the low level wind flows in from south-west. This low-level inflow creates a convergence of moisture, which maintains the cumulus convection. and in winter, radiative cooling of continent gives rise to a thermal high and to its southeast the low-level wind is from northeast. The mechanism in this interpretation does undoubtedly exist. However, this mechanism, though believed to be the main driving force of monsoon, has not been tested in numerical experiments. There has been an increasing recognition in the recent years that monsoon is inextricably tied to the heating in the intertropical convergence zone (ITCZ). We propose that the main cause of monsoon is ITCZ's being substantially away from the equator. A brief qualitative explanation of why the ITCZ can be a source of monsoon circulation can be offered based on the circulation field forced by the ITCZ heating. The existence of the ITCZ's does not always have to rely on land-sea contrast on the continental scale. This is hinted in the fact that in February the ITCZ close to Australia (and its associated monsoon circulation) covers a longitudinal range several times as long as that of Australia and thus cannot possibly be caused mainly by the land-sea contrast associated with Australia. Yet, this cannot be used as a proof that the ITCZ in the Asian summer monsoon is not mainly due to land-sea contrast. One of the purposes of this work is to provide a convincing proof. In this work the role of land-sea contrast in the origin of monsoon is examined through numerical simulation with the Goddard general circulation model. The Asian and Australian monsoon cir-

culations are obtained in a four-year integration and then the integration is repeated with Asia, the maritime continent, and Australia replaced by ocean. The sea surface temperature (SST) at each affected grid is specified as the SST at the first grid to the east that is an ocean grid in the first experiment. The latter integration shows that the monsoon circulation pattern over where south Asia and Australia were and the surrounding region has largely remained. The results discount land-sea contrast as the main cause of Asian monsoon. A third experiment is the same as the first except that the topography of Asia, the maritime continent, and Australia is reduced to zero. This experiment reveals that the difference between the first two experiments is due more to the removal of topography than to the removal of land-sea contrast. August precipitation is shown averaged over the last three years of each of the three experiments. They show that the Asian monsoon rainy region is largely intact in the second experiment and the difference between the second and the third experiment is mainly in the longitudinal location of the maximum precipitation. Additionally, in Asian and Australian winter monsoons land-sea contrast also plays only a modifying role. Although land-sea contrast plays only a modifying role in Asian and Australian (and Central American including Mexican) monsoons, it is the main reason that ITCZ (and thus monsoon) exists in Africa and South America. Thus, monsoons can be classified into two groups depending on whether land-sea contrast plays a major role.
Author
Monsoons; Atmospheric Circulation; Asia; Convergence

20000074489 NASA Goddard Space Flight Center, Greenbelt, MD USA
Tropical Cyclone Lightning Distribution and Its Relationship to Convection and Intensity Change
Rodgers, Edward, NASA Goddard Space Flight Center, USA; Wienman, James, NASA Goddard Space Flight Center, USA; Pierce, Harold, Science and System Application, Inc., USA; Olson, William, Maryland Univ. Baltimore County, USA; [2000]; 1p; In English; 24th; Hurricanes, 29 May - 2 Jun. 2000, Fort Lauderdale, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The long distance National Lightning Detection Network (NLDN) was used to monitor the distribution of lightning strokes in various 1998 and 1999 western North Atlantic tropical cyclones. These ground-based lightning observations together with the Defense Meteorological Satellite Program (DMSP) Special Sensor Microwave/Imager (SSM/I) and the Tropical Rain Mapping Mission (TRMM) Microwave Instrument (TMI) derived convective rain rates were used to monitor the propagation of electrically charged convective rain bands aid to qualitatively estimate intensification. An example of the lightning analyses was performed on hurricane George between 25-28 September, 1998 when the system left Key West and moved towards the Louisiana coast. During this period of time, George's maximum winds increased from 38 to 45 meters per second on 25 September and then remained steady state until it made landfall. Time-radius displays of the lightning strokes indicated that the greatest number of lightning strokes occurred within the outer core region (greater than 165 km) with little or no lightning strokes at radii less than 165 km. The trend in these lightning strokes decreased as George move into the Gulf of Mexico and showed no inward propagation. The lack inward propagating lightning strokes with time indicated that there was no evidence that an eye wall replacement was occurring that could alter George's intensity. Since George was steady state at this time, this result is not surprising. Time-azimuth displays of lightning strokes in an annulus whose outer and inner radii were respectively, 222 and 333 km from George's center were also constructed. A result from this analysis indicated that the maximum number of strokes occurred in the forward and rear right quadrant when George was over the Gulf of Mexico. This result is, consistent with the aircraft and satellite observations of maximum rainfall.
Author
Convection; Cyclones; Lightning; Remote Sensing; Tropical Storms; Meteorology

20000074638 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Probabilistic Technique for Improving the Mid-Swath Wind Direction Accuracy of Scanning Pencil Beam Scatterometers
Stiles, Bryan, Jet Propulsion Lab., California Inst. of Tech., USA; Pollard, Brian, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The SeaWinds on QuikSCAT scatterometer is a device developed by NASA JPL to measure the speed and direction of ocean surface winds. Simulations performed in order to determine the expected performance of the instrument prior to its launch have indicated that the accuracy of the retrieved wind vectors varies across the swath. In particular the mid-swath accuracy is worse than that of the rest of the swath. This behavior is a general characteristic of scanning pencil beam scatterometers. For SeaWinds, the accuracy of the rest of the swath, and the size of the swath are such that the instrument meets its science requirements despite mid-swath shortcomings. However, by understanding the problem at mid-swath, we can improve the performance there as well, yielding even better coverage and accuracy than was originally intended. The mid-swath performance degradation is due to suboptimal viewing geometry. In particular mid-swath measurements contains measurements from two azimuths, roughly 180 degrees

apart. With the standard wind retrieval technique, mid-swath root mean square (RMS) wind direction errors are approximately 30 degrees for low wind speeds (3 - 5.5 m/s) and 20 degrees for moderate to high wind speeds (5.5 - 30 m/s). We discuss the underlying causes of this phenomenon in detail and propose a modification to the wind retrieval technique in order to improve mid-swath performance. by estimating the range of likely wind directions for each measurement cell, one can optimally apply information from neighboring cells in order to reduce random wind direction errors without significantly degrading the resolution of the resultant wind field. In this manner we are able to achieve mid-swath RMS wind direction errors as low as 15 degrees for low winds and 10 degrees for moderate to high winds, while at the same time preserving high resolution structures such as cyclones and fronts. Since our results are based on simulated data, we also outline a procedure for making use of real data to optimize the technique after launch.
Author
Probability Theory; Wind Direction; Ground Wind; Ocean Surface; Wind Velocity; Velocity Distribution; Root-Mean-Square Errors; Error Analysis

20000074724 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Calibration of Atmospherically Induced Delay Fluctuations Due to Water Vapor
Resch, George, Jet Propulsion Lab., California Inst. of Tech., USA; Jacobs, Christopher, Jet Propulsion Lab., California Inst. of Tech., USA; Keihm, Steve, Jet Propulsion Lab., California Inst. of Tech., USA; Lanyi, Gabor, Jet Propulsion Lab., California Inst. of Tech., USA; Naudet, Charles, Jet Propulsion Lab., California Inst. of Tech., USA; Riley, Abraham, Jet Propulsion Lab., California Inst. of Tech., USA; Rosenberger, Hans, Jet Propulsion Lab., California Inst. of Tech., USA; Tanner, Alan, Jet Propulsion Lab., California Inst. of Tech., USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 274-279; In English; See also 20000074683; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We have completed a new generation of water vapor radiometers (WVR), the A- series, in order to support radio science experiments with the Cassini spacecraft. These new instruments sense three frequencies in the vicinity of the 22 GHz emission line of atmospheric water vapor within a 1 degree beamwidth from a clear aperture antenna that is co-pointed with the radio telescope down to 10 degree elevation. The radiometer electronics features almost an order of magnitude improvement in temperature stability compared with earlier WVR designs. For many radio science experiments, the error budget is likely to be dominated by path delay fluctuations due to variable atmospheric water vapor along the line-of-sight to the spacecraft. In order to demonstrate the performance of these new WVRs we are attempting to calibrate the delay fluctuations as seen by a radio interferometer operating over a 21 km baseline with a WVR near each antenna. The characteristics of these new WVRs will be described and the results of our preliminary analysis will be presented indicating an accuracy of 0.2 to 0.5 mm in tracking path delay fluctuations over time scales of 10 to 10,000 seconds.
Author
Atmospheric Moisture; Calibrating; Radio Interferometers; Radiometers; Water Vapor; Atmospheric Correction; Time Lag; Instrument Errors

20000074794 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Cirrus Parcel Model Comparison Project, Phase 1
Lin, Ruei-Fong, Universities Space Research Association, USA; Starr, D., NASA Goddard Space Flight Center, USA; DeMott, P., CSU; Cotten, R., Meteor. Res. Fl; Jensen, E., NASA Ames Research Center, USA; Sassen, K., Utah Univ., USA; [2000]; 1p; In English; 13th; 13th International Conference on Clouds and Precipitation, 14 Aug. 2000, Reno, NV, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The cirrus Parcel Model Comparison Project involves the systematic comparison of current models of ice crystal nucleation and growth for specified, typical, cirrus cloud environments. In Phase 1 of the project reported here, simulated cirrus cloud microphysical properties are compared for situations of ”warm” (-40 C) and ”cold” (-60 C) cirrus subject to updrafts of 4, 20 and 100 centimeters per second, respectively. Five models are participating in the project. These models employ explicit microphysical schemes wherein the size distribution of each class of particles (aerosols and ice crystals) is resolved into bins. Simulations are made including both homogeneous and heterogeneous ice nucleation mechanisms. A single initial aerosol population of sulfuric acid particles is prescribed for all simulations. to isolate the treatment of the homogeneous freezing (of haze drops) nucleation process, the heterogeneous nucleation mechanism is disabled for a second parallel set of simulations. Qualitative agreement is found amongst the models for the homogeneous-nucleation-only simulations, e.g., the number density of nucleated ice crystals increases with the strength of the prescribed updraft. However, non-negligible quantitative differences are found. Systematic bias exists between results of a model based on a modified classical theory approach and models using an effective freezing temperature approach to the treatment of nucleation. Each approach is constrained by critical freezing data from laboratory studies. This information is necessary, but not sufficient, to construct consistent formulae for the two approaches. Large haze particles may

deviate considerably from equilibrium size in moderate to strong updrafts (20-100 centimeters per second) at -60 C when the commonly invoked equilibrium assumption is lifted. The resulting difference in particle-size-dependent solution concentration of haze particles may significantly affect the ice nucleation rate during the initial nucleation interval. The uptake rate for water vapor excess by ice crystals is another key component regulating the total number of nucleated ice crystals. This rate, the product of ice number concentration and ice crystal diffusional growth rate, partially controls the peak nucleation rate achieved in an air parcel and the duration of the active nucleation time period.
Author
Cirrus Clouds; Cloud Physics; Nucleation; Atmospheric Models; Crystal Growth; Ice

20000074795 NASA Goddard Space Flight Center, Greenbelt, MD USA
Kinematic and Microphysical Structures of Hurricane Bob (1991) Determined from a 1.3-km-Resolution Numerical Simulation
Braun, Scott A., NASA Goddard Space Flight Center, USA; Simpson, Joanne, NASA Goddard Space Flight Center, USA; Tao, Wei-Kuo, NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; ICCP Conference, 14-18 Aug. 2000, Reno, NV, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Hurricane Bob (1991) is simulated using the Penn State/NCAR mesoscale model MM5. The simulation is conducted for a 24-h period at 4-km resolution and for a 6-h period at 1.3-km resolution. The 4-km simulation is able to fairly realistically capture the intensity and structure of the storm. The 1.3-km simulation depicts very small-scale convective structures and produces a convective band outside of the eye wall that did not occur in the 4-km simulation. The 1.3-km results are used to characterize several kinematic and cloud microphysical structures in the storm. Characteristics of air parcels flowing into and rising within the eye wall will be examined through trajectory calculations.
Author
Hurricanes; Kinematics; Mesoscale Phenomena; Computerized Simulation; Mathematical Models; Cloud Physics; Storms (Meteorology)

20000074966 NASA Marshall Space Flight Center, Huntsville, AL USA
Tropical Microwave Brightness Temperature Data from AMPR
LaFontaine, Frank J., Raytheon ITSS, USA; Hood, Robbie E., NASA Marshall Space Flight Center, USA; Guillory, Anthony R., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 24th; Hurricanes and Tropical Meteorology, 29 May - 2 Jun. 2000, Fort Lauderdale, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Advanced Microwave Precipitation Radiometer (AMPR) was deployed in four major tropical field programs in 1998-1999; the Texas-Florida Underflights (TEFLUN), the Third Convection and Moisture Experiment (CAMEX-3), the Tropical Rainfall Measuring Mission-Land Biosphere Atmosphere (TRMM-LBA) Experiment, and the Kwajalein Experiment (KWAJEX). Each experiment concentrated on a distinct tropical climate regime and/or phenomena. AMPR sampled passive microwave radiation at approximately 10, 19, 37, and 85 GHz from the NASA ER-2 (TEFLUN, CAMEX-3, TRMM-LBA) and the NASA DC-8 (KWAJEX) research aircraft. Presented will be the microwave brightness temperature signatures for each of these climate regimes. Results will be discussed and suggested avenues of research and development explored. Also, brightness temperature and precipitation comparisons with coincident data from the TRMM TMI and DMSP SSM/I(s) will be made where applicable and available.
Author
Brightness Temperature; Microwave Radiometers; Moisture; Precipitation (Meteorology); Signatures; Temperature Profiles; Tropical Regions; Data Acquisition

20000075258 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
TRMM Surface Backscatter Measurements - Temporal and Spatial Analysis: Inter-Comparison with NSCAT
Im, Eastwood, Jet Propulsion Lab., California Inst. of Tech., USA; Meagher, Jonathan, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Global rainfall is the primary redistributor of earth's energy by the process of latent heat release. This forms the main driving force for the tropical circulation, which in turn impacts the global circulation .through transient events-such as El Nino. Hence, more precise and long-term time series of the rainfall and its variability is crucial to the understanding and prediction of the global climate and climate change. The Precipitation Radar (PR) abroad the US/Japan Tropical Rainfall Measuring Mission (TRMM) is the first radar ever launched into space that measures detailed vertical profiles of rain intensity over the tropics. One of the challenges in estimating rainfall from spaceborne radars is the presence of attenuation at frequencies, such as 14 GHz of the TRMM PR and future planned systems at this and higher frequencies. A common approach in current rainfall retrieval algorithms is to

employed the path integrated attenuation (PIA) as a constraint to the retrieval, and hence overcome errors in the radar calibration or in the assumed rainfall parameters. PIA can either be derived from a radiometer or from the surface reference technique, in which a clear air radar measurement is compared with the measurement in the raining area. The current TRMM 2A21 PIA data product makes use of both a temporal and spatial clear air database for comparison to rainy measurements. In this paper we present results from analysis of TRMM surface backscatter cross-section (sigmaO) measurements from Nov 97-Feb99, and a comparison with sigmaO measurements obtained by the NASA Scatterometer (NSCAT) between Sept96-June97. Measurements for a given month from both instruments are compiled on a 1 deg. (lat.) x 1 deg. (lon.) x 1 hr. grid. This enables TRMM--NSCAT comparison and the investigation of seasonal and diurnal trends in both data sets. From preliminary analysis of TRMM sigmaO's we have decided not to treat the ocean as a single homogeneous region but to select a number of ocean sub-regions and individually analyze their trends. Likewise, and in a similar approach to previous studies of Seasat over-land data, we have selected a number of over-land regions for study. From said sigmaO maps and regional trend analysis we investigate possible sources of trends and variability. In addition, we study the effects of TRMM PR sensitivity through the PR "possible rain" class. Given NSCAT's inability to flag rain contaminated measurements we are able to gauge the impact of rain contamination on NSCAT monthly sigmaO maps, using TRMM measurements. The research described in this paper was carried out by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration (NASA), U.S.A.
Author
Backscattering; Climate Change; Data Bases; Measuring Instruments; Meteorological Radar; Scatterometers

20000075260 Meteorological Satellite Center, Kiyose, Japan
Discriminating Method of Cloud Systems Which Develop Into Tropical Cyclone in the Early Stage
Tsuchiya, Akio, Meteorological Satellite Center, Japan; Mikawa, Tetsuya, Meteorological Satellite Center, Japan; Kikuchi, Akihiro, Meteorological Satellite Center, Japan; Meteorological Satellite Center Technical Note; Mar. 2000; ISSN 0388-9653, No. 38, pp. 13-19; In Japanese; No Copyright; Avail: Issuing Activity

Although we use the Dvorak's Technique in tropical cyclone intensity analysis in MSC, we do not analyze the Initial Development(step 1A) and the 24-hour intensity forecast(step 10) as shown in the technique. Last year we experimented the analysis of the Initial Development(step 1A) by Dvorak's Technique. As the result of the experiment we recognize that we can estimate T-number 1.0 very well. and we also find that we can get the information if a tropical cyclone develops to a typhoon by monitoring in its intensity for an early stage of 24 hours.
Author
Procedures; Clouds (Meteorology); Tropical Storms; Weather Forecasting

20000075261 Meteorological Satellite Center, Kiyose, Japan
Characteristics of Extratropical Transition of Tropical Cyclones in Satellite Imagery
Suzuki, Kazufumi, Meteorological Satellite Center, Japan; Meteorological Satellite Center Technical Note; March 2000; ISSN 0388-9653, No. 38, pp. 21-42; In Japanese; Original contains color illustrations; No Copyright; Avail: Issuing Activity

Characteristics of tropical cyclones during extratropical transition were investigated. During this transition, a "dark area" in water vapor imagery intrudes into the center of tropical cyclone from the west, and a convective cloud line extended southward from near the cyclone center is organized. The former is related to the dissipation of the upper level warm core structure which is typical of tropical disturbances, and the latter corresponds to cold frontogenesis.
Author
Cyclones; Fronts (Meteorology); Satellite Imagery

20000075262 Meteorological Satellite Center, System Engineering Div., Kiyose, Japan
MTSAT Window Channels' (IR1 and IR2) Potential for Distinguishing Volcanic Ash Clouds
Tokuno, Masami, Meteorological Satellite Center, Japan; Meteorological Satellite Center Technical Note; March 2000; ISSN 0388-9653, No. 38, pp. 1-11; In English; No Copyright; Avail: Issuing Activity

GMS-5 infrared window channels [IR1 (10.5 - 11.5 microns) and IR2 (11.5 - 12.5 microns)] have been successfully used to distinguish volcanic ash clouds from water/ice clouds. Results for the Brightness Temperature Difference (BTD) of the two channels become negative for volcanic ash clouds and positive for ice/water clouds. The response functions of IR1 (10.3 - 11.5 microns) and TR2 (11.5 - 12.5 microns) for the Multi-functional Transport Satellite (MTSAT), a successor to GMS-5, have been significantly improved. Therefore, this research has documented the improvement in discrimination of volcanic ash clouds and meteorological clouds using two-channel data in the thermal infrared spectrum based on results derived from a radiative transfer model. Radiative transfer calculations have been made with a semitransparent cloud model based on assumptions of a spherical particle shape, a homogeneous underlying surface, and a simple thin cloud parallel to the surface. to evaluate the temperature difference

between two window channels caused by the difference in the two response functions, the BTD value was determined between two infrared window channels using MTSAT, GMS-5, and NOAA-14/AVHRR to observe quartz (volcanic ash cloud) and ice (meteorological high level cloud). Calculations were made with assumptions that: (1) the vertical profile of the atmosphere is the tropical, the midlatitude summer, and the midlatitude winter atmospheric model, (2) the cloud base height is 10 km for the midlatitude ml summer and winter atmospheric models, and 14 km for the tropical model over the surface while geometrical cloud thickness is 1 km, (3) a modified- gamma size distribution is used and the satellite optical cloud thickness is varied from 0 to 9 by changing the total number of particles per unit of volume. The results indicate that the BTD value is greatest for MTSAT, lesser for NOAA-14/AVHRR, and lowest with GMS-5 for every case in the study. For example, given a mode particle radius of 2 microns and satellite cloud optical depth of 3.0 in the tropical atmospheric model, the BTD value is -25K for MTSAT, -22K for NOAA-14/AVHRR, and -16K for GMS-5. Thus, results confirm that MTSAT data can further improve the detection of volcanic ash clouds in relation to images from GMS-5.
Author
Ashes; Volcanoes; Temperate Regions; Radiative Transfer; Optical Thickness; Infrared Windows; Ice Clouds; Brightness Temperature; Atmospheric Models

20000075263 Meteorological Satellite Center, Kiyose, Japan
On the Availability of Accumulated Rainfall Amount Estimated from GMS-5 IR Data for Monitoring Convective Activities Over the Tropics
Koyama, Tomoko, Meteorological Satellite Center, Japan; Meteorological Satellite Center Technical Note; March 2000; ISSN 0388-9653, No. 38, pp. 43-51; In Japanese; Original contains color illustrations; No Copyright; Avail: Issuing Activity

The Meteorological Satellite Center (MSC) has estimated ”Daily accumulated rainfall amount” as an experimental product since January 1st, 1999. This document describes comparisons made between monthly estimated rainfall from GMS-5 IR data and monthly precipitation amounts reported in the CLIMAT data format over a period from January 1999 to April 1999. A positive correlation was found between the CLIMAT monthly precipitation and the estimated rainfall data from GMS-5 IR channels. Diurnal variation was examined by using TBB (equivalent black-body temperature) and the total accumulated rainfall derived from GMS-5 IR channels on the base of 4-months averages at each 3 hourly observation times (from 00UTC to 21UTC) . by this comparison between both data, it is found that the estimated rainfall data exhibits more obvious diurnal variation than the TBB data and would be useful in the monitoring of convective activities over the tropical region.
Author
Estimating; Rain; Convection; Accumulations

20000075277 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
System Concepts for the Advanced Post-TRMM Rainfall Profiling Radars
Im, Eastwood, Jet Propulsion Lab., California Inst. of Tech., USA; Smith, Eric A., Florida State Univ., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Global rainfall is the primary distributor of latent heat through atmospheric circulation. The recently launched Tropical Rainfall Measuring Mission satellite is dedicated to advance our understanding of tropical precipitation patterns and their implications on global climate and its change. The Precipitation Radar (PR) aboard the satellite is the first radar ever flown in space and has provided. exciting, new data on the 3-D rain structures for a variety of scientific uses. However, due to the limited mission lifetime and the dynamical nature of precipitation, the TRMM PR data acquired cannot address all the issues associated with precipitation, its related processes, and the long-term climate variability. In fact, a number of new post-TRMM mission concepts have emerged in response to the recent NASA’s request for new ideas on Earth science missions at the post 2002 era. This paper will discuss the system concepts for two advanced, spaceborne rainfall profiling radars. In the first portion of this paper, we will present a system concept for a second-generation spaceborne precipitation radar for operations at the Low Earth Orbit (LEO). The key PR-2 electronics system will possess the following capabilities: (1) A 13.6/35 GHz dual frequency radar electronics that has Doppler and dual-polarization capabilities. (2) A large but light weight, dual-frequency, wide-swath scanning, deployable antenna. (3) Digital chirp generation and the corresponding on-board pulse compression scheme. This will allow a significant improvement on rain signal detection without using the traditional, high-peak-power transmitters and without sacrificing the range resolution. (4) Radar electronics and algorithm to adaptively scan the antenna so that more time can be spent to observe rain rather than clear air. and (5) Built-in flexibility on the radar parameters and timing control such that the same radar can be used by different future rain missions. This will help to reduce the overall instrument development costs. In the second portion of this paper, we will present

a system concept for a geostationary rainfall monitoring radar for operations at the geosynchronous Earth Orbit (GEO). In particular, the science requirements, the observational strategy, the instrument design, and the required technologies will be discussed. Author

Climatology; Low Earth Orbits; Meteorological Radar; Mission Planning; Precipitation (Meteorology); Rain; Trmm Satellite; Tropical Regions

20000075642 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Spacebased Observations of the Oceanic Responses to Monsoons in South China Sea and Arabian Sea

Xie, Xiao-Su, Jet Propulsion Lab., California Inst. of Tech., USA; Liu, W. Timothy, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A large percentage of the world's population and their agrarian economy must endure the vagaries of the monsoons over the tropical oceans between Africa and the Philippines. We know very little about the oceanic responses to changes of the monsoon in the South China Sea (SCS), which is under the influence of the East Asian Monsoon System, and the Arabian Sea (AS), which is dominated by the Indian Monsoon System; oceanic observations are sparse in both regions. Data from spaceborne microwave scatterometers and radiometers have been used to estimate the two major atmospheric forcing, momentum flux and latent heat flux (LHF), which change with the monsoon winds. Spaceborne sensors also observed the surface signatures of the oceanic response: SST and sea level changes (SLC. Sufficient durations of these data have recently become available to allow the meaningful studies of the annual cycles and interannual anomalies. In SCS, the winter monsoon is strong and steady but the summer monsoon is weak and has large intraseasonal fluctuations. In AS, the summer monsoon is much stronger than the winter monsoon. Significant correlations between LHF and SST tendency, and between curl of wind stress and SLC are found in both oceans. In the north SCS, winds are strong and dry, LHF is high, and ocean cooling is also large in fall; LHF is low and the ocean warms up in spring. In AS, LHF and SST tendency have a semi annual period; LHF is high in summer when the wind is strong and in winter when the wind is dry. Along the coast of Oman, the strong summer southwest monsoon causes intense upwelling, low SST and LHF in summer; such wind-driven SST changes is not as obvious along the Vietnam coast because of the weaker summer monsoon. The negative correlation between curl of wind stress and SLC found in the central basins of both SCS and AS agrees with a simple Ekman pumping scenario. Cyclonic winds drive surface divergence and upwelling in the ocean; the rise of the thermocline causes lower sea levels. Anticyclonic winds cause higher SLC. The exceptions (positive correlations) are found in the coastal regions in the north and the south of SCS, off the west coast of India between 5N and 10N, and along the coast of Somalia. Author

Monsoons; Anticyclones; Heat Flux; Atmospheric Circulation; Satellite-Borne Instruments; Thermoclines

20000076801 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Inst. fuer Physik der Atmosphaere, Wesseling, Germany

Proceedings of the COST 75 final seminar on advanced weather radar systems

Baumann, R.; Flender, F.; Hagen, M.; Hoeller, H.; Keil, C.; Jul. 31, 1998; 69p; In English

Report No.(s): DE99-719910; ETDE-DE-736; No Copyright; Avail: Department of Energy Information Bridge

Across Europe more than 110 weather radars are in operation. More than 60 of them are Doppler radars and this number is increasing steadily. Doppler systems are becoming an operational standard. Most systems operate in C-band, with the exception of the Spanish radar network which is composed of S-band Doppler radars. Radar product composites are available for Scandinavia and Central Europe. National networks exist for the UK, France and Spain. Europe further is fortunate to have 8 polarimetric Doppler radars used mainly for research. In Italy some of those systems are used also for operational nowcasting applications for dedicated customers. The Chilbolton multiparameter Doppler radar operates at S-band.

NTIS

Conferences; Radar Networks; Meteorological Radar; Doppler Radar

20000076828 National Weather Service, Silver Spring, MD USA

Vision 2005: National Weather Service Strategic Plan for Weather, Water and Climate Services, 2000-2005

Aug. 1999; 26p

Report No.(s): PB2000-106263; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Contents include: The Importance of Weather, Water, and Climate Conditions to America in the 21st Century; Strategic Context; The Changing World: Opportunities and Challenges; National Weather Service-Past and Future; Serving Our Customers; Relation to the Department of Commerce and NOAA Strategic Plans; Vision and Goals 2000-2005; Agenda for Action-Interlocking Goals for Advancement (Deliver Better Products and Services; Capitalize on Scientific and Technological Advances; Exercise

Global Leadership; Change the NWS Organizational Culture; Manage NWS Resources); Continuing a 130-Year Legacy-Improved and Innovative Service to America; and NWS Corporate Board Concurrence.
NTIS
Meteorological Services; Weather Forecasting; Weather Stations; Meteorological Instruments; Climate; Hydrology; Weather

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.

20000074721 Onsala Space Observatory, Sweden
Ocean Loading Tides For, In, and From VLBI
Scherneck, Hans-Georg, Onsala Space Observatory, Sweden; Haas, Ruediger, Onsala Space Observatory, Sweden; Laudati, Alessandro, Onsala Space Observatory, Sweden; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 257-262; In English; See also 20000074683
Contract(s)/Grant(s): FMRX-CT96-0071; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The general problem of predicting surface displacements due to ocean tide loading is reviewed. This includes the procedures in the IERS Conventions and suggestions for their next issue. In order to increase modeling accuracy we focus on the tides in the Gulf of Maine. This area is difficult to represent in global tide models. The VLBI station of Westford is located close enough to open up a model inversion opportunity. We have revived an ocean tide model to compute fully time-dependent solutions; in one run we included forcing by air pressure using ECMWF pressure fields and the corresponding geostrophic wind. We show observed ocean loading parameters and discuss the remaining discrepancies with respect to the model results.
Author
Ocean Models; Earth Tides; Very Long Base Interferometry; Displacement; Loads (Forces); Ocean Dynamics

20000074801 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Oceanic Excitation of Polar Motion During 1992-1994
Gross, R., Jet Propulsion Lab., California Inst. of Tech., USA; Chao, Y., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Two global ocean general circulation models have been used to compute the angular momentum of nontidal oceanic current and sea level height variations: (1) the Princeton Modular Ocean Model (MOM) having 22 vertical layers and a rigid lid, and (2) the Miami Isopycnic-Coordinate Ocean Model (MICOM) having 11 vertical layers with a mixed layer and a free surface. Both models were run on the same 2 degree longitude by 1 degree latitude grid spanning 80 S to 80 N latitude. Following a 10-year spin-up with climatological air-sea fluxes, both models were forced during 1992-1994 with daily wind and heat flux from the NCEP operational analysis and sea surface salinity restoring to Levitus climatology. After correcting for the effects of mass non-conservation in these models, they are shown to predict similar effects on polar motion excitation of sea level height variations, but the effect of currents predicted by MOM is much larger than that predicted by MICOM.
Author
Air Water Interactions; Climatology; Density Distribution; Ocean Dynamics; Ocean Models; Computerized Simulation; Computation; Angular Momentum

20000075209 NASA Wallops Flight Facility, Wallops Island, VA USA
Open Ocean and Landfalling Hurricane Directional Wave Spectra from a Scanning Radar Altimeter
Wright, C. Wayne, NASA Wallops Flight Facility, USA; [2000]; 1p; In English; 6th; 6th International Conference on Remote for Marine and Coastal Env., 1-3 May 2000, Charleston, SC, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The sea surface directional wave spectrum was measured for the first time in all quadrants of a hurricane in open water using the NASA airborne scanning radar altimeter (SRA) carried aboard one of the National Oceanic and Atmospheric Administration (NOAA) WP-3D hurricane research aircraft at 1.5 km height. The open-ocean data were acquired on 24 August 1998 when Bonnie, a large category 3 hurricane, was east of the Bahamas and moving about 5 meters per second toward 330. The NOAA aircraft spent over five hours within 180 km of the hurricane Bonnie eye and made five eye penetrations. Individual waves with heights up to 18 m were observed and the spatial variation of the wave field was dramatic. The dominant waves generally propagated at significant angles to the downwind direction. At some positions there were three different wave fields of comparable energy cross-

ing each other. On 26 August 1998, the SRA documented the wave spectrum spatial variation while Bonnie was making landfall near Wilmington, NC.
Author
Airborne Radar; Radio Altimeters; Hurricanes; Ocean Surface; Surface Waves; Spectra

20000075544 Mississippi State Univ., Dept. of Computer Science, Mississippi State, MS USA
Knowledge Discovery in an Object-Oriented Oceanographic Database System ***Final Report, 1 Sep. 1996-31 Dec. 1999***
Hodges, Julia; Bridges, Susan; Jun. 14, 2000; 26p; In English
Contract(s)/Grant(s): N00014-96-1-1276
Report No.(s): AD-A378406; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The rate at which scientific data is collected today has overwhelmed the ability of scientists to store and analyze the data. This report describes the results of a three year effort in the development of a knowledge discovery system for use by oceanographers at the Naval Oceanographic Office (NAVOCEANO) at the Stennis Space Center in the identification of provinces of interest in the ocean floor from acoustic imagery. The system is composed of a knowledge discovery component built to interact with a database system currently in use at Stennis Space Center. The knowledge discovery system applies machine learning techniques to features extracted from sonar images to identify provinces of the ocean floor based on visual texture. This requires that the images be segmented into regions of homogeneous texture using a region-growing technique, that features describing the texture of these regions be extracted, that machine learning techniques be applied to classify the regions, that classified images be constructed for visualizing the results, and that the classified images be combined and geo-referenced using a mosaic procedure. NAVOCEANO is currently supporting efforts to integrate the software developed from this project with their image analysis system.
DTIC
Data Bases; Image Analysis; Machine Learning; Oceanography; Self Organizing Systems; Computer Programs; Image Processing; Oceanographic Parameters

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.

20000074288 National Agency for Medicines, Helsinki, Finland
Phototherapy appliances, their ultraviolet radiation and quality assurance of phototherapy
Huurto, L.; Leszczynski, K.; Visuri, R.; Ylianttila, L.; Jokela, K.; Dec. 31, 1998; 69p; In Finnish
Report No.(s): DE99-636794; LL-JULK-4/1998; ISBN 952-5099-22-9; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Artificial UV radiation (UVR) is used in the treatment of psoriasis and other skin diseases. Long term phototherapy is associated to increased risk of squamous cell carcinoma. This report gives a short review of biological effects of UVR and technical aspects of phototherapy units. The phototherapy units used in Finnish Central hospitals are described and the measured UVR dose rates of these units are presented. In addition, the UVR meters used in hospitals are described and the calibration factors are given for UVR dose rate measurements. Finally, recommendations are given for the quality assurance of photo-therapy units as well as for assessing UVR doses of patients.
NTIS
Therapy; Ultraviolet Radiation; Quality Control

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.

20000074644 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Multimode-Optical-Fiber Imaging Probe
Jackson, Deborah, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Currently, endoscopic surgery uses single-mode fiber-bundles to obtain in vivo image information inside orifices of the body. This limits their use to the larger natural bodily orifices and to surgical procedures where there is plenty of room for manipulation. The knee joint, for example can be easily viewed with a fiber optic viewer, but joints in the finger cannot. However, there are a host of smaller orifices where fiber endoscopy would play an important role if a cost effective fiber probe were developed with small enough dimensions (is less than 250 microns). Examples of beneficiaries of micro-endoscopes are the treatment of the Eustatian tube of the middle ear, the breast ducts, tear ducts, coronary arteries, fallopian tubes, as well as the treatment of salivary duct parotid disease, and the neuro endoscopy of the ventricles and spinal canal. to solve this problem, this work describes an approach for recovering images from. tightly confined spaces using multimode fibers and analytically demonstrates that the concept is sound. The proof of concept draws upon earlier works that concentrated on image recovery after two-way transmission through a multimode fiber as well as work that demonstrated the recovery of images after one-way transmission through a multimode fiber. Both relied on generating a phase conjugated wavefront which was predistorted with the characteristics of the fiber. The described approach also relies on generating a phase conjugated wavefront, but utilizes two fibers to capture the image at some intermediate point (accessible by the fibers, but which is otherwise visually unaccessible).
Author
Imaging Techniques; Fiber Optics; Endoscopes; Coronary Circulation

20000074735 Communications Research Lab., Kashima Space Research Center, Kashima, Japan
Optical Linked VLBI in Japan
Nakajima, Junichi, Communications Research Lab., Japan; Koyama, Yasuhiro, Communications Research Lab., Japan; Kondo, Tetsuro, Communications Research Lab., Japan; Sekido, Mamoru, Communications Research Lab., Japan; Takahashi, Yukio, Communications Research Lab., Japan; Kawai, Eiji, Communications Research Lab., Japan; Okubo, Hiroshi, Communications Research Lab., Japan; Kiuchi, Hitoshi, Communications Research Lab., Japan; Kawaguchi, Noriyuki, National Astronomical Observatory, Japan; Kimura, Moritaka, National Astronomical Observatory, Japan; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 334-337; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Optical linked VLBI is the key technology to change historical VLBI style in this decade. It will not only achieve high sensitivity by the fast data transfer beyond magnetic tapes, but other features are also attractive for the VLBI operation. The optical linked data transfer without the media transport and its real-time correlation capability enables the quick look of observations. This means our global VLBI network will serve as a connected interferometer. Dynamic scheduling and realtime fringe checks eliminate independent fringe tests before observation and after standby. These features of optical linked VLBI minimize observation failure usually known long after observation and maximize telescope resources. Currently operated optical VLBI network KSP (Key Stone Project), GALAXY (Giga-bit Astronomical Large Array Xross-connect) and other experimental based optical VLBI in Japan are briefly summarized in this report.
Author
Very Long Base Interferometry; Optical Data Processing; Data Transmission; Interferometers; Real Time Operation

20000075211 NASA Ames Research Center, Moffett Field, CA USA
Stress, Aging and Thirst
Greenleaf, John E., NASA Ames Research Center, USA; Facts, Research and Intervention in Geriatrics, 1998: Hydration and Aging; [1998]; 7p; In English; ISBN 2-909342-52-2; Copyright; Avail: Issuing Activity

After growth during adolesence, total body water decreases progressively with aging from 65% of body weight to about 53% of body weight in the 70th decade; a majority of the loss occurs from the extracellular volume, from 42% to about 25%, respectively. Cellular volume also reaches equilibrium in the 70th decade at about 25% of body weight. Various stresses such as exercise, heat and attitude exposure, ad prior dehydration attenuate voluntary fluid intake (involuntary dehydration). Voluntary fluid intake

appears to decrease with aging (involuntary dehydration in this sense aging can be considered as a stress. Kidney function and muscle mass (80% water) decrease somewhat with aging, and voluntary fluid intake (thirst) is also attenuated. Thirst is stimulated by increasing osmolality (hypernatremia) of the extracellular fluid and by decreased extracellular volume (mainly plasma volume) which act to increase intracellular fluid volume osmolality to activiate drinking. The latter decreases fluid compartment osmolality which ' It terminates drinking. However, this drinking mechanism seems to be attenuated with aging such that increasing plasma osmolality no longer stimulates fluid intake appropriately. Hypernatremia in the elderly has been associated all too frequently with greater incidence of bacterial infection and increased mortality. Involuntary dehydration can be overcome in young men by acclimation to an intermittent exercise-in-heat training program. Perhaps exercise training in the elderly would also increase voluntary fluid intake and increase muscle mass to enhance retention of water.
Author
Age Factor; Dehydration; Drinking; Aging (Biology); Gerontology; Water Loss

20000075545 Naval Health Research Center, San Diego, CA USA
A Proposal for Integrated Shipboard Alertness Management
Makeig, Scott; Neri, David F.; Mar. 13, 1996; 12p; In English
Report No.(s): AD-A378421; NHRC-96-4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Under reduced manning policies now proposed for U.S. military naval vessels, continuity of on-duty crew alertness may become a major problem. We propose an integrated hardware and software system for fatigue and alertness management of military shipboard personnel, which would involve: (1) continuous, noninvasive monitoring of crew sleep history via wristband activity monitor; (2) dynamic work/rest scheduling software for optimizing crew schedules under changing missions and personnel demands; and (3) real time, objective alertness monitoring of on-duty crew in key work stations using electroencephalographic (EEG) signals recorded via noninvasive dry electrodes built into a cap or audio headset. The system would allow commanders to make operational decisions based on objective knowledge of their crew's state of fatigue and alertness, to maximize human-system efficiency and safety.
DTIC
Electroencephalography; Sleep Deprivation; Computer Programs; Fatigue Life; Real Time Operation; Ships

20000075722 Naval Health Research Center, San Diego, CA USA
An Epidemiologic Study of the Association Between Patterns of Physical Training and Musculoskeletal Injuries *Final Report, 1994-1995*
Almeida, Sandra A.; Williams, Karen M.; Shaffer, Richard S.; Brodine, Stephanie K.; Jan. 1998; 28p; In English
Report No.(s): AD-A378312; NHRC-96-32; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study identified rates of diagnosis-specific musculoskeletal injuries in USA Marine Corps (USMC) recruits, and examined the association between patterns of physical training and these injuries. Subjects were 1,296 randomly selected USMC male recruits, ages 17 to 28 years, who reported to Marine Corps Recruit Depot (MCRD) San Diego for boot camp training between January 12 and September 14, 1993. Recruits were followed prospectively through 12 weeks of training for injury outcomes. Weekly volumes and types of vigorous physical training were correlated with injury patterns. The overall injury rate was 39.6%, with 82% of injuries occurring in the lower extremities. Overuse injuries accounted for 78% of the diagnoses. The most frequent site of injury was the ankle/foot region (34.3% injuries), followed by the knee (28.1%). Ankle sprains (6.2%, n = 1,143), iliotibial band syndrome (5.3%, n = 1,143), and stress fractures (4.0%, n= 1,296) were the most common diagnoses. The highest rates of injury were reported during the first 3 weeks of training and during weeks 8,10, and 11. These weeks included high total volumes of vigorous physical training and the greatest number of hours of running and military marching.
DTIC
Injuries; Musculoskeletal System; Physical Fitness; Epidemiology

20000075965 Naval Health Research Center, San Diego, CA USA
Limits of Tolerance to Hypothermia *Final Report*
Pozos, R. S.; Iaizzo, P. A.; Danzl, D. F.; Mills, W J.; Aug. 09, 1993; 57p; In English
Report No.(s): AD-A378275; NHRC-93-15; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

With the advent of sophisticated rewarming techniques, physiologic systems demonstrate great tolerance to hypothermia. Organs can be cooled, and in some cases frozen, leading to a decrease in metabolic demands and then rewarmed with little or no long-term damage. Not all cases of hypothermia are reversed with rewarming. The major challenge for extending the limits of tolerance to hypothermia is to ascertain the fundamental mechanisms that are unleashed upon rewarming. The microvasculature remains the key site for extending human tolerance to hypothermia. The currently favored hypothesis for frostbit- induced damage

is that free radicals are released by reperfusion that subsequently alter vascular tone. Eventually, these changes cause failure of the microcirculation and endothelial cell damage, resulting in thrombosis and necrosis. It is probable that the same cascade of events that occurs in frostbite also occurs during rewarming of the hypothermic patient. Predicting which system will fail upon rewarming is difficult since in many cases the hypothermia is secondary to some underlying pathology. This review will focus on two aspects of tolerance to the cold: 1) the physiologic effects that occur during hypothermia, and 2) the role various forms of rewarming play in reversing hypothermia.
DTIC
Human Tolerances; Hypothermia; Physiological Effects; Free Radicals; Frostbite

20000076642 NASA Langley Research Center, Hampton, VA USA
Aerospace Medicine and Biology: A Continuing Bibliography With Indexes, Supplement 502
July 2000; 45p; In English
Report No.(s): NASA/SP-1999-7011/SUPPL502; NAS 1.21:7011/SUPPL502; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This supplemental issue of Aerospace Medicine and Biology, A Continuing Bibliography with Indexes (NASA/SP-2000-7011) lists reports, articles, and other documents recently announced in the NASA STI Database. In its subject coverage, Aerospace Medicine and Biology concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. Two indexes-subject and author are included after the abstract section.
CASI
Aerospace Medicine; Bibliographies; Exobiology; Bioastronautics; Biological Effects; Indexes (Documentation); Pharmacology

20000076825 Institute of Space Medico-Engineering, Beijing, China
Space Medicine and Medical Engineering (Hangtian Yixue yu Yixue Gongcheng), Volume 13, No. 1, February 2000 ***Space Medicine and Medical Engineering***
Feb. 2000; 88p; In Mixed
Report No.(s): PB2000-106338; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Topics discussed are: Effect of Total Flavonoids of Hippophae Rhamnoides on Contractile Mechanics and Calcium Transfer in Stretched Myoctye (in English); Effects of Rotating-table Simulated 'Push-Pull Maneuver' on Cerebral Circulation Function; Material Selection and Structural Design of Simulated Space Module for Field; Effects of Acute Hypobaric Hypoxia on the Distribution of Somatostatin Contents in lower Gastrointestinal Tract of Rats; Measurement and Evaluation of Visual Index in VDT Operators under Multi-User System; Weightlessness and Heat Stress on Astronauts; and Chinese Science Citation Database (CSCD) Fulfilled and Made in Use.
NTIS
Aerospace Medicine; Weightlessness; Biometrics

20000076826 Institute of Space Medico-Engineering, Beijing, China
Space Medicine and Medical Engineering (Hangtian Yixue yu Yixue Gongcheng), Volume 12, No. 5, October 1999
Wei, J.; Oct. 1999; 88p; In Mixed
Report No.(s): PB2000-106337; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Topics discussed are: Analysis of Heart Rate Variability during Parallel Swinging; Effects of Tea Polyphenols on Microcirculation and Antioxidation in Aircrew; Analysis of Mass Optimization of Manned Spacecraft ECLSS Thermo-hydraulic Network; Effect of Extremity Cuffs as a Countermeasure against the Cardiovascular Deconditioning during 21 d Heat-down Bedrest; Temperature Environment and the Heat Exchange of Astronaut in the Emergency Landing Areas; and Mechanisms and Detection of G-induced Loss of Consciousness.
NTIS
Aerospace Medicine; Biometrics; Weightlessness

20000078371 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Human Tolerance to Acceleration Loads Generated in High-Performance Helicopters

Shender, Barry S.; Jan. 2000; 43p; In English

Report No.(s): AD-A378150; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The risk to helicopter aircrew of acceleration stress was assessed by investigating the human physiologic response to transitions from - 1 Gz (push) to +4.5 Gz (pull) loads. Nine volunteers participated in a study conducted at the Veridian Operations Centrifuge Facility in Warminster, PA. A 1-hr mission scenario consisting of nine helicopter maneuvers, based on in-flight G measurements (push-pull mission, PPM), simulated both current (CM: .0.2 to +3.3 Gz) and projected future platform capabilities (FM: -1 to +4.5 Gz). Measurements included blood pressure, heart rate (FIR), loss of vision, and subjective fatigue. Visual decrements were minimal during CM while muscular tensing was required to avoid blackout during FM. Light loss typically occurred during the transition from -Gz to +Gz. Within the scope of these tests, subjects tolerated the range of Gz-stresses associated with current USN rotary wing platforms. When subjected to FM G-loads (typical of current USA platforms), cardiovascular stress significantly increased, Gz tolerance dropped as much as 1.2 6, and HR increased as much as 67 bpm. Cardiovascular changes were significantly greater during FM PPM relative to GM. Four subjects reported Almost-Loss of Consciousness symptoms during FM. While G-stress experienced by aircrew generated by current helicopters does not appear to present a high risk, 6 awareness training is recommended to reduce risks to aircrew exposed to G-loads generated by more aggressive helicopters. Future studies are required to determine the impact of longer mission times and dehydration.

DTIC

Helicopters; Human Reactions; Human Tolerances; Flight Crews; Physiological Effects; Acceleration Tolerance; Flight Simulation

53
BEHAVIORAL SCIENCES

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

20000075969 Naval Postgraduate School, Monterey, CA USA

An Interactive Virtual Environment for Training Map-Reading Skill in Helicopter Pilots

McLean, Timothy D.; Sep. 1999; 121p; In English

Report No.(s): AD-A378330; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Currently, Student Naval Aviators are trained to interpret 1:50,000 scale contour maps by watching VHS videotapes. These tapes show a helicopter moving about twice its normal speed over desert terrain. Primarily due to the lack of interactivity in these videos, students often make mistakes very early in the videotaped flight. The helicopter does not stop until the tape is over, hence, the training evolution quickly becomes useless because students usually make mistakes during the first minute of the tape and are unable to recover or to learn from those mistakes. Based on a previous study at the Naval Postgraduate School, a training system that utilizes virtual environment technology was developed that is compliant with the Information for the 21st Century (IT-21) initiative. The system was built using a Windows NT / Intel (Wintel) based computer along with three 24-inch monitors to train the tasks of map interpretation and terrain association. This desktop system was fielded at Helicopter Antisubmarine Squadron 10 (HS-10) for experimentation. Results of this experiment indicate that student pilots who received VE training performed the navigation task better in the helicopter than students who received only conventional training. Also, an IT-21 Wintel based computer is capable of rendering a graphically intensive multi-monitor application at frame rates suitable for training.

DTIC

Aircraft Pilots; Air Navigation; Virtual Reality; Computer Assisted Instruction; Pilot Training

54
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..

20000074273 Naval Undersea Warfare Center, Newport, RI USA
Ultrasonic Disinfection of Water Suspensions of Escherichia Coli and Legionella Pneumophila
Evora, Victor F., Naval Undersea Warfare Center, USA; Kavarnos, George J., Thames Testing Lab., LLC, USA; Apr. 05, 1999; 18p; In English
Report No.(s): AD-A365444; TR-11.086; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This report describes an experiment in which water samples innoculated with Escherichia (E) coli and Legionella (L) Pneumophila organisms were exposed to ultrasonic energy. It visa found that treating t samples with pule" of ultrasound for at least 15 minutes at a 50% amplitude virtually eliminated the E. coli colonies. Longer exposure times were required to completely destroy L. pneumophila. Although the water samples experienced slight warming during the course of the ultrasonification, control experience on which the test samples were not exposed to ultrasound but simply warmed have supported the conclusion that the test organisms were destroyed by acoustic energy alone. The use of ultrasound as an applied and commerical technology for disinfecting water supplies in also discussed in the report. However, the mechanisms of cell destruction not yet fully understood, am left for the subject of a future publication.
Author
Antiseptics; Escherichia; Sound Waves; Ultrasonics; Antiinfectives and Antibacterials; Sterilization; Bactericides; Decontamination; Water Treatment

20000076818 Chief of Naval Development, Washington, DC USA
Joint Service Lightweight Integrated Suit Technology (JSLIST), Operational Requirements Document (ORD) ***Final Report***
May 17, 2000; 32p; In English
Report No.(s): AD-A378165; ORD-556-86-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During Operation Desert Storm (ODS), a major deficiency identified was the inability of U.S. forces to provide the warfighter with percutaneous protection against Nuclear, Biological, and Chemical (NBC) Warfare agents and Toxic Industrial Materials (TIMs). Current national military strategy specifies a worldwide force projection capability that requires U.S. forces to employ effective force protection measures against NBC threats. JSLIST will meet the Joint Chief's urgent need to enhance the survivability of U.S. forces. The JSLIST will provide the wearer with protection from the effects of NBC contaminants and TIMs in any form or state. The JSLIST will be an integrated ensemble consisting of a protective garment (with/without a hood), footwear and gloves; and be compatible with the protective mask currently in inventory and those in development.
DTIC
Protective Clothing; Chemical Warfare; Military Operations; Chemical Defense

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.

20000076135 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Semiinfinite Cohomology of Contragradient Weyl Modules over Small Quantum Groups
Arkhipov, S.; Apr. 2000; 26p
Report No.(s): PB2000-106237; IHES/M/00/31; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The present paper can be considered as a natural extensive the article (Ar7). Fix root data (Y,X ,...) of the finite type (I,.) and positive integer number l. In (Ar7) the authors obtained a nice description for semiinfinite cohomology of the trivial module C over the small quantum group u(sub l) corresponding to the root data (Y,X,...) in terms of local cohomology of the structure sheaf on the nilpotent cone N in the semisimple. The geometric approach to various homological questions concerning the algebra U(sub l) appeared first in the pioneering paper of Ginzburg and Kumar (GK). Let us state the main result from that paper.
NTIS
Algebra; Homology

20000076471 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Representation of Generalized Braid Group in Classical Braid Group
Roushon, S. K.; Feb. 2000; 26p
Report No.(s): PB2000-106153; IHES/M/00/08; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We ask if any finite type generalized braid group is a subgroup of some classical Artin braid group. We define a map from a given finite type generalized braid group to a classical Artin braid group and ask if this map is an injective homomorphism. We also check that this map is homomorphism for the generalized braid groups of type A(n), B(n) and I(2)(k).
NTIS
Automorphisms; Subgroups; Theorems

20000076612 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Nakai-Moishezon Criterion for Non-Kaehler Surfaces
Buchdahl, N.; Dec. 1999; 14p; In English
Report No.(s): PB2000-106158; IHES/M/99/88; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A version of the classical Nakai-Moishezon Criterion is proved for all compact complex surfaces, regardless of the parity of the first Betti number.
NTIS
Manifolds (Mathematics); Differential Geometry

20000076613 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette, France
Congruence Subgroups and Rational Conformal Field Theory
Coste, A.; Gannon, T.; Sep. 1999; 28p; In English
Report No.(s): PB2000-106159; IHES/M/99/76; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
No abstract available.
NTIS
Congruences; Subgroups; Field Theory (Algebra)

20000076619 Joint Inst. for Nuclear Research, Lab. of High Energies, Dubna, USSR
Maximum entropy technique in the doublet structure analysis
Belashev, B. Z.; Panebrattsev, Y.; Shakhaliev, E.; Soroko, L. M.; Dec. 31, 1998; 28p; In English
Report No.(s): DE99-616060; JINR-E-11-98-90; No Copyright; Avail: Department of Energy Information Bridge
The Maximum Entropy Technique (MENT) for solution of the inverse problems is explained. The effective computer program for resolution of the nonlinear equations system encountered in the MENT has been developed and tested. The possibilities of the MENT have been demonstrated on the example of the MENT in the doublet structure analysis of noisy experimental data. The comparison of the MENT results with results of the Fourier algorithm technique without regularization is presented. The tolerant noise level is equal to 30% for MENT and only 0.1% for the Fourier algorithm.
NTIS
Maximum Entropy Method; Computer Programs

20000076636 Rutherford Appleton Lab., Computational Science and Engineering Dept., Oxford, UK
Superlinear Convergence of Primal-Dual Interior Point Algorithms for Nonlinear Programming
Gould, N. I. M.; Orban, D.; Sartenaer, A.; Toint, P. L.; Apr. 07, 2000; 40p; In English
Report No.(s): PB2000-106351; RAL-TR-2000-014; Copyright; Avail: National Technical Information Service (NTIS)
The local convergence properties of a class of primal-dual interior point methods are analyzed. These methods are designed to minimize a nonlinear, nonconvex, objective function subject to linear equality constraints and general inequalities. They involve an inner iteration in which the log-barrier merit function is approximately minimized subject to satisfying the linear equality constraints, and an outer iteration that specifies both the decrease in the barrier parameter and the level of accuracy for the inner minimization.
NTIS
Convergence; Algorithms; Nonlinear Programming

20000076637 Rutherford Appleton Lab., Computational Science and Engineering Dept., Oxford, UK
Lanczos Method with Semi-Inner Product
Meerbergen, K.; Apr. 18, 2000; 22p; In English
Report No.(s): PB2000-106352; RAL-TR-2000-010; Copyright; Avail: National Technical Information Service (NTIS)

The spectral transformation Lanczos method is very popular for solving large scale Hermitian generalized eigenvalue problems. The method uses a special inner product so that the symmetric Lanczos method can be used. Sometimes, a semi-inner product must be used. This may lead to instabilities and break-down. In this paper, the authors suggest a cure for breakdown by use of an implicit restart in the Lanczos method.
NTIS
Spectrum Analysis; Transformations (Mathematics)

20000076830 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Slow Motion and Metastability for a Non Local Evolution Equation
Butta, P.; De Masi, A.; Apr. 2000; 34p; In English
Report No.(s): PB2000-106222; IHES/P/00/33; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper we continue the analysis of a non local mean field equation, proving the existence of an invariant, unstable, one dimensional manifold connecting the critical droplet with the stable and metastable phases. We prove that the points on the manifold are droplets longer or shorter than the critical one, and that their motion is very slow in agreement with the theory of metastable patterns.
NTIS
Metastable State; Evolution (Development)

61
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.

20000074716 Naval Observatory, Washington, DC USA
Mark 4 Data Analysis: Software Changes and Early Experiences
Archinal, Brent A., Naval Observatory, USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 236; In English; See also 20000074683; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Data from the Mark IV correlator hardware/software system should first become available in late November, 1999. For various reasons, this data is formatted differently than that of the earlier Mark III and IIIA systems, for example because additional types of data and diagnostic information are available. Changes have been made and will continue to be made to the ”Calc/Solve” analysis system in order to process the data in this new format. These changes and early experience in processing such data will be discussed, and some questions will be raised about whether further changes, i.e. in algorithms, weighting, and databases may be appropriate or even necessary.
Author
Computer Programs; Correlators; Data Processing; Very Long Base Interferometry

20000074733 Centre National d’Etudes Spatiales, Groupe de Recherches de Geodesie Spatiale, Toulouse, France
GINS: A New Multi-Technique Software for VLBI Analysis
Meyer, Ulrich, Centre National d’Etudes Spatiales, France; Charlot, Patrick, Observatoire de Bordeaux, France; Biancale, Richard, Centre National d’Etudes Spatiales, France; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 324-328; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The GINS software, developed initially for analysis of satellite geodetic technique data, has recently been extended with a VLBI module for analysis of both Earth-based and space VLBI observations. This report presents the current status of its development and discusses future plans. These include analysis of space VLBI data from the VSOP/HALCA satellite as well as multi-technique (VLBI/SLR/DORIS/GPS) combinations of geodetic data at the observation level.
Author
Geodesy; Very Long Base Interferometry; Computer Programs; Data Processing; Data Reduction

20000075546 Naval Postgraduate School, Monterey, CA USA
COM and XPCOM as a Solution to Bamboo's Versioning Problem
Daglar, Mithat; Mar. 2000; 141p; In English
Report No.(s): AD-A378430; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Bamboo is a systems toolkit that is primarily concerned with supporting performance-critical applications that must run continuously for extremely long periods of time. Bamboo supports this by managing the loading and unloading of executable code into and out of process memory at runtime. Thus, as application requirements change over time, obsolete code can be replaced without having to restart the application. This technique's flexibility has already been demonstrated, but fails in one critical way. Although the C++ programming language standard defines a consistent syntax, it fails to specify a consistent binary encapsulation. Thus, if the executable code for a C++ base class is dynamically replaced, it is very likely that its in memory layout differs from before and therefore incompatible with whatever derived classes may exist. The only recourse is to recompile and reload the derived classes as well. Component Object Model (COM) and Cross Platform Object Model (XPCOM) solve C++'s weakness by enforcing a complete separation of a class' interface from its implementation. This thesis demonstrates support for dynamic versioning of Bamboo C++ modules using COM and XPCOM.
DTIC
Object-Oriented Programming; Software Engineering; Computer Programs

20000075971 California Univ., Dept. of Electrical Engineering and Computer Science, Berkeley, CA USA
Advanced Microwave Tube Computer Experiments Research ***Final Report, 1 May 1996-30 Apr 2000***
Birdsall, Charles K.; Apr. 30, 2000; 50p; In English
Contract(s)/Grant(s): F49620-96-1-0154; AF Proj. 2301
Report No.(s): AD-A378343; AFRL-SR-BL-TR-00-0217; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As one of the pioneering efforts in object-oriented (OO) scientific programming, XOOPIC has demonstrated conclusively the benefits of the methods. The code extensibility and development costs are lower, and the development more rapid than traditional methods. Similar methods of simplifying development and maintenance are now propagating into industrial and laboratory codes, including MRC's MAGIC and AF Phillips Lab's ICE-PIC.
DTIC
Object-Oriented Programming; Microwave Tubes; Computerized Simulation; Computer Programs

20000076114 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
A Validation Assessment of the Storm Air-to-Air Prototype Algorithm
Pugh, David M.; Mar. 2000; 125p; In English
Report No.(s): AD-A378254; AFIT/GOA/ENS/00M-06; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A validation assessment of the new STORM air-to-air prototype algorithm is accomplished using structural and output validation techniques. In the structural validation phase, the algorithms, code, and assumptions are evaluated to determine if the implementation of the model will match the intent of the designers. The components of the algorithm are compared to its predecessor, THUNDER, to evaluate if the prototype improves upon the weaknesses of THUNDER. In the output validation phase, the results of the model are evaluated to determine the extent to which the implementation of the model matches expected outcomes. Sensitivity analysis is presented to provide insight into the responsiveness of the algorithm to changes in aircraft performance. A two-level half-fraction factorial design with seven factors is used to determine the most significant factors.
DTIC
Aircraft Performance; Algorithms; Simulation

20000076115 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Locating Search and Rescue Stations in the Aegean and Western Mediterranean Regions of Turkey
Basdemir, M. M.; Mar. 2000; 127p; In English
Report No.(s): AD-A378256; AFIT/GOR/ENS/00M-03; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The service of present Search and Rescue (SAR) stations in the Aegean and the Western Mediterranean regions of Turkey are not sufficient to meet the demands of the Turkish Air Force. This research seeks to find the optimum location of new SAR stations. The number of SAR stations required to cover all areas of operation becomes a very decisive element in finding the optimal coverage of the operation area by these stations. The problem of finding the optimum SAR locations can he modeled as a maximal covering location problem (MCLP). Additional constraints are added to set standards on various issues in the regions. Main emphasis is to given to finding the minimum number of SAR locations that achieves maximum coverage in the operation area. Bonus values that indicate the importance of covering demand points are also included for analysis purposes. The model

is coded and solved with an optimization software. The solution shows the location of SAR stations and the total coverage in the area based on the operational capacity of SAR units. Several scenarios are examined and the results are then analyzed and presented.
DTIC
Rescue Operations; Computer Programs; Position (Location)

20000076472 Kazakhskij Gosudarstvennyj Natsional'nyj Univ., Kazakhstan
Numerical simulation of dynamics of 2 (pi)-solitons at forced combination scattering
Akanaev, B. A.; Akanaev, A. B.; Dzhumagulov, O. M.; Shakirov, A.; Dec. 31, 1998; 130p; In Russian; In English
Report No.(s): DE99-616838; INIS-KZ-037; No Copyright; Avail: Department of Energy Information Bridge
In the paper the necessity to consider physical processes at nonlinear interaction of soliton waves during processes of forced combination scattering is stated. The nonlinear equations in partial derivative describing such process are deduced. The numerical algorithm of solution is constructed, the program in the PASCAL language is written and the results are received as diagrams.
NTIS
Scattering; Shock Waves; Solitary Waves

62
COMPUTER SYSTEMS

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

20000075212 Naval Postgraduate School, Monterey, CA USA
Analysis for A Trusted Computing Base Extension Prototype Board
Turan, Bora; Mar. 2000; 117p; In English
Report No.(s): AD-A377677; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
Agencies, institutions, individuals are demanding the use of commercial-off-the-shelf systems and cannot enforce mandatory security policies with these systems, which are equipped only with discretionary access controls. An inexpensive implementation of a multilevel secure local area network utilizing commercial-off-the-shelf hardware and software does not exist. The Naval Postgraduate School (NPS) is developing a Multilevel Secure Local Area Network (MLS LAN) to provide secure information sharing, classified at different security levels. The MLS LAN extends the high assurance of an evaluated multilevel secure System to a LAN that is formed by commercial personal computers (PCs) running commercial operating systems and office productivity software. The MLS LAN accomplishes the defined functionality by using custom boards which are designed to be plugged into personal computers. The boards are named the Trusted Computing Base Extension (TCBE). The TCBE is intended to provide trusted path and object reuse supporting services to the network TCB. This thesis describes the hardware and software components, structures, interfaces required for the TCBE to complete a trusted path and control the client PC. Potential implementations are suggested and analyzed for security implications. A preliminary TCBE prototype has been constructed and tested for selected TCBE functions. It is shown that the TCBE prototype can be made both non-by-passable and tamper resistant.
DTIC
Prototypes; Operating Systems (Computers); Data Processing; Computer Information Security; Access Control

20000075541 Naval Postgraduate School, Monterey, CA USA
QOS Management With Adaptive Routing for Next Generation Internet
Quek, Henry C.; Mar. 2000; 286p; In English
Report No.(s): AD-A378393; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche
Up till today, the Internet only provides best-effort service, where traffic is processed as quickly as possible, with no guarantee as to timeliness or actual delivery. As the Internet develops into a global commercial infrastructure, demands for guaranteed and differentiated network quality of service (QoS) will increase rapidly. Several QoS service models have been developed to provide and support QOS in the Internet, namely: Integrated Service (IntServ), Differentiated Service (DiffServ) and MultiProtocol Label Switching (MPLS). QoS routing, such as Widest-Shortest Path, Shortest-Widest Path and Shortest-Distance Path, is required in order to support QoS and optimize the network resource utilization. The Server and Agent based Active network Management (SAAM) system is a network management system designed for the next generation Internet. It is capable of supporting all types of service. It will be able to control and optimize the utilization of the network through resource allocation and adaptive QOS routing. This thesis describes a design and implementation of the QoS Management component of a SAAM Server. This compo-

nent optimizes the utilization of network resources and supports the various service classes in a cohesive manner. It utilizes an adaptive routing strategy to balance the network load.
DTIC
Internets; Network Analysis; Systems Analysis

20000076819 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
A Layer Approach to Instrumentation
Jones, Sid; Chalfant, Tim; Jan. 2000; 9p; In English
Report No.(s): AD-A378166; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Networks are becoming a part of everyday life. They are in our offices, homes, cars, and the basis for the Internet. The ground processing side of T&E have used networks in various forms for years to direct the incoming test data to the many project engineer stations. These interfaces are becoming relatively inexpensive due to the proliferation of networks. We are now seeing networks appear in the vehicular data acquisition arena. to take advantage of what networks have to offer, we need to view the data system as a communications network. As a communications network, the instrumentation system must be segregated into individual layers in a logical fashion. Each layer operates independently and can be upgraded or replaced without regard or effect to the other layers. This layered model can be used as a blueprint to take advantage of commercial network architectures. It will easily allow new technology insertion in key areas without affecting the rest of the system. The Navy and the Air Force see this approach as a key component of acquisition reform and have established a comprehensive road map to achieve this goal.
DTIC
Communication Networks; Data Acquisition; Data Systems; Internets; Architecture (Computers)

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

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

20000075542 Naval Postgraduate School, Monterey, CA USA
Comparison of Vega(trademark) and Java3D(trademark) in a Virtual Environment Enclosure
Christianson, Brian K.; Kimsey, Andrew J.; Mar. 2000; 111p; In English
Report No.(s): AD-A378395; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Large enclosures offer a myriad of possibilities for virtual environments and can dramatically improve presence for a number of applications. Scene graphs are accepted as the logical and optimized way to generate and render applications, however most scene graphs are proprietary or platform specific. Open source scene graphs are emerging that are easily used and cross-platform. This thesis describes the physical construction of a large sized Multiple Angle Automatic Virtual Environment (MAAVE) and the programming of visual simulations using Vega, a powerful commercially available software package, and Java3D, an open source scene graph. The two simulations are networked walkthrough virtual environments using the same geometry. After the MAAVE was built, the two applications were tested on multiple platforms with frame rate being the main measure of performance. Initial expectations were that Vega would be faster, but the ease and speed of development of each application was unknown. Results showed that the Vega application was 10 to 30 times faster on SGI hardware and 4 to 20 times faster on a standard PC. The Java3D application required one third of the development time and was easier to program. Overall, we conclude that Vega is the better development platform for multi-channel walkthrough applications.
DTIC
Applications Programs (Computers); Virtual Reality; Distributed Interactive Simulation; Scene Generation; Environment Simulation

20000075636 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Modeling and Design of an Electro-Rheological Fluid Based Haptic System for Tele-Operation of Space Robots
Mavroidis, Constantinos, Rutgers - The State Univ., USA; Pfeiffer, Charles, Rutgers - The State Univ., USA; Paljic, Alex, Rutgers - The State Univ., USA; Celestino, James, Rutgers - The State Univ., USA; Lennon, Jamie, Rutgers - The State Univ., USA; Bar-Cohen, Yoseph, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; Space and Robotics, 28 Feb. - 2 Mar. 2000, Albuquerque, NM, USA; No Copyright; Avail: Issuing Activity; Abstract Only

For many years, the robotic community sought to develop robots that can eventually operate autonomously and eliminate the need for human operators. However, there is an increasing realization that there are some tasks that human can perform signifi-

cantly better but, due to associated hazards, distance, physical limitations and other causes, only robot can be employed to perform these tasks. Remotely performing these types of tasks requires operating robots as human surrogates. While current ”hand master” haptic systems are able to reproduce the feeling of rigid objects, they present great difficulties in emulating the feeling of remote/virtual stiffness. In addition, they tend to be heavy, cumbersome and usually they only allow limited operator workspace. In this paper a novel haptic interface is presented to enable human-operators to ”feel” and intuitively mirror the stiffness/forces at remote/virtual sites enabling control of robots as human-surrogates. This haptic interface is intended to provide human operators intuitive feeling of the stiffness and forces at remote or virtual sites in support of space robots performing dexterous manipulation tasks (such as operating a wrench or a drill). Remote applications are referred to the control of actual robots whereas virtual applications are referred to simulated operations. The developed haptic interface will be applicable to IVA operated robotic EVA tasks to enhance human performance, extend crew capability and assure crew safety. The electrically controlled stiffness is obtained using constrained ElectroRheological Fluids (ERF), which changes its viscosity under electrical stimulation. Forces applied at the robot end-effector due to a compliant environment will be reflected to the user using this ERF device where a change in the system viscosity will occur proportionally to the force to be transmitted. In this paper, we will present the results of our modeling, simulation, and initial testing of such an electrorheological fluid (ERF) based haptic device.
Author
Models; Design Analysis; Electrorheological Fluids; Stimulation; Simulation; Robots; Human Performance; Teleoperators

20000076112 Army Research Lab., Sensors Directorate, Adelphi, MD USA
A Target-Tracking Algorithm ***Final Report, 1 Oct. 1998-30 Sep. 1999***
Vrabel, Michael J.; Apr. 2000; 39p; In English
Contract(s)/Grant(s): Proj-AH16
Report No.(s): AD-A378234; ARL-TN-158; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A computationally fast algorithm for tracking targets in a sequence of scenes is described. The algorithm is based on a variation of template matching.
DTIC
Algorithms; Tracking (Position); Target Recognition; FLIR Detectors

20000076611 Helsinki Univ. of Technology, Dept. of Engineering Physics and Mathematics, Espoo Finland
Characterization of Random Rough Surfaces from Scattered Intensities by Neural Networks
Kallioniemi, I.; Niinistoe, A.; Saarinen, J.; Friberg, A. T.; Feb. 11, 2000; 22p; In English
Report No.(s): PB2000-106113; TKK-F-A798; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
Optical scatterometry, a noninvasive characterization method, is used to infer the statistical properties f random rough surfaces. The Gaussian model with rms-roughness sigma and correlation length, lambda is considered in this paper but the employed technique is applicable to any representation of random rough surfaces. Surfaces with wide ranges of lambda and sigma, up to 5 wavelengths, are characterized with neutral networks. Two models are used: self-organizing map (SOM) for rough classification and multi-layer perceptron (MLP) for quantitative estimation with nonlinear regression. Models infer lambda and sigma from scattering, thus solving the inverse problem. The intensities are calculated with the exact electromagnetic theory which enables the wide ranges of parameters.
NTIS
Surface Roughness; Neural Nets

20000076809 NASA Langley Research Center, Hampton, VA USA
Application of Neural Networks to Wind tunnel Data Response Surface Methods
Lo, Ching F., Tennessee Univ. Space Inst., USA; Zhao, J. L., Tennessee Univ. Space Inst., USA; DeLoach, Richard, NASA Langley Research Center, USA; [2000]; 14p; In English; 21st; 21st Aerodynamic Measurement Technology and Ground Testing Conference, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAG1-2185
Report No.(s): AIAA Paper 2000-2639; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
The integration of nonlinear neural network methods with conventional linear regression techniques is demonstrated for representative wind tunnel force balance data modeling. This work was motivated by a desire to formulate precision intervals for response surfaces produced by neural networks. Applications are demonstrated for representative wind tunnel data acquired at NASA Langley Research Center and the Arnold Engineering Development Center in Tullahoma, TN.
Author
Neural Nets; Nonlinearity; Wind Tunnel Apparatus; Wind Tunnel Tests; Mathematical Models; Algorithms

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20000076629 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Contractions of Lie algebras and separation of variables. From two-dimensional hyperboloid to pseudo-Euclidean plane
Izmest'ev, A. A.; Pogosyan, G.; Dec. 31, 1998; 15p; In English
Report No.(s): DE99-616072; JINR-E-2-98-83; No Copyright; Avail: Department of Energy Information Bridge

The Inonu-Wigner contraction from the rotation group O(2,1) to the pseudo-Euclidean group E(1, 1) is used to relate the separation of variables in the Laplace-Beltrami operators on two corresponding homogeneous spaces. We consider the contractions on four levels: the Lie algebra, the commuting sets of the second order operators in the enveloping algebra of o(2,1), the coordinate systems and some eigenfunctions of the Laplace-Beltrami operators.
NTIS
Lie Groups; Euclidean Geometry

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

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

20000075538 Army War Coll., Carlisle Barracks, PA USA
The Integration of Space Forces in the Unified Command Structure
Collins, Glen C.; Apr. 15, 2000; 56p; In English
Report No.(s): AD-A378375; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This SRP will first establish the case that the integration of Space Forces into the unified/joint Command structure has been identified in doctrine (JP 3-14 draft v1.4), but has not been properly defined to the point where specific doctrine (to include Tactics, Techniques, & Procedures), resources, and training can be applied to meet this doctrinal requirement. The study will address three models to determine best fit: (1) The functional component model; (2) The SOCOM model; and (3) The "invisible integration" model. This paper will be researched and written to provide a specific argument to support a policy decision. Possible outcomes are changes to joint and service doctrines, and considerations for supported commanders when task organizing provided space forces. A secondary goal (if SOCOM model is selected) could result in changes to the US Space Command mission as described in the Unified Command Plan (UCP).
DTIC
Policies; Space Missions; Decision Making

20000075718 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Toward Validating Vertical Aggregation in Object Oriented Simulation
Johnson Jr, George W.; Mar. 2000; 73p; In English
Report No.(s): AD-A378298; AFIT/GOR/ENS/00M-17; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Recent interest in studying the nonlinear effects of intelligence, surveillance, and reconnaissance in combat models has prompted researchers to employ vertical aggregation in object-oriented simulations. Traditional horizontal aggregation falls short for its inability to provide accurate means for nonlinear functions. Averaging a group of objects that exhibit nonlinear behavior provides a linear approximation to the mean, which is not necessarily the expected value of the underlying nonlinear function. Vertical aggregation explicitly models individual objects, thus preserving their nonlinear behaviors. In this research, a validation procedure is derived to study the aptness of vertical aggregation methods. Validation is carried out by comparison with a control, considered model truth, since it contains no vertical aggregation. Response surfaces are mapped for the control and the hypothesized model. Family confidence intervals are used to test the hypothesis that the difference between the two is zero. An illustrative example is presented using a homogeneous combat scenario embellished with experimental factors. Metamodels are derived using the method of least squares and validated prior to drawing inferences. Simultaneous inferences are drawn between the i(th) regression coefficient of two models. The results suggest fascinating avenues for further study.
DTIC
Object-Oriented Programming; Nonlinear Systems; Regression Analysis; Combat

20000075720 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

The Distributor's Three-Dimensional Pallet-Packing Problem: A Mathematical Formulation and Heuristic Solution Approach

Ballew, Brian P.; Mar. 2000; 111p; In English

Report No.(s): AD-A378300; AFIT/GOR/ENS/00M-02; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

It is through practice and experience Air Force loadmasters are able to pack the Air Force standard HCU-6/E (463L) pallets efficiently. Although the loadmasters perform their jobs exceptionally well, the Air Force is in search of a model that will more efficiently pack the pallets. We have developed a mathematical formulation of the three-dimensional pallet-packing problem which minimizes the amount of unused space on a pallet. The formulation ensures each box is packed with the correct volume and dimensions, and ensures the volume of all the boxes packed is less than the available pallet volume. Additionally, the formulation ensures that each box has a foundation on which to be placed and allows, at most, one box to be placed in each location on the pallet. The three-dimensional pallet-packing problem is a NP-hard problem. Thus, for large problems, the optimal solution can not be found in a reasonable amount of time. Therefore a heuristic solution approach is required to solve these large problems. This research observes the performance of a genetic algorithm on the three-dimensional pallet-packing problem using single-point crossover.

DTIC

Genetic Algorithms; Heuristic Methods; Mathematical Models; Distributors

20000075967 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

A Group Theoretic Tabu Search Approach to the Traveling Salesman Problem

Hall, Shane N.; Mar. 2000; 108p; In English

Report No.(s): AD-A378321; AFIT/GOR/ENS/00M-14; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The traveling salesman problem (TSP) is a combinatorial optimization problem that is mathematically modeled as a binary integer program. The TSP is a very important problem for the operations research academician and practitioner. This research demonstrates a Group Theoretic Tabu Search (GTTS) Java algorithm for the TSP. The tabu search metaheuristic continuously finds near-optimal solutions to the TSP under various different implementations. Algebraic group theory offers a more formal mathematical setting to study the TSP providing a theoretical foundation for describing tabu search. Specifically, this thesis uses the Symmetric Group on n letters, S(n), which is the set of all n! permutations on n letters whose binary operation is permutation multiplication, to describe the TSP solution space. Thus, the TSP is studied as a permutation problem rather than an integer program by applying the principles of group theory to define the tabu search move and neighborhood structure. The group theoretic concept of conjugation (an operation involving two group elements) simplifies the move definition as well as the intensification and diversification strategies. Conjugation in GTTS diversifies the search by allowing large rearrangement moves within a tour in a single move operation. Empirical results are presented along with the theoretical motivations for the research.

DTIC

Traveling Salesman Problem; Heuristic Methods; Combinatorial Analysis

20000076113 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Feature Selection for Predicting Pilot Mental Workload

East, Julia A.; Mar. 21, 2000; 140p; In English

Report No.(s): AD-A378241; AFIT/GOR/ENS/00M-09; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Advances in technology have the cockpits of the aircraft in the Air Force inventory increasingly complex. Consequently, mental demands on the pilot have risen. In some cases, mental demands were so overwhelming that pilots have forgotten basic flying techniques, such as G-straining maneuvers. The results have been fatal. Recent research in this area has involved collecting psychophysiological features, such as electroencephalography (EEG), heart, eye and respiration measures, in an attempt to identify pilot mental workload. This thesis focuses on feature selection and reduction of the psycophysiological features and subsequent classification of pilot mental workload on multiple subjects over multiple days. A stepwise statistical technique and the signal-to-noise ratio (SNR) saliency metric were used to reduce the number of features required for classification. Factor analysis was used to compare the variables chosen by the discriminant procedure and the SNR metric as applied to a neural network. A total of 151 psychophysiological features were derived from data collected during an actual flight study. The original flight study contained three workload levels, low, medium and high. These levels were aggregated into two categories of pilot mental workload, low/medium and high. Mental workload associated with each flight segment was determined by difficult of task.

DTIC

Mental Performance; Workloads (Psychophysiology); Neural Nets; Cockpits; Psychophysiology

67
THEORETICAL MATHEMATICS

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

20000076625 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Contractions of Lie algebras and separation of variables. The n-dimensional sphere
Izmest'ev, A. A.; Pogosyan, G. S.; Sisakyan, A. N.; Winternitz, P.; Dec. 31, 1998; 39p; In English
Report No.(s): DE99-616068; JINR-E-2-98-52; No Copyright; Avail: Department of Energy Information Bridge

Inonu-Wigner contractions from the rotation group O (n + 1) to the Euclidean group E (n) are used to relate the separation of variables in Laplace- Beltrami operators on n-dimensional spheres and Euclidean spaces. We consider all subgroup type coordinates corresponding to different chains of subgroups of O (n + 1) and E (n). In particular, the contractions relate the graphical formalism of 'trees' on spheres to the 'clusters' on Euclidean spaces (introduced in this article). The contractions are considered analytically on several levels: the vector fields realizing the Lie algebras, the complete sets of commuting operators characterizing separable coordinate systems, the coordinate systems themselves and the separated eigenfunctions.
NTIS
Contraction; Lie Groups; Spheres

20000076633 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Eigenfunction expansions associated with a nonlinear Schroedinger equation
Zhidkov, P.; Dec. 31, 1998; 12p; In English
Report No.(s): DE99-616079; JINR-E-5-98-61; No Copyright; Avail: Department of Energy Information Bridge

We consider a nonlinear one-dimensional Schroedinger-type eigenvalue problem on a segment and, using properties of its eigenfunctions obtained earlier, present a new and shorter proof of the statement that these eigenfunctions form a Razes basis in the space L(sub 2). The approach used in the paper is based on a theorem of N.K.Bary.
NTIS
Eigenvectors; Schroedinger Equation

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.

20000074690 NASA Goddard Space Flight Center, Greenbelt, MD USA
It's About Time!
Clark, Tom, NASA Goddard Space Flight Center, USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 69; In English; See also 20000074683; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Everything we do in VLBI is connected to time. In this contribution, we review 28 orders of magnitude of the spectrum of time ranging from a few hundred femtoseconds (i.e. one degree of phase at X-band - Pi x 10(exp -13) seconds) upwards to tens of millions of years (i.e. ten million years Pi x 10(exp 14) seconds). In this discussion, we will pay special attention to the relation between the underlying oscillator (the frequency standard that defines a clock's rate) and the time kept by the clock (which counts the oscillations of the frequency standard). We will consider two different types of time - time kept by counting an atomic frequency standard (Hydrogen Maser or Cesium), and time reckoned by the rotation of the Earth underneath the stars and sun.
Author
Very Long Base Interferometry; Time Measurement; Time Measuring Instruments; Oscillators; Sidereal Time; Universal Time

20000074728 Naval Observatory, Earth Orientation Dept., Washington, DC USA
New Timing Products from the IGS: IGS/BIPM Time Transfer Pilot Project and UT1-Like Estimates from GPS
Ray, Jim R., Naval Observatory, USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 289-295; In English; See also 20000074683; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The International GPS Service (IGS) and its Analysis Centers are engaged in developing new products related to timekeeping, some of which are relevant to the IVS community. Global comparisons and techniques for dissemination of atomic time are being developed

in a Pilot Project with the Bureau International des Poids et Mesures (BIPM). Full project information is available at http://maia.usno.navy.mil/gpst.html. In addition, high-quality estimates of Universal Time are now being made based on the observed motions of the GPS orbit planes. While these cannot replace the need for VLBI determinations of UT1, they are nonetheless very valuable for densifying the VLBI-based time series and for providing extremely rapid turnaround results necessary for real-time applications.
Author
Global Positioning System; Universal Time; Very Long Base Interferometry; Atomic Clocks

20000075641 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Measurements of Tc (Q,P): Depression of the Superfluid Transition Temperature by a Heat Current Along the Lambda Line
Liu, Yuan-Ming, Jet Propulsion Lab., California Inst. of Tech., USA; Larson, Melora, Jet Propulsion Lab., California Inst. of Tech., USA; Israelsson, Ulf, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English, 1999, Pasadena, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We report experimental measurements of Tc (Q,P) for heat currents (Q) between I1and 100 micro W/sq cm and pressure (P) between SVP and 15 bar. The measurements were performed in a normal gravity environment, using the low-gravity simulator facility at JPL without the magnet being energized. The sample pressure was controlled to 0.1 micro bar using a hot volume, and a Straty-Adams capacitive pressure gauge. The total volume of helium in the sample cell and the hot volume was held constant using a pneumatic low temperature valve. A melting curve thermometer (MCT) measured the transition temperature (Tc) with a resolution of about 10 nK through a sidewall probe of the thermal conductivity sample cell. We employed the same measurement technique and procedure described by DAS. Preliminary results indicate that Tc (Q,P) depends very little on the pressure in the pressure range between SVP and 15 bar with a variation in the amplitude of Tc(Q,P) of less than about 5% observable in this pressure range. According to the Renormalization-group theory calculation by Haussmann and Dohm, the amplitude of Tc (Q,P) has a leading pressure-dependence term proportional to xi(sub 0) (sup (1/nu)), where xi(sub 0) is the correlation-length amplitude and nu is the correlation-length exponent. Thus, a small pressure dependence of the amplitude of Tc (Q,P) is expected since xi(sub 0) is very weakly dependent on pressure between SVP and 15 bar, consistent with our measurements.
Author
Control Valves; Measuring Instruments; Experimentation; Temperature Measurement; Renormalization Group Methods; Thermal Conductivity

20000078411 Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Brazil
Critical and paramagnetic spin fluctuations in Heisenberg magnets
Cuccoli, A.; Tognetti, V.; Lovesey, S. W.; Dec. 31, 1989; 6p; In English; Meeting on new trends in magnetism
Report No.(s): DE99-618002; INIS-BR-3697; No Copyright; Avail: Department of Energy Information Bridge

The correlations function magnetization fluctuations in Heisenberg ferromagnets Eu O and Eu S has been obtained from mode-coupling theory. In the critical region the simplified integral equation can be used but the dipolar interaction must be taken into account in order to explain the puzzling results of spin-echo experiments. For intermediate and high wave-vectors the microscopic features of the magnetic interaction turn out to be essential. The numerical solution of the mode-coupling equation has been obtained for the three cubic lattices allowing for interactions beyond nearest neighbors. The results for fcc ferromagnetic europium compounds are in good agreement with recent high resolution neutron scattering data. Similar good agreement is found with very recent experiments in Pd2 Mn Sn. For a bcc lattice the equations have been solved adopting various sets of exchange constants proposed to interpret the magnetic properties of iron. The importance of the proper lattice structure and interactions is shown.
NTIS
Electron Spin; Magnetic Variations; Ferromagnetic Materials

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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.

20000075259 NASA Langley Research Center, Hampton, VA USA
Noise Prediction for Maneuvering Rotorcraft
Brentner, Kenneth S., NASA Langley Research Center, USA; Jones, Henry E., Army Aviation and Missile Command, USA; [2000]; 14p; In English; 6th; 6th Aeroacoustics Conference, 12-14 Jun. 2000, Lahaina, HI, USA; Sponsored by American Inst.

of Aeronautics and Astronautics, USA; Original contains color illustrations
Report No.(s): AIAA Paper 2000-2031; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents the initial work toward first-principles noise prediction for maneuvering rotors. Both the aeromechanical and acoustics aspects of the maneuver noise problem are discussed. The comprehensive analysis code, CAMRAD 2. was utilized to predict the time-dependent aircraft position and attitude, along - with the rotor blade airloads and motion. The major focus of this effort was the enhancement of the acoustic code WOPWOP necessary to compute the noise from a maneuvering rotorcraft. Full aircraft motion, including arbitrary transient motion, is modeled together with arbitrary rotor blade motions. Noise from a rotorcraft in turning and descending flight is compared to level flight. A substantial increase in the rotor noise is found both for turning flight and during a transient maneuver. Additional enhancements to take advantage of parallel computers and clusters of workstations, in addition to a new compact-chordwise loading formulation, are also described.
Author
Noise Prediction; Rotary Wing Aircraft; Acoustics; Aerodynamic Noise; Turning Flight

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.

20000074681 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of
Study on the Diagnosis for Atomic Power Apparatuses using the Measurement of the Partial Discharges
Lee, J. H.; Seung, H. B.; Shin, D. S.; Yun, D. H.; Kwon, Y. H.; Jul. 31, 1997; 232p; In Korean; In English
Report No.(s): DE99-727779; KAERI-CM-092/96; No Copyright; Avail: Department of Energy Information Bridge

The power apparatuses in atomic power plants is apt to be degraded by the influence of electrical stress and the exposure of radioactivity and the possibility of sudden accidents owing to the troubles and breakdown of them is relatively high as compared with those in general power plants. The partial discharge measurement method is superior to others with a viewpoint of principles and has the advantages in ON-Line monitoring as well as the detection sensitivity. The partial discharge measurements can be the main and general diagnosis method in detecting the degradation degree of electrical apparatuses in the near future. Therefore for the purpose of preventing the atomic power plants from the sudden accidents due to degradation of power apparatuses as well as verifying the exchange period and the life time of equipments, it is indispensable to establish the diagnosis system using the partial discharge measurement. In this works, we have studied the partial discharge mechanism and its characteristics theoretically. We have also designed and made partial detection and/or data acquisition system and tested this system in order to guarantee the reliability of the system. The effect of X-ray and which are inevitable in the atomic power apparatuses on PD patterns or the related mechanisms are also investigated. We have proposed a new PD measurement technique of pulse superposition method and the neural network algorithm was discussed for the purpose of the diagnosis of the atomic power system in the near future. The Weibull function and wavelet transformation technique was also discussed in order to evaluate the applicability to PD measurement.
Author(NTIS)
Atoms; Nuclear Power Plants; Diagnosis; Atomic Physics

20000075271 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Coherence Measurements for Excited to Excited State Transitions in Barium
Trajmar, S., Jet Propulsion Lab., California Inst. of Tech., USA; Kanik, I., Jet Propulsion Lab., California Inst. of Tech., USA; Karaganov, V., Jet Propulsion Lab., California Inst. of Tech., USA; Zetner, P. W., Manitoba Univ., Canada; Csanak, G., Los Alamos Scientific Lab., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Experimental studies concerning elastic and inelastic electron scattering by coherently ensembles of Ba (...6s6p (sub 1)P(sub 1)) atoms with various degrees of alignment will be described. An in-plane, linearly-polarized laser beam was utilized to prepare these target ensembles and the electron scattering signal as a function of polarization angle was measured for several laser geometries at fixed impact energies and scattering angles. From these measurements, we derived cross sections and electron-impact coherence parameters associated with the electron scattering process which is time reverse of the actual experimentally studied process. This interpretation of the experiment is based on the theory of Macek and Herte. The experimental results were also interpreted in terms of cross sections and collision parameters associated with the actual experimental processes. Results obtained so far will be presented and plans for further studies will be discussed.
Author
Barium; Atomic Excitations

20000076476 Al-Farabi Kazak State National Univ., Almaty, Kazakhstan
Influence of acidity on kinetics of radiation-chemical oxidation of As(III)
Burkitbaev, M.; Turdieva, U.; Dec. 31, 1998; 130p; In English
Report No.(s): DE99-616834; INIS-KZ-033; No Copyright; Avail: Department of Energy Information Bridge
Radiation induced oxidation of As (III) by molecular oxygen in aqueous solutions has been investigated. Radiation chemical yields of oxidation increase with the increasing of hydroxide concentration. The chain mechanism of oxidation has been proposed.
NTIS
Acidity; Reaction Kinetics; Oxidation

20000076481 Grand Accelerator National d'Ions Lourds, Caen, France
Role of the experimental filter in obtaining the Arrhenius plot in multi-fragmentation reactions
Tirel, O.; Auger, G.; Nebauer, R.; Aichelin, J.; Jun. 30, 1998; 13p; In English
Report No.(s): DE99-616006; GANIL-P-98-26; No Copyright; Avail: Department of Energy Information Bridge
Recently it has been argued that the linear relation between the transverse energy and the apparent probability to emit a fragment proves that the total system is in thermal equilibrium. It is shown, for the specific reaction Xe+Sn at 50 A.MeV, that the same behavior is obtained in the context of Quantum Molecular Dynamical without invoking the idea of equilibrium. The linear dependence is shown to be a detector effect.
NTIS
Molecular Dynamics; Fragmentation; Reaction Kinetics

20000076482 Grand Accelerator National d'Ions Lourds, Caen, France
Anharmonic double-(gamma) vibrations in nuclei and their description in the interacting boson model
Garcia-Ramos, J. E.; Alonso, C. E.; Arias, J. M.; VanIsacker, P.; Jul. 31, 1998; 13p; In English
Report No.(s): DE99-616005; GANIL-P-98-25; No Copyright; Avail: Department of Energy Information Bridge
Double-(gamma) vibrations in deformed nuclei are studied in the context of the interacting boson model with special reference to their anharmonic character. It is shown that large anharmonicities can be obtained with interactions that are (at least) of three-body nature between the bosons. As an example the (gamma) vibrations of the nucleus (sub 68)(sup 166)Er(sub 98) are studied in detail.
NTIS
Vibration; Bosons; Nuclei (Nuclear Physics); Nuclear Physics

20000076621 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Scalar mesons in the Nambu-Jona-Lasinio model with the 't Hooft interaction
Volkov, M. K.; Yudichev, V. L.; Nagy, M.; Dec. 31, 1998; 11p; In English
Report No.(s): DE99-616064; JINR-E-2-98-101; No Copyright; Avail: Department of Energy Information Bridge
We calculate the mass spectra of the pseudoscalar and scalar meson nonets in the Nambu-Jona-Lasinio model with the 't Hooft interaction. We obtain satisfactory result for the pseudoscalar mesons. For the scalar mesons, the 't Hooft interaction somewhat increases the values of the masses. However, it is not sufficient to explain the whole scalar mass spectrum. The situation could be improved for the (sigma) and f(sub 0) mesons through mixing with the glueball state. For the description of the masses of a(sub 0) and K(sub 0)(sup *) mesons, it is necessary to involve the other models. The strong decay widths of the scalar mesons are described.
NTIS
Scalars; Mesons; Mass Spectra

20000076624 Joint Inst. for Nuclear Research, Lab. of High Energies, Dubna, USSR
Asymmetry of jet production in polarized pp-collisions at RHIC and sign of (Delta)G
Skoro, G. P.; Tokarev, M. V.; Dec. 31, 1998; 15p; In English
Report No.(s): DE99-616067; JINR-E-2-98-50; No Copyright; Avail: Department of Energy Information Bridge
The jet production in polarized pp-collisions at high energies is studied. Double-spin asymmetry A(sub LL) of the process is calculated by using Monte Carlo code SPHINX. A possibility to discriminate the spin-dependent gluon distributions and to determine sign of (Delta)G is discussed. The predictions for the longitudinal asymmetry A(sub LL) of the jet and dijet production at RHIC energies have been made.
NTIS
Particle Collisions; Asymmetry

20000076631 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR

Radiative corrections to the background of (mu) (yields) e (gamma) decay

Arbuzov, A. B.; Kuraev, E.; Magar, E.; Shajkhatdenov, B. G.; Krehl, O.; Dec. 31, 1998; 15p; In English

Report No.(s): DE99-616077; JINR-E-4-98-89; No Copyright; Avail: Department of Energy Information Bridge

Radiative muon decay in the kinematics similar to the neutrino less decay (mu) (yields) e (gamma) is considered. Radiative corrections due to one-loop virtual photons and emission of additional soft or hard photons are taken into account. Analytical expressions and numerical estimations are presented.

NTIS

Particle Decay; Correction

20000076632 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR

Time dependent approach to proton decay in spherical nuclei

Misicu, S.; Carjan, N.; Talou, P.; Dec. 31, 1998; 23p; In English

Report No.(s): DE99-616078; JINR-E-4-98-93; No Copyright; Avail: Department of Energy Information Bridge

Based on a single particle model which describes the time evolution of the wave function during tunneling across a one-dimensional potential barrier we study the proton decay of (sup 208)Pb from excited states with non-vanishing angular momentum l.Several quantities of interest in this process like the decay rate (lambda), the period of oscillation T(sub osc), the transient time t(sub tr), the tunneling time t(sub tun) and the average value of the proton packet position r(sub av) are computed and compared with the WKB results.

NTIS

Time Dependence; Protons; Particle Decay

20000076800 Joint Inst. for Nuclear Research, Lab. of Particle Physics, Dubna, USSR

Programme library for numerical simulation of charged particle dynamics in transportation lines

Aleksandrov, V. S.; Shevtsov, V. F.; Shirkov, G. D.; Batygin, Y.; Dec. 31, 1998; 19p; In English

Report No.(s): DE99-616080; JINR-E-9-98-148; No Copyright; Avail: Department of Energy Information Bridge

The description of a PC codes library to simulate the beam transportation of charged particles is presented. The codes are realized on IBM PC in Visual Basic common interface. It is destined for the simulation and optimization of beam dynamics and based on the successive and consistent use of two methods: the momentum method of distribution functions (RMS technique) and the particle-particle method (PP-Method). The library allows to calculate the RMS parameters of electron and ion beams, passing through a set of quadrupoles, solenoids, bends, accelerating sections. The RMS code is a fast code suitable for the first test, design and optimization of the beam line parameters. The PP code requires more time for execution but provides a high accuracy of simulation taking into account the space charge effects, aberrations and beam losses. One of the main advantages of PP code presented is the ability to simulate a real multicomponent beam of different masses and charged states of ions from ion sources.

NTIS

Electron Beams; Charged Particles; Ion Beams

20000078410 Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, Brazil

Isotopic shift measurement and hyperfine structure of uranium using Inter modulation Optogalvanic Spectroscopy (IMOGS)

Cruz, F. C.; Pereira, D.; Scalabrin, A.; Destro, M. G.; Schwab, C.; Dec. 31, 1992; 6p; In Portuguese; In English; 5th; State symposium of lasers and applications, Portugal

Report No.(s): DE99-618000; INIS-BR-3695; No Copyright; Avail: Department of Energy Information Bridge

Absorption frequency shifts of different isotopes allow a given isotope to be selectively excited by a monochromatic radiation beam. In the case of uranium, if a (sup 235) U and (sup 238) U isotopes mixture is pumped by a laser tuned in resonance with the (sup 235) U transition and with a sufficiently narrow line width, the laser radiation will be absorbed preferentially by this isotope. Hence, the linewidth, isotope shift and hyperfine structure determination is very important in the development of the atomic vapor laser isotope separation process. This measurements were made by means of inter modulated optogalvanic spectroscopy, using a natural uranium hollow cathode discharge and a ring dye laser.

NTIS

Hyperfine Structure; Isotope Effect; Spectral Shift Control

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.

20000074669 NASA Marshall Space Flight Center, Huntsville, AL USA
Space Fission Power and Propulsion Deep Space Exploration
Sackheim, Robert L., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; The Outer Heliosphere: The Next Frontiers, 24-28 Jul. 2000, Potsdam, Germany; Sponsored by Committee on Space Research, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

Deep space exploration missions are limited by cost and weight constraints. The presentation will discuss the benefits of using a safe in-space nuclear reactor for power and propulsion. This technology will enable deep space exploration missions, including reaching the heliopause and beyond.
Author
Fission; Nuclear Reactors; Propulsion; Space Exploration

20000074671 NASA Marshall Space Flight Center, Huntsville, AL USA
In Space Nuclear Power as an Enabling Technology for Deep Space Exploration
Sackheim, Robert L., NASA Marshall Space Flight Center, USA; Houts, Michael, Los Alamos National Lab., USA; [2000]; 1p; In English; 36th; Joint Propulsion, 16-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Deep Space Exploration missions, both for scientific and Human Exploration and Development (HEDS), appear to be as weight limited today as they would have been 35 years ago. Right behind the weight constraints is the nearly equally important mission limitation of cost. Launch vehicles, upper stages and in-space propulsion systems also cost about the same today with the same efficiency as they have had for many years (excluding impact of inflation). Both these dual mission constraints combine to force either very expensive, mega systems missions or very light weight, but high risk/low margin planetary spacecraft designs, such as the recent unsuccessful attempts for an extremely low cost mission to Mars during the 1998-99 opportunity (i.e., Mars Climate Orbiter and the Mars Polar Lander). When one considers spacecraft missions to the outer heliopause or even the outer planets, the enormous weight and cost constraints will impose even more daunting concerns for mission cost, risk and the ability to establish adequate mission margins for success. This paper will discuss the benefits of using a safe in-space nuclear reactor as the basis for providing both sufficient electric power and high performance space propulsion that will greatly reduce mission risk and significantly increase weight (IMLEO) and cost margins. Weight and cost margins are increased by enabling much higher payload fractions and redundant design features for a given launch vehicle (higher payload fraction of IMLEO). The paper will also discuss and summarize the recent advances in nuclear reactor technology and safety of modern reactor designs and operating practice and experience, as well as advances in reactor coupled power generation and high performance nuclear thermal and electric propulsion technologies. It will be shown that these nuclear power and propulsion technologies are major enabling capabilities for higher reliability, higher margin and lower cost deep space missions design to reliably reach the outer planets for scientific exploration.
Author
Interplanetary Spacecraft; Mission Planning; Nuclear Electric Propulsion; Nuclear Reactors; Propulsion System Configurations; Reactor Design; Reactor Technology

20000075270 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Generation of a Cold Atom Beam from a Pyramidal Magneto-Optical Trap
Bliss, J. L., California Inst. of Tech., USA; Libbrecht, K. G., California Inst. of Tech., USA; Maleki, Klipstein L., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We have built an atomic beam source utilizing a simple and robust design based on the pyramidal trap geometry of Kim et al. Our design allows use of a single large diameter (\le20 cm) laser beam to obtain large capture rates of atoms from a background vapor. A small (about 1mm diameter) hole in the retro-optic at the apex of the pyramid provides an extraction column for the atoms. We have operated the apparatus both as a magneto-optical trap (using an auxiliary plug laser beam), and as a cold atomic beam

source. The characterization of this large pyramidal beam source will be reported, including an investigation of scaling to very large (10--20cm) high power (about 1W) laser beams which should allow significant improvements in atomic beam flux.
Author
Atomic Beams; Laser Beams; Magneto-Optics

20000076483 Grand Accelerator National d'Ions Lourds, Caen, France
Hard photons beyond proton-neutron Bremsstrahlung in heavy-ion collisions
Gudima, K.; Ploszajczak, M.; May 17, 1998; 10p; In English
Report No.(s): DE99-616001; GANIL-P-98-17; No Copyright; Avail: Department of Energy Information Bridge
The study of extremely high energy photons, pions and etas, produced in intermediate energy heavy-ion collisions is presented. Possibility of imaging the final-state phase space in these collisions by the Bose-Einstein correlations for photons is critically examined.
NTIS
Photons; Bremsstrahlung; Ionic Collisions; Imaging Techniques; Protons; Nuclear Physics

20000076618 Joint Inst. for Nuclear Research, Dubna, USSR
Measurement of the tensor analyzing power A(sub yy) in inclusive breakup of 9 GeV/c deuterons on carbon at large transverse momenta of protons
Afanas'ev, S. V.; Arkhipov, V. V.; Azhgirej, L. S.; Dec. 31, 1998; 16p; In English
Report No.(s): DE99-616059; JINR-E-1-98-75; No Copyright; Avail: Department of Energy Information Bridge
The tensor analyzing power A(sub yy) in inclusive breakup of 9 GeV/c deuterons on carbon has been measured at 85 mr of the detected proton angle. The analyzing power remains positive at the highest measured momentum of the proton, what is in definitive contradiction with the predictions of the existing models. The vector analyzing power A(sub y) has been obtained simultaneously with A(sub yy).
NTIS
Tensors; Deuterons; Nuclear Physics

20000076620 Joint Inst. for Nuclear Research, Frank Lab. of Neutron Physics, Dubna, USSR
Observation of spatial splitting of a polarized neutron beam as it is refracted on the interface of two magnetically non-collinear media
Aksenov, V. L.; Kozhevnikov, S. V.; Nikitenko, Y.; Fredrikze, H.; Rekveldt, M.; Dec. 31, 1998; 8p; In English
Report No.(s): DE99-616063; JINR-E-14-98-85; No Copyright; Avail: Department of Energy Information Bridge
In the conducted experimental investigation of neutron refraction on the interface of two magnetically non-collinear media spatial splitting of a polarized neutron beam was observed. The beam of neutrons initially in the spin state '+' or '-' splits into two beams of neutrons in the states '+' and '-'. All four split beams have different spatial positions. The reported phenomenon has been observed for the first time.
NTIS
Neutron Beams; Splitting; Nuclear Physics

20000076622 Joint Inst. for Nuclear Research, Lab. of Nuclear Problems, Dubna, USSR
Backward elastic p(sup 3)He-scattering and high momentum components of (sup 3)He wave function
Uzikov, Y.; Dec. 31, 1998; 11p; In English
Report No.(s): DE99-616065; JINR-E-2-98-112; No Copyright; Avail: Department of Energy Information Bridge
It is shown that owing to a dominance of np-pair transfer mechanism of backward elastic p(sup 3)He-scattering for incident proton kinetic energies T(sub p) > 1 GeV the cross section of this process is defined mainly by the values of the Faddeev component of the wave function of (sup 3)He nucleus, (phi) (sup 23) (q(sub 23), p(sub 1)), at high relative momenta q(sub 23) > 0.6 GeV/c of the NN-pair in the (sup 1)S(sub 0)-state and at low spectator momenta p(sub 1) (approx) 0 - 0.2 GeV/c.
NTIS
Momentum; Wave Functions; Backscattering; Nuclear Physics

20000076626 Joint Inst. for Nuclear Research, Lab. of High Energies, Dubna, USSR
Study of new scaling of direct photon production in pp collisions at high energies using MC simulation
Tokarev, M. V.; Potrebenikova, E.; Dec. 31, 1998; 15p; In English
Report No.(s): DE99-616069; JINR-E-2-98-64; No Copyright; Avail: Department of Energy Information Bridge

The new scaling, z scaling, of prompt photon production in pp collisions at high energies is studied. The scaling function H(z) is expressed via the inclusive cross section of photon production Ed(sup 3)(sigma) / dq(sup 3) and the multiplicity density of charged particles, (rho) (s), at pseudorapidity (eta) = 0. Monte Carlo (MC) simulation based on the PYTHIA code is used to calculate the cross section and to verify the scaling. The MC technique used to construct the scaling function is described. The H (z) dependence on the scaling variable z, the center-of-mass energy (radical) s at a produced angle of (theta) = 90 deg is investigated. The predictions of the Ed(sup 3)(sigma) / dq(sup 3) dependence on transverse momentum q at a colliding energy of (radical) s = 0.5, 5.0 and 14.0 TeV are made. The obtained results are compared with the experimental data and can be of interest for future experiments at RHIC (BNL). LHC (CERN), HERA (DESY) and Tevatron (Batavia).
NTIS
Photons; Particle Collisions; Scaling Laws; Particle Production; Nuclear Physics

20000076634 Joint Inst. for Nuclear Research, Lab. of High Energie, Dubna, USSR
Dependence of radiation resource of detectors on operating conditions of collider
Zajtsev, L.; Dec. 31, 1998; 11p; In Russian; In English
Report No.(s): DE99-616082; JINR-R-16-98-59; No Copyright; Avail: Department of Energy Information Bridge

The long-term (t=2 years) cycling irradiation is performed for the first time of solid scintillators with the gamma-source Cs-137 at D=1.2(+/-) 0.14 Gy/hour load over the temperature range from 298 to 378 K. With the superposition method, the dependence is obtained of the limiting dose D(sub lim) = f(D, (xi)), where xi is approximately 10%, the light loss after irradiation. Coefficients k(sub 3) are calculated for the resource formula: t(sub r) k(sub 3) (D(sub lim)/D), if the D(sub lim) is determined from the faster tests at D is greater than = 100 Gy/hour. In the case of LHC radiation loads to the detectors, 10 to the -1st power up to 10 to the -4 power, the values of k(sub 3) are in the range 2 x 10 to the -2nd power up to 7 to 10 to the -4th power what is explained by the photoradiation oxidizing. Under irradiation with the breaks the resource t(sub R) is much greater than t(sub r), but it requires to correlate the sessions and the breaks with the account of collider operation regime and scintillator recovery time. In the framework of this work, at D(sub lim) (is less than =) 4 kGy the record time of recovery is obtained: the PS2 sample recovers for 104% in 6 hours. This sample is made from PSM-115 by casting under pressure and, for the first time, it contains the anti-oxidants and photo-stabilizers added instead of the anti-rads.
NTIS
Radiation Detectors; Radiation Sources

74
OPTICS

Includes light phenomena and the theory of optical devices. For lasers see 36 Lasers and Masers.

20000074242 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Realization of Ultra-High Spectral Purity with the Opto-Electronic Oscillator
Yao, Steve, Jet Propulsion Lab., California Inst. of Tech., USA; Maleki, Lute, Jet Propulsion Lab., California Inst. of Tech., USA; Ji, Yu, Jet Propulsion Lab., California Inst. of Tech., USA; Dick, John, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Recent results with the Opto-Electronic Oscillator (OEO) have led to the realization of very high spectral purity. Experimental results have produced a performance characterized by a noise as low as by -50 dBc/Hz at 10 Hz for a 10 GHz OEO. The unit was built in a compact package containing an integrated DFB laser and the modulator. This performance is significant because the oscillator is free running, and since the noise in an OEO is independent of the oscillation frequency, the same result can also be obtained at higher frequencies. The result also demonstrates that high frequency, high performance, low cost, and miniature OEO can be realized with the integrated photonic technology. We have also developed a novel carrier suppression technique to reduce the 1/f phase noise of the oscillator even further. The technique is based on the use of a long fiber delay, in place of the high Q cavity, to implement carrier suppression. Our preliminary experimental results indicate an extra 10 to 20 dB phase noise reduction of the OEO with this novel technique. Further noise reduction beyond this value is expected with improved circuit design and longer reference fiber.
Author
Oscillators; Optoelectronic Devices; Electro-Optics; Electromagnetic Noise; Noise Reduction

20000074271 NASA Marshall Space Flight Center, Huntsville, AL USA

Status on NGST Mirror Technology

Jacobson, David, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; H2L2, 17-18 Apr. 2000, Japan; Sponsored by Tokyo Univ., Japan; No Copyright; Avail: Issuing Activity; Abstract Only

The NGST primary mirror is anticipated to be a segmented deployable optic with segment size being in the range of 1 - 3 m depending on the details of the architecture. The secondary mirror will likely be a monolith similar in size to one of the primary mirror segments. Over the past 4 years the NGST program has initiated and implemented an aggressive lightweight cryogenic mirror technology program. The program was designed to challenge and excite the optical community in reaching a new standard in production of lightweight optics. The goal was to develop optics at less than 15 kg/sq m, operational at approx. 40 K and meeting the overall NGST observatory requirement for diffraction limited performance at 2 microns. In order to meet the NGST needs, technology efforts were initiated to investigate and develop mirrors in a variety of materials, which held promise for the program. The basic technology approaches have initially targeted the production of large mirrors in the 1.2 - 2.0 m diameter range (or side-to-side distance in the case of hexagonal optics). Although this size may not be the final size of an NGST primary mirror segment, it was felt that a 1.2 - 2.0 m optic would be of sufficient size to understand the mirror material and fabrication processes which drive the cost and schedule of mirror production. The ultimate goals of the technology program are both to demonstrate mirrors meeting, the NGST performance requirements, and to establish cost and schedule credibility for producing and implementing the mirrors for the NGST flight system. Establishing cost and schedule credibility is essential to NGST which is a cost capped mission, with past program experience demonstrating that the optics will be a large portion of the total cost of the program. The first two years of the program were dedicated to understanding; the various applicable materials, funding those materials to various levels of maturity and implementing the first large mirror procurement, the NGST Mirror System Demonstrator (NMSD), in order to establish a benchmark for the state-of-the-art in lightweight optics and to establish credibility that the goals of NGST could be achieved. The past two years of the program has seen major steps in the development of several mirror materials, which not only might have NGST applicability but could also support other programs for other customers. Additionally, a second large mirror procurement, the Advanced Mirror System Demonstrator (AMSD), has been implemented providing a focal point to complete the mirror technology development and lead ultimately to the production of mirrors that will fly on NEXUS (the NGST flight experiment- discussed below) and NGST. This talk will focus on the mirror technology developed over the past 4 years on the NGST program.

Author

Optical Materials; Mirrors; Segments; Fabrication; Folding Structures

20000074275 Space and Naval Warfare Systems Command, San Diego, CA USA

Measurement of Low-Altitude Infrared Transmission

Zeisse, C. R., Space and Naval Warfare Systems Command, USA; Nener, B. D., University of Western Australia, Australia; Dewees, R. V., Naval Air Warfare Center, USA; June 1999; 48p; In English

Report No.(s): AD-A365507; TR-1797; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Review how the atmosphere influences infrared transmission. Describe a transmissometer suitable for low-altitude measurements of transmission and scintillation in the infrared window regions. The optical properties of molecules and aerosol particles and the optical phenomena of refraction and interference are the primary factors influencing infrared transmission. A transmissometer was used to measure longwave and midwave infrared transmission and scintillation within several meters of the surface of San Diego Bay. The transmissometer has a black body source, a midwave detector made from InSb, and a longwave detector made from HgCdTe. The instrument achieves an accuracy of +/-10% when measuring transmission at a range of 7 km, has a maximum useful transmission range of 18 km in the longwave and 90 km in the midwave, and has a maximum useful scintillation range of 20 km in the midwave.

Derived from text

Infrared Radiation; Transmissometers; Transmittance

20000074479 NASA Marshall Space Flight Center, Huntsville, AL USA

The Fabrication of Replicated Optics for Hard X-Ray Astronomy

Speegle, C. O., Raytheon Co., USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; Engelhaupt, D., Alabama Univ., USA; Feb. 10, 2000; 3p; In English; OSA Optical Fabrication and Testing Meeting, 18-22 Jun. 2000, Quebec, Canada; Sponsored by Optical Society of America, USA

Contract(s)/Grant(s): NAS8-40836; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We describe the fabrication process for producing shallow-graze-angle mirrors for hard x-ray astronomy. This presentation includes the generation of the necessary super-polished mandrels, their metrology, and the subsequent mirror shell electroforming and testing.
Author
Electroforming; Fabrication; Mandrels; Metrology; Mirrors

20000074658 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
High Resolution Multimode Fiber Image Recovery
Jackson, Deborah, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The research emphasis is on developing a cost-effective method of recovering image information from small, closely confined spaces using multimode fibers. The state-of-the-art good quality-viewing fiber, which can currently be used for performing this function, is a 0.5 mm diameter bundle containing 6000 pixels at a cost of $10,000 per fiber bundle. However, these fiber bundles are very fragile and can easily break during surgical use, thereby making instrument reliability and replacement cost,a major impediment to their routine use in many applications. The advantage of working with a single multimode fiber is that it is significantly less expensive and mechanically more robust. In addition, careful choice of numerical aperture allows a higher image resolution (roughly 750,000 pixels) with a 0.5 mm diameter multimode fiber.
Author
Image Resolution; Numerical Aperture; Pixels; Imaging Techniques

20000075426 Norwegian Defence Research Establishment, Kjeller, Norway
Characterization of Fiber Bragg Gratings by Use of a Tunable External Cavity Laser
Trond, Kjerre, Norwegian Defence Research Establishment, Norway; Mar. 03, 2000; 88p; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj. FFIE/711/116
Report No.(s): FFI/RAPPORT-2000/01306; ISBN 82-464-0423-7; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report is a thesis for the master of science degree in physics at the University of Bergen. It describes theory and experiments used to determine the reflection characteristics of fiber optic Bragg gratings with high resolution. The experimental technique uses the interference between the Bragg reflection and fiber end reflection to determine the amplitude and phase response of the grating as a tunable laser is swept across the grating's reflection bandwidth. Several gratings have been characterized while they were exposed to varying levels of transverse strain.
Author
Bandwidth; Bragg Gratings; Frequency Response; Optical Fibers; Characterization; Fiber Optics

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PLASMA PHYSICS

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

20000074662 NASA Marshall Space Flight Center, Huntsville, AL USA
Numerical Model of the Plasma Sheath Generated by the Plasma Source Instrument Aboard the Polar Satellite
Leung, Wing C., Alabama Univ., USA; Singh, Nagendra, Alabama Univ., USA; Moore, Thomas E., NASA Goddard Space Flight Center, USA; Craven, Paul D., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Copyright; Avail: Issuing Activity; Abstract Only

The plasma sheath generated by the operation of the Plasma Source Instrument (PSI) aboard the POLAR satellite is studied by using a 3-dimensional Particle-In-Cell (PIC) code. When the satellite passes through the region of low density plasma, the satellite charges to positive potentials as high as 4050Volts due to the photoelectrons emission. In such a case, ambient core ions cannot accurately be measured or detected. The goal of the onboard PSI is to reduce the floating potential of the satellite to a sufficiently low value so that the ions in the polar wind become detectable. When the PSI is operated, an ion-rich Xenon plasma is ejected from the satellite, such that the floating potential of the satellite is reduced and is maintained at about 2Volts. Accordingly, in our 3-dimensional PIC simulation, we considered that the potential of the satellite is 2Volts as a fixed bias. Considering the relatively high density of the Xenon plasma in the sheath (approx. 10 - 10(exp 3)/cc), the ambient plasma of low density (less than 1/cc) is neglected. In the simulations, the electric fields and plasma dynamics are calculated self-consistently. We found that an "Apple"

shape positive potential sheath forms surrounding the satellite. In the region near the PSI emission, a high positive potential hill develops. Near the Thermal Ion Detection Experiment (TIDE) detector away from the PSI, the potentials are sufficiently low for the ambient polar wind ions to reach it. In the simulations, it takes about a hundred electron gyroperiods for the sheath to reach a quasi-steady state. This time is approximately the time taken by the heavy Xe(+) ions to expand up to about one average Larmor radius of electrons from the satellite surface. Using the steady state sheath, we performed trajectory calculations to characterize the detector response to a highly supersonic polar wind flow. The detected ions' velocity distribution shows significant deviations from a shifted Maxwellian in the ambient polar wind population. The deviations are caused by the effects of electric fields on the ions' motion as they traverse the sheath.
Author
Mathematical Models; Plasma Sheaths; Plasma Dynamics; Velocity Distribution; Space Plasmas; Electric Fields

20000074963 NASA Marshall Space Flight Center, Huntsville, AL USA
A Dust Grain Photoemission Experiment
Venturini, C. C., Alabama Univ., USA; Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; Abbas, M. M., NASA Marshall Space Flight Center, USA; Comfort, R. H., Alabama Univ., USA; [2000]; 1p; In English; 8th; Physics of Dusty Plasmas, 26-28 Apr. 2000, Santa Fe, NM, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A laboratory experiment has been developed at Marshall Space Flight Center to study the interaction of micron-sized particles with plasmas and FUV radiation. The intent is to investigate the conditions under which particles of various compositions and sizes become charged, or discharged, while exposed to an electron beam and/or UV radiation. This experiment uses a unique laboratory where a single charged micron size particle is suspended in a quadrupole trap and then subjected to a controlled environment. Tests are performed using different materials and sizes, ranging from 10 microns to 1 micron, to determine the particle's charge while being subjected to an electron beam and /or UV radiation. The focus of this presentation will be on preliminary results from UV photoemission tests, but past results from electron beam, secondary electron emission tests will also be highlighted. A monochromator is used to spectrally resolve UV in the 120 nm to 300 nm range. This enables photoemission measurements as a function of wavelength. Electron beam tests are conducted using I to 3 micron sized aluminum oxide particles subjected to energies between 100 eV to 3 KeV. It was found that for both positive and negative particles the potential tended toward neutrality over time with possible equilibrium potentials between -0.8 Volts and 0.8 Volts.
Author
Dust; Grain Size; Laboratories; Plasmas (Physics); Electron Beams; Microparticles

20000076124 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Minimizing energy losses in plasma-filled waveguide using relativistic electron beam
Khalil, S. M.; El-Shorbagy, K. H.; El-Siragy, E. N.; Dec. 31, 1998; 20p; In English
Report No.(s): DE99-616016; IC-98/219; No Copyright; Avail: Department of Energy Information Bridge

In this work we investigate the effect of a relativistic electron beam on the field stability and minimize the energy losses in waveguide. Analytical calculations are performed to find the plasma dielectric tensor, which leads to apply the boundary conditions at plasma-conductor interface. In addition we derive the dispersion equations which describe E- and H-waves, hence the damping rate of these waves. The necessary condition for the field stability in the waveguide and amplification coefficient for E-wave is also obtained. The effect of external magnetic field is taken into consideration. Electron beam is found to play a crucial role in controlling the field attenuation in waveguide.
NTIS
Energy Dissipation; Waveguides; Cold Plasmas; Relativistic Plasmas

20000076473 Kazakhskij Gosudarstvennyj Natsional'nyj Univ., Kazakhstan
Kinetic equation for weakly nonhomogeneous plasma which is in a high frequency electrical field
Koshtybaev, T.; Dec. 31, 1998; 130p; In Russian; In English
Report No.(s): DE99-616837; INIS-KZ-036; No Copyright; Avail: Department of Energy Information Bridge

In polarization approximation, there was obtained a kinetic equation for one particle distribution function taking account particle interaction and presence of high frequency and weakly nonhomogeneous electric field.
NTIS
Plasma Physics; Plasmas (Physics); Electromagnetic Fields

20000076474 Kazakhskij Gosudarstvennyj Natsional'nyj Univ., Kazakhstan
Total and transport cross-sections of particles' scattering for non-ideal plasma
Ramazanov, T. S.; Nurekenov, K.; Gabdullina, G.; Dec. 31, 1998; 130p; In Russian; In English
Report No.(s): DE99-616836; INIS-KZ-035; No Copyright; Avail: Department of Energy Information Bridge
The expressions for transport and total cross-section of scattering were obtained and dependences (zeta)(sub tr)(sup *) and (zeta)(sub total)(sup *) from bond's parameters (gamma) at different of r(sub s) parameters were cited.
NTIS
Plasma Physics; Scattering

20000076475 Kazakhskij Gosudarstvennyj Natsional'nyj Univ., Kazakhstan
Asymptotical decomposition in pseudopotential model of non-ideal plasma
Ramazanov, T. S.; Nurekenov, K.; Gabdullina, G.; Dec. 31, 1998; 130p; In Russian; In English
Report No.(s): DE99-616835; INIS-KZ-034; No Copyright; Avail: Department of Energy Information Bridge
The analytical equation for pseudopotential of particle's interaction in second approach and asymptotical decomposition for pseudopotential using the Krylov-Bogolyubov-Mitropol'skij method were obtained with help of method of straight decomposition. In this case, the second approach coincided with results which were obtained on the basis of straight decomposition.
NTIS
Decomposition; Pseudopotentials; Plasma Physics

20000076478 Al-Farabi Kazak State National Univ., Almaty, Kazakhstan
About relaxation phenomena and transport processes in a fully ionized non-ideal plasma
Baimbetov, F. B.; Iztleuov, N.; Dec. 31, 1998; 130p; In English
Report No.(s): DE99-616832; INIS-KZ-031; No Copyright; Avail: Department of Energy Information Bridge
In this work based on the kinetics equation, the reaction of directed velocities and particle temperatures of the fully ionized non-ideal plasma are investigated. The transport equations are obtained. With the help of these equations, the expressions for thermal and electrical conductivities and viscosity of non-ideal plasma are calculated.
NTIS
Plasmas (Physics); Plasma Physics

20000076605 National Inst. for Fusion Science, Toki, Japan
Electron Cyclotron Current Drive at Omega approximately equals Omega(sub c) With X-mode Launched From the Low Field Side
Leuterer, F., Max-Planck-Inst. fuer Plasmaphysik, Germany; Kubo, S., National Inst. for Fusion Science, Japan; February 2000; ISSN 0915-633X; 16p; In English
Report No.(s): NIFS-624; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
The electron cyclotron resonance layer in a tokamak, omega = omega (sub c)(r), is not accessible by the extraordinary wave from the low field side, because it is shielded by a cutoff layer. However, a X-mode launched with a nonzero toroidal angle propagates at the cutoff parallel to the magnetic field and has a circular polarization. Therefore it can already at the cutoff layer interact efficiently with electrons via the Doppler shifted resonance. The driven current can be substantially higher than that driven by the second harmonic X-mode. The applicability of this current drive scheme is limited to rather low values of but may be of interest for high magnetic field devices.
Author
Cyclotron Radiation; Electron Cyclotron Resonance; Magnetic Fields; Tokamak Devices; Low Density Flow

20000076606 Ecole Polytechnique, Palaiseau, France
Laboratoire pour l'Utilisation des Lasers Intenses: Rapport d'Activite 1999 du LULI (LULI Annual Report, 1999. Plasma Physics on LULI Facilities)
Amiranoff, F.; Jun. 2000; 172p; In French
Report No.(s): PB2000-105868; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
Work performed at LULI during the year 1999 is described in a set of 55 original contributions covering topics such as: laser-matter interaction, shocks, hydrodynamics, equations of states, atomic physics, X-ray lasers and laser developments.
NTIS
Plasma Physics; X Ray Lasers; Research Facilities

20000076617 Joint Inst. for Nuclear Research, Lab. of Nuclear Problems, Dubna, USSR
Tritium high pressure target
Perevozchikov, V. V.; Yukhimchuk, A. A.; Demin, D. L.; Dec. 31, 1998; 15p; In English
Report No.(s): DE99-616058; JINR-D-15-98-107; No Copyright; Avail: Department of Energy Information Bridge

The design of the tritium high pressure target with the volume of 16.5 cm(exp 3) developed at the RFNC-ARRIEP for the research of muon catalysis of nuclear fusion reactions in a hydrogen isotope mixture H-D-T at pressures up to 120 MPa in the range of operating temperatures 300 - 800 K is presented. The paper describes the operation of the main systems of the target, namely: cooling, heating, evaluation, radiation safety and performance monitoring system.
NTIS
Tritium; Targets; Cooling; Heating; Plasma Physics

20000076630 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Trajectory calculations for the ternary cold fission of (sup 252)Cf
Misicu, S.; Dec. 31, 1998; 27p; In English
Report No.(s): DE99-616076; JINR-E-4-98-121; No Copyright; Avail: Department of Energy Information Bridge

We compute the final kinetic energies of the fragments emitted in the light charged particle accompanied by cold fission of (sup 252)Cf taking into account the deformation and the finite-size effects of the fragments and integrating the equations of motion for a three-body system subjected only to Coulomb forces. The initial conditions for the trajectory calculations were derived in the framework of a deformed cluster model which includes also the effect due to the absorbative nuclear part. Although the distributions of initial kinetic energies are rather broad we show that in cold fission the initial conditions can be better determined than in the usual spontaneous fission.
NTIS
Trajectories; Fission; Kinetic Energy

20000076639 National Inst. for Fusion Science, Toki, Japan
On Turbulent Transport in Burning Plasmas
Itoh, K., National Inst. for Fusion Science, Japan; Yagi, M., Kyushu Univ., Japan; Itoh, S.-I., Kyushu Univ., Japan; Fukuyama, A., Kyoto Univ., Japan; Mar. 2000; ISSN 0915-633X; 14p; In English
Report No.(s): NIFS-626; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The change of the transport coefficient due to the fusion energy source is studied. The scale invariance property of the reduced set of equations is investigated in the presence of the self-heating term due to the fusion reaction. The pressure gradient as well as the fusion power are the free energy sources that dictate the turbulent transport. It is shown that the burning transport coefficient can have a form with much wider variety, and that the transport property could he different owing to the self-heating by the fusion reactions.
Author
Turbulence; Plasmas (Physics); Mathematical Models; Transport Properties; Plasma Diffusion

20000076640 National Inst. for Fusion Science, Theory and Computer Simulation Center, Toki, Japan
Wakefield of a Charged Particulate Influenced by Emission Process of Secondary Electrons
Nishimura, Kazumi, National Inst. for Fusion Science, Japan; Mar. 2000; ISSN 0915-633X; 12p; In English
Report No.(s): NIFS-625; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Wakefield of a charged particulate in a streaming plasma is investigated by a three-dimensional particle simulation. A difference is found in wakefields between a negatively charged particulate and a positively charged one, depending on the velocity of the particulate relative to that of the streaming plasma.
Author
Plasmas (Physics); Three Dimensional Models; Computerized Simulation; Charged Particles; Electron Emission

20000078400 Sandia National Labs., Albuquerque, NM USA
Z-Pinch Driven Inertial Confinement Fusion Target Physics Research at Sandia National Laboratories
Alberts, T. E.; Asay, J. R.; Baca, P. M.; Baker, K. L.; Breeze, S. P.; Oct. 27, 1998; 18p; In English
Report No.(s): DE00-001534; SAND98-0844C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Three hohlraum concepts are being pursued at Sandia National Laboratories (SNL) to investigate the possibility of using pulsed power driven magnetic implosions (z-pinches) to drive high gain targets capable of yields in the range of 200-1000 MJ. This research is being conducted on SNL'S.Z facility that is capable of driving peak currents of 20 MA in z-pinch loads producing

implosion velocities as high as 7.5 x 10(exp 7) cm/s, x-ray energies approaching 2 MJ, and x-ray powers exceeding 200 TW. This paper will discuss each of these hohlraum concepts and will overview the experiments that have been conducted on these systems to date.
NTIS
Zeta Pinch; Inertial Confinement Fusion; Controlled Fusion

20000078407 Rio Grande do Sul Univ., Inst. de Fisica, Porto Alegre, Brazil
Plasma turbulence in tokamaks
Caldas, I. L.; Heller, M. V. A.; Brasilio, Z. A.; Dec. 31, 1997; 6p; In English; LAWNP'97: 5. Latin American workshop on nonlinear phenomena
Report No.(s): DE99-617986; INIS-BR-3681; No Copyright; Avail: Department of Energy Information Bridge

In this work we summarize the results from experiments on electrostatic and magnetic fluctuations in tokamak plasmas. Spectral analyses show that these fluctuations are turbulent, having a broad spectrum of wavectors and a broad spectrum of frequencies at each wavector. The electrostatic turbulence induces unexpected anomalous particle transport that deteriorates the plasma confinement. The relationship of these fluctuations to the current state of plasma theory is still unclear. Furthermore, we describe also attempts to control this plasma turbulence with external magnetic perturbations that create chaotic magnetic configurations. Accordingly, the magnetic field lines may become chaotic and then induce a Lagrangian diffusion. Moreover, to discuss nonlinear coupling and intermittency, we present results obtained by using numerical techniques as bi spectral and wavelet analyses.
NTIS
Tokamak Devices; Plasma Turbulence; Plasma Physics; Electrostatics

20000078409 Rio Grande do Sul Univ., Inst. de Fisica, Porto Alegre, Brazil
Dynamical analysis of the magnetic field line evolution in tokamaks with ergodic limiters
Ullmann, K.; Caldas, I. L.; Dec. 31, 1997; 6p; In English; LAWNP'97: 5. Latin American workshop on nonlinear phenomena
Report No.(s): DE99-617991; INIS-BR-3686; No Copyright; Avail: Department of Energy Information Bridge

Magnetic ergodic limiters are commonly used to control chaos in the tokamak border and several models have been developed to study the influence of these limiters on the magnetic field line evolution in the tokamak vessel. In this work we derive a bidimensional symplectic mapping describing this evolution with toroidal corrections. Poincare plots presenting typical Hamiltonian behaviour, such as island chains and hetero clinic and homo clinic orbits are obtained. Then we perform the dynamical analysis of these Poincare plots using standard algorithms such as calculation of Lyapunov exponents, safety factors, FFT spectra and parameters space plots to perform the dynamical analysis.
NTIS
Tokamak Devices; Plasma Physics; Borders; Magnetic Fields

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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.

20000074270 NASA Marshall Space Flight Center, Huntsville, AL USA
Does Warming a Lysozyme Solution Cook Ones Data?
Pusey, Marc, NASA Marshall Space Flight Center, USA; Burke, Michael, Alabama Univ., USA; Judge, Russell, Alabama Univ., USA; [2000]; 1p; In English, 23-28 Jul. 2000, Saint Paul, MN, USA; Sponsored by American Crystallographic Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Chicken egg white lysozyme has a well characterized thermally driven phase transition. Between pH 4.0 and 5.2, the transition temperature, as defined by the point where the tetragonal and orthorhombic solubility are equal, is a function of the pH, salt (precipitant) type and concentration, and most likely of the buffer concentration as well. This phase transition can be carried out with protein solution alone, prior to the initiation of the crystallization process. We have now measured the kinetics of this process and investigated its reversibility. An aliquot of a stock protein solution is held at a given temperature, and at periodic intervals used to set up batch crystallization experiments. The batch solutions were incubated at 20 C until macroscopic crystals were obtained, at which point the number of crystals in each well were counted. The transition effects increased with temperature, slowly falling off at 30 C with a half time (time to approx. 1/2 the t = 0 number of crystals) of approx. 5 hours, and an estimated half time of approx. 0.5 hours at 43 C. Further, the process was not reversible by simple cooling. After holding a lysozyme solution

at 37 C (prior to addition of precipitant) for 16 hours, then cooling and holding it at 4 C, no return to the pre-warmed nucleation kinetics are observed after at least 4 weeks. Thus every thermal excursion above the phase transition point results in a further decrease in the nucleation rate of that solution, the extent being a function of the time and temperature. Orthorhombic lysozyme crystals apparently do not undergo the flow-induced growth cessation of tetragonal lysozyme crystals. We have previously shown that putting the protein in the orthorhombic form does not affect the averaged face growth kinetics, only nucleation, for tetragonal crystals. We may be able to use this differential behavior to elucidate how flow affects tile lysozyme crystal growth process.
Author
Cooling; Crystallization; Eggs; Lysozyme; Proteins; Transition Temperature

20000074668 NASA Marshall Space Flight Center, Huntsville, AL USA
Melt Motion Due to Peltier Marking During Bridgman Crystal Growth with an Axial Magnetic Field
Sellers, C. C., Illinois Univ., USA; Walker, John S., Illinois Univ., USA; Szofran, Frank R., NASA Marshall Space Flight Center, USA; Motakef, Shariar, Cape Simulations, Inc., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

This paper treats a liquid-metal flow inside an electrically insulating cylinder with electrically conducting solids above and below the liquid region. There is a uniform axial magnetic field, and there is an electric current through the liquid and both solids. Since the lower liquid-solid interface is concave into the solid and since the liquid is a better electrical conductor than the adjacent solid, the electric current is locally concentrated near the centerline. The return to a uniform current distribution involves a radial electric current which interacts with the axial magnetic field to drive an azimuthal flow. The axial variation of the centrifugal force due to the azimuthal velocity drives a meridional circulation with radial and axial velocities. This problem models the effects of Peltier marking during the vertical Bridgman growth of semiconductor crystals with an externally applied magnetic field, where the meridional circulation due to the Peltier Current may produce important mixing in the molten semiconductor.
Author
Semiconductors (Materials); Magnetic Field Configurations; Liquid-Solid Interfaces; Current Distribution; Crystal Growth; Axes of Rotation

20000076120 Al-Farabi Kazak State National Univ., Almaty, Kazakhstan
Determination of crystal oscillatory spectra by internal friction data spectroscopic analysis
Zaykin, Y.; Dec. 31, 1998; 130p; In English
Report No.(s): DE99-616830; INIS-KZ-029; No Copyright; Avail: Department of Energy Information Bridge

Technique for relaxation spectra determination on the basis of internal friction averaging over relaxation frequencies is developed. It is shown that mathematically the problem is reduced to solution of the first type Fredholm integral equation. Impurity oscillatory spectra in alpha-iron, molybdenum, and Fe-Cr-Ni alloy are obtained.
NTIS
Oscillations; Crystals; Spectra

20000076125 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Stark effect of excitons in corrugated lateral surface superlattices: effect of centre-of-mass quantization
Hong Sun,; Nov. 30, 1998; 18p; In English
Report No.(s): DE99-616015; IC-98/215; No Copyright; Avail: Department of Energy Information Bridge

The quantum confined Stark effect (QCSE) of excitons in GaAs/AlAs corrugated lateral surface superlattices (CLSSLs) is calculated. Blue and red shifts in the exciton energies are predicted for the heavy- and light-excitons in the CLSSLs, respectively, comparing with those in the unmodulated quantum well due to the different effective hole masses in the parallel direction. Sensitive dependence of the QCSE on the hole effective mass in the parallel direction is expected because of the ''centre-ofmass'' quantization (CMQ) induced by the periodic corrugated interfaces of the CLSSLs. The effect of the CMQ on the exciton mini-bands and the localization of the excitons in the CLSSLs is discussed.
NTIS
Stark Effect; Excitons; Center of Mass; Measurement

20000076480 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Memorization of short-range potential fluctuations in Landau levels
Manolescu, A.; Gudmundsson, V.; Aug. 31, 1998; 12p; In English
Report No.(s): DE99-616011; IC-98/110; No Copyright; Avail: Department of Energy Information Bridge

We calculate energy spectra of a two-dimensional electron system in a perpendicular magnetic field and periodic potentials of short periods. The Coulomb interaction is included within a screened Hartree-Fock approximation. The electrostatic screening is poor and the exchange interaction amplifies the energy dispersion. We obtain, by numerical iterations, self-consistent solutions that have a hysteresis-like property. With increasing amplitude of the external potential the energy dispersion and the electron density become periodic, and they remain stable when the external potential is reduced to zero. We explain this property in physical terms and speculate that a real system could memorize short-range potential fluctuations after the potential has been turned off.
NTIS
Energy Spectra; Magnetic Fields

20000078406 Oak Ridge National Lab., TN USA
Atomic Structure and Properties of Extended Defects in Silicon
Buczko, R.; Chisholm, M. F.; Kaplan, T.; Maiti, A.; Mostoller, M.; Oct. 15, 1998; 14p; In English; 5th International Conference on Polycrystalline Semiconductors, Schwabisch- Gmund, Germany, September 13-18, 1998
Report No.(s): DE00-001710; ORNL/CP-100178; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The Z-contrast technique represents a new approach to high-resolution electron microscopy allowing for the first time incoherent imaging of materials on the atomic scale. The key advantages of the technique, an intrinsically higher resolution limit and directly interpretable, compositionally sensitive imaging, allow a new level of insight into the atomic configurations of extended defects in silicon. This experimental technique has been combined with theoretical calculations (a combination of first principles, tight binding, and classical methods) to extend this level of insight by obtaining the energetic and electronic structure of the defects.
NTIS
Atomic Structure; Electronic Structure; Defects; Silicon

20000078412 Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Brazil
Hyper chaos in nonlinear magnetic resonance
Meier, P. F.; Moser, H. R.; Warden, M.; Waldner, F.; Dec. 31, 1989; 6p; In English; Meeting on new trends in magnetism
Report No.(s): DE99-618003; INIS-BR-3698; No Copyright; Avail: Department of Energy Information Bridge
Nonlinear antiferromagnetic resonance at 9 GHz was observed by the parallel pumping technique with continuous waves in (C H2 N H3)(sub 2) Cu Cl4 single crystals. When pumped well above (30 d B) the instability threshold self spiking of the absorbed microwave power was observed. Due to the strong non-linearity of the sample the measurements present a rich variety of strongly irregular time behaviour with high fractal dimensions 2.5 (<=) D(<=) 5. The measurements are compared to the results of the 2 n-dimensional stroboscopic model which describes the dynamics of n non-linear coupled spin wave modes. The classically derived SM qualitatively predicts the more regular behaviour in the two mode system whereas the more irregular measurements with high fractal dimensions were modeled by the three mode system. These simulations revealed two positive Lyapunov exponents indicating hyper chaotic behavior. General features of hyper chaotic systems are discussed and compared to the results obtained on experiments on parallel pumped antiferromagnets.
NTIS
Chaos; Magnetic Resonance; Chemical Analysis

20000078413 Sao Paulo Univ., Inst. de Ciencias Matematicas, Sao Carlos, Brazil
Algorithm for three dimension reconstruction of magnetic resonance tomographs and X-ray images based on Fast Fourier Transform
Bueno, J. M.; Traina, A. J. M.; Cruvinel, P. E.; Dec. 31, 1995; 6p; In Portuguese; In English; 1st; Workshop on defense dissertations at SCE-ICMSC (Sao Carlos Mathematical Sciences Institute)
Report No.(s): DE99-618005; INIS-BR-3700; No Copyright; Avail: Department of Energy Information Bridge
This work presents an algorithm for three-dimensional digital image reconstruction. Such algorithms based on the combination of both a Fast Fourier Transform method with Hamming Window and the use of a tri-linear interpolation function. The algorithm allows not only the generation of three-dimensional spatial spin distribution maps for Magnetic Resonance Tomography data but also X and Y-rays linear attenuation coefficient maps for CT scanners. Results demonstrates the usefulness of the algorithm in three-dimensional image reconstruction by doing first two-dimensional reconstruction and rather after interpolation. The algorithm was developed in C++ language, and there are two available versions: one under the DOS environment, and the other under the UNIX/Sun environment.
NTIS
Magnetic Resonance; Algorithms; Image Reconstruction

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.

20000074286 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Quantum supergroup structure of 1+1-dimensional quantum super-plane, its dual and its differential calculus
ElFalaki, M.; Tahri, E. H.; Jul. 31, 1999; 13p; In English
Report No.(s): DE99-636786; IC-99/82; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We show that the 1+1-dimensional quantum super-plane introduced by Manin is a quantum supergroup according to the Faddeev-Reshetikhin-Takhtajan approach. We give its super-matrix element, its corresponding R-matrix and its Hopf structure. This new point of view allows us to realize its dual Hopf super-algebra starting from postulated initial pairings. Second, we construct a right-invariant differential calculus on it and then deduce the corresponding quantum Lie super-algebra which as a commutation super-algebra appears classical, and as Hopf structure is a non-cocommutative q-deformed one. An isomorphism between the latter and the dual one obtained in the first method is given.
NTIS
Quantum Theory; Group Theory; Lie Groups; Differential Calculus

20000074289 Clermont-Ferrand Univ., Lab. de Physique Corpusculaire, France
Virtual Compton scattering under Pi(sup 0) threshold at Q(sup 2) = 0.33 GeV(sup 2): Preliminary results
Roche, J.; DHose, N.; Ducret, J. E.; Gousset, T.; Gouchon, P. A. M.; Dec. 31, 1999; 5p; In English
Report No.(s): DE99-636820; PCCF-RI-9902; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The absolute unpolarized cross sections for photon electro-production off the proton ep yields ep(gamma) have been measured with the Three-Spectrometer-Setup at MAMI at a momentum transfer q = 600 MeV/c and a virtual photon polarization (epsilon) = 0.62. The momentum range for the outgoing real photon q' = 33/111 MeV/c.
NTIS
Compton Effect; Photoelectricity; Electron Scattering; Photon-Electron Interaction; Elementary Particle Interactions

20000076127 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Vortices, semi-local vortices in gauged linear sigma model
Kim, N.; Nov. 30, 1998; 21p; In English
Report No.(s): DE99-616013; IC-98/199; No Copyright; Avail: Department of Energy Information Bridge

We consider the static (2+1)D gauged linear sigma model. by analyzing the governing system of partial differential equations, we investigate various aspects of the model. We show the existence of energy finite vortices under a partially broken symmetry on R(sup 2) with the necessary condition suggested by Y. Yang. We also introduce generalized semi-local vortices and show the existence of energy finite semi-local vortices under a certain condition. The vacuum manifold for the semi-local vortices turns out to be graded. Besides, with a special choice of a representation, we show that the O(3) sigma model of which target space is nonlinear is a singular limit of the gauged linear sigma model of which target space is linear.
NTIS
Vortices; Gauge Invariance

20000076479 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
D-strings in unconventional type I vacuum configurations
Bianchi, M.; Gava, E.; Morales, F.; Narain, K. S.; Nov. 30, 1998; 31p; In English
Report No.(s): DE99-616012; IC-98/197; ROM2F-98-39; No Copyright; Avail: Department of Energy Information Bridge

We determine the spectrum of D-string bound states in various classes of generalized type I vacuum configurations with sixteen and eight supercharges. The precise matching of the BPS spectra confirms the duality between unconventional type IIB orientfolds with quantized NS-NS antisymmetric tensor and heterotic CHL models in D=8. A similar analysis puts the duality between type II (4,0) models and type I strings without open strings on a firmer ground. The analysis can be extended to type II (2,0) asymmetric orbifolds and their type I duals that correspond to unconventional K3 compactifications. Finally we discuss BPS-saturated threshold corrections to the corresponding low- energy effective lagrangians. In particular we show how the exact

moduli dependence of some F(sup 4) terms in the eight-dimensional type II (4,0) orbifold is reproduced by the infinite sum of D-instanton contributions in the dual type I theory.
NTIS
Strings; Vacuum

20000076627 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Quantum mechanics in general relativity and its special - relativistic limit
Tagirov, E.; Dec. 31, 1998; 28p; In English
Report No.(s): DE99-616070; JINR-E-2-98-71; No Copyright; Avail: Department of Energy Information Bridge

Quantum mechanics of a neutral point-like particle in the general Riemannian space-time is constructed starting with the general Fock representation of the quantum scalar field. The known ambiguity of the representation is removed by the requirement that the quasi-one-particle wave functions in configurational space should admit the Born probabilistic interpretation after a transformation, generally nonlocal, and therefore may be considered as the one-particle wave functions. Operators of momentum and spatial position of a particle acting in the space of these transformed wave functions are deduced consecutively from basic naturally defined operators of the observables in the Fock space. They coincide with the canonical ones only in the case of the infinite velocity of light. In particular, even in the Minkowski space-time and inertial frames of reference , the operators of curvilinear coordinates do not commute 26 refs.
NTIS
Quantum Mechanics; Relativity

20000076628 Joint Inst. for Nuclear Research, Bogolyubov Lab. of Theoretical Physics, Dubna, USSR
Interbasis expansion for isotropic oscillator on two-dimensional sphere
Akopyan, E. M.; Pogosyan, G.; Dec. 31, 1998; 12p; In English
Report No.(s): DE99-616071; JINR-E-2-98-82; No Copyright; Avail: Department of Energy Information Bridge

The isotropic oscillator system on the two-dimensional sphere in the spherical systems of coordinates is analyzed. The expansion coefficients for transitions between three spherical bases of the oscillator are calculated. It is shown that these coefficients are expressed through the Clebsch-Gordan coefficients for SU(2) group analytically continued to real values of their argument.
NTIS
Isotropy; Oscillators

20000078408 Rio Grande do Sul Univ., Inst. de Fisica, Porto Alegre, Brazil
Sine-Gordon mean field theory of a Coulomb gas
Diehl, A.; Barbosa, M. C.; Levin, Y.; Dec. 31, 1997; 6p; In English; LAWNP'97: 5. Latin American workshop on nonlinear phenomena
Report No.(s): DE99-617987; INIS-BR-3682; No Copyright; Avail: Department of Energy Information Bridge

The Coulomb gas provides a paradigm for the study of various models of critical phenomena. In particular, it is well known that the two dimensional (2 D). Coulomb gas can be directly used to study the superfluidity transition in (sup 4) He films, arrays of Josephson junctions, roughening transition, etc. Not withstanding its versatility, our full understanding of the most basic model of Coulomb gas, namely an ensemble of hard spheres carrying either positive or negative charges at their center, is still lacking. It is now well accepted that at low density the two dimensional plasma of equal number of positive and negative particles undergoes a Kosterlitz-Thouless (KT) metal insulator transition. This transition is of an infinite order and is characterized by a diverging Debye screening length. As the density of particles increases, the validity of the KT theory becomes questionable and the possibility of the KT transition being replaced by some kind of first order discontinuity has been speculated for a long time. In this work sine-Gordon field theory is used to investigate the phase diagram of a neutral Coulomb gas. A variational mean-field free energy is constructed and the corresponding phase diagrams in two and three dimensions are obtained. When analyzed in terms of chemical potential, the sine-Gordon theory predicts the phase diagram topologically identical to the Monte Carlo simulations and a recently developed Debye-Huckel-Bjerrum theory. In 2D, we find that the infinite-order Kosterlitz-Thouless line terminates in a tricritical point, after which the metal-insulator transition becomes first order. However, when the transformation from chemical potential to the density is made the whole insulating phase is mapped onto zero density.
NTIS
Field Theory (Physics); Neutral Gases; Phase Diagrams

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SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula.

20000076833 Syracuse Univ., Center for Training and Research in Hypersonics, NY USA
The Syracuse University Center for Training and Research in Hypersonics ***Final Report, 1 Aug. 1993 - 31 Jan. 2000***
LaGraff, John, Syracuse Univ., USA; Jul. 18, 2000; 24p; In English; Sponsored in part by NASA/Cornell University Space Grant Consortium
Contract(s)/Grant(s): NAGW-3713; NAG1-1400; NGT-51171; NGT-70380; NSF EEC-93-00414; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In Fall 1993, NASA Headquarters established Centers for Hypersonics at the University of Maryland, the University of Texas-Arlington, and Syracuse University. These centers are dedicated to research and education in hypersonic technologies and have the objective of educating the next generation of engineers in this critical field. At the Syracuse University Center for Hypersonics this goal is being realized by focusing resources to: Provide an environment in which promising undergraduate students can learn the fundamental engineering principles of hypersonics so that they may make a seamless transition to graduate study and research in this field; Provide graduate students with advanced training in hypersonics and an opportunity to interact with leading authorities in the field in both research and instructional capacities; and Perform fundamental research in areas that will impact hypersonic vehicle design and development.
Author
Hypersonics; Research and Development; Hypersonic Vehicles

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ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20000074672 Patent and Trademark Office, Washington, DC USA
Strategic Information Technology Plan for Fiscal Years 2000-2005 (Patent and Trademark Office). Executive Overview
2000; 56p; In English
Report No.(s): PB2000-105932; No Copyright; Avail: National Technical Information Service (NTIS)

The US Patent and Trademark Office's (USPTO) mission is to administer the laws relating to patents and trademarks, promote industrial and technical progress in the USA, and strengthen the national economy. As an integral part of this mission, the USPTO provides inventors and entrepreneurs with the protection and encouragement they need to take their inventive and creative ideas to the market place. This support ultimately enables job creation, economic growth, sustainable development, and improved living standards for all Americans. The USPTO's overall corporate vision is to lead the world in providing customer-valued intellectual property rights that spark innovation, create consumer confidence, and promote creativity. Recognizing the increasing importance of intellectual property protection in a global and technology-based economy, the USPTO established two strategic goals designed to focus agency priorities in accomplishing this vision: Play a leadership role in intellectual property rights policy, including trade-related intellectual property issues for which we have responsibility; Provide our customers with the highest level of quality and service in all aspects of the USPTO operations.
NTIS
Information Systems; Economic Development; Laws; Records Management; Information Dissemination; Data Base Management Systems; Management Planning

20000076129 General Accounting Office, General Government Div., Washington, DC USA
Information Policy: NTIS' Financial Position Provides an Opportunity to Reassess Its Mission
Jun. 2000; 32p
Report No.(s): PB2000-106512; GAO/GGD-00-147; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The report responds to the requirement in Senate Report 106-76 that the USA General Accounting Office (GAO) examine an issue involving the Department of Commerce's National Technical Information Service (NTIS). NTIS is a permanent repository and principal disseminator for scientific, technical, and engineering information (hereafter referred to as research). The report also responds to broader NTIS issues of concern to the Senate Committee on Commerce, Science, and Transportation and the House Committee on Science. NTIS' World News Connection (WNC) operates an on-line foreign news service that disseminates to the public, for a fee, news obtained from

the Central Intelligence Agency's (CIA) Foreign Broadcast Information Service (FBIS). For over 55 years, NTIS (or its predecessor agency) has collected and disseminated agencies' research reports to the public. However, during the late 1990s, agencies increasingly began making many of their research reports available to the public for free through the World Wide Web. This contributed to a decline in NTIS revenues from the sale of these reports. The objectives of the report were to (1) determine whether NTIS can continue to be self-sufficient and, if not, what issues need to be addressed; and (2) determine whether WNC's on-line foreign news service exceeds NTIS statutory authority to the detriment of private firms offering similar news services.
NTIS
Congressional Reports; Financial Management; Information Systems

20000076614 Daresbury Nuclear Physics Lab., UK
Report of the Council for the Central Laboratory of the Research Councils, April 1, 1998-March 31, 1999. Annual Report 1998-99
Feb. 23, 2000; 40p; In English; Original contains color illustrations
Report No.(s): PB2000-106348; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The Central Laboratory of the Research Councils (CLRC) is the UK's primary user facility organization, providing world class sources of X-rays, neutrons, muons and laser light to scientists from both the UK and abroad. It operates on three main sites, the Rutherford Appleton Laboratory, the Daresbury Laboratory and the Chilbolton Observatory, and is the home of internationally renowned researchers in fields from microelectronics to particle physics. As a result, a critical mass of expertise has developed to which researchers have access, either directly or via the appropriate funding research council. Over the past year the emphasis has been on building partnerships both with universities and industry. Eighty per cent of the funding for the programs carried out by the CCLRC comes through partnership with other UK research councils, whilst the remaining twenty per cent comes through direct partnership with universities, industry and overseas organizations.
NTIS
Research Facilities; Test Facilities; Synchrotron Radiation; Radiation Sources; Research and Development; Microelectronics; Particle Interactions; Particle Theory

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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.

20000074717 Technische Univ., Inst. fuer Geodaesie und Geophysik, Vienna, Austria
Considering A Priori Correlations in VLBI Data Analysis
Schuh, Harald, Technische Univ., Austria; Tesmer, Volker, Deutsches Geodaetisches Forschungsinstut, Germany; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 237-242; In English; See also 20000074683; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The complete model of least-squares adjustment contains the full variance-covariance matrix of the observables. However, in present standard VLBI solutions, only the variances of the observed time delays are introduced, whereas the covariances are set to zero, i.e. no a priori correlations between the observables of a VLBI-session are taken into account. In this study, correlation coefficients for 36 IRIS-S sessions since 1994 were determined empirically, the a priori correlation matrices were designed and entered into the VLBI data analysis. The OCCAM 3.4 VLBI software had been modified for that purpose by introducing the full variance-covariance matrix. The results were compared with those of an uncorrelated approach. The formal errors of the results usually increased and hence became more realistic. The repeatability of the baseline lengths and of the vertical and horizontal components improved significantly.
Author
Very Long Base Interferometry; Data Processing; Data Reduction; Data Correlation; Correlation Coefficients

20000074726 Naval Observatory, Washington, DC USA
Improving the ICRF Using the Radio Reference Frame Image Database
Fey, Alan L., Naval Observatory, USA; Boboltz, David A., Naval Observatory, USA; Gaume, Ralph A., Naval Observatory, USA; Johnston, Kenneth J., Naval Observatory, USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 285-287; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

We describe applications of the Radio Reference Frame Image Database aimed specifically toward improvement of the International Celestial Reference Frame.
Author
Radio Sources (Astronomy); Data Bases; Astrometry; Celestial Reference Systems

20000074732 Deutsches Geodaetisches Forschungsinstut, Munich, Germany
Status of IADA: An Intelligent Assistant for Data Analysis in VLBI
Schwegmann, Wolfgang, Deutsches Geodaetisches Forschungsinstut, Germany; Schuh, Harald, Deutsches Geodaetisches Forschungsinstut, Germany; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 319-323; In English; See also 20000074683
Contract(s)/Grant(s): DFG-Schu-1103/2-1; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche
A faster and semiautomatic data analysis is important if the VLBI procedure shall be accelerated. Most of the tasks during the VLBI data analysis are very complex and require typical knowledge-based techniques. Thus, a Knowledge-Based System (KBS) called IADA (Intelligent Assistant for Data Analysis in VLBI) is being built which can be adapted to different geodetic VLBI software packages. The concept of IADA is described and it is shown how the knowledge about the VLBI data analysis process can be modeled and applied to the data analysis by the problem solving component of the KBS, to automate the data analysis. An interface has to be developed to transfer data and information between the existing software, e.g. the Mark III data analysis software package SOLVE, and IADA. The concept of the interface and the data flow between the KBS and SOLVE is described.
Author
Applications Programs (Computers); Expert Systems; Geodesy; Very Long Base Interferometry; Data Processing

20000075213 Naval Postgraduate School, Monterey, CA USA
The Role of Expert Systems in Federated Distributed Multi-Database Systems
Ince, Levent; Mar. 2000; 252p; In English
Report No.(s): AD-A377679; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche
A shared information system is a series of computer systems interconnected by some kind of communication network. There are data repositories residing on each computer. These data repositories must somehow be integrated. The purpose for using distributed and multi-database systems is to allow users to view collections of data repositories as if they were a single entity. Multidatabase systems, better known as heterogeneous multidatabase systems, are characterized by dissimilar data models, concurrency and optimization strategies and access methods. Unlike homogenous systems, the data models that compose the global database can be based on different types of data models. It is not necessary that all participant databases use the same data model. Federated distributed database systems are a special case of multidatabase systems. They are completely autonomous and do not rely on the global data dictionary to process distributed queries. Processing distributed query requests in federated databases is very difficult since there are multiple independent databases with their own rules for query optimization, deadlock detection, and concurrency. Expert systems can play a role in this type of environment by supplying a knowledge base that contains rules for data object conversion, rules for resolving naming conflicts, and rules for exchanging data.
DTIC
Data Bases; Expert Systems; Information Systems; Knowledge Bases (Artificial Intelligence); Knowledge Based Systems

20000075962 Army War Coll., Carlisle Barracks, PA USA
The Role of Army Special Operations Forces in Information Warfare in the 21st Century
Bone, John H., Jr; Apr. 10, 2000; 21p; In English
Report No.(s): AD-A378280; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Relevancy on tomorrow's battlefield begins today. The USA military is facing an amorphic future. There is a lack of a clearly definable enemy. The nation's leadership has employed the military on more contingency operations during the last ten years than the prior fifty. General Schoomaker, Commander in Chief, U.S. Special Operations Command, has been emphasizing self-examination as it pertains to emerging missions and force structure since 1997. Maintaining a relevancy into the future is critical if ARSOF is to remain an effective weapon to help maintain America's freedom. This paper reviews the seven forms of information warfare and suggests four potential information warfare mission capabilities that could be added to the ARSOF mission matrix. These potential mission profiles are compatible with existing mission matrixes under the capabilities of Psychological Operations, Direct Action, Special Reconnaissance and Foreign Internal Defense. The decision to develop and incorporate the new skill sets rests with the Leadership of SOF in conjunction with current information warfare policy and NCA guidance.
DTIC
Warfare; Military Operations; Mission Planning

20000075974 RAND Corp., Santa Monica, CA USA
Public-Private Partnerships for Data Sharing: A Dynamic Environment
Lachman, Beth E.; Apr. 2000; 155p; In English
Report No.(s): AD-A378368; RAND/DRU-2259-NASA/OSTP; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report presents a RAND analysis of public-private partnerships focused on data sharing. Many different practical case studies, models of data sharing partnering, were analyzed to understand differences and similarities in the practical approaches to data sharing, especially geospatial data sharing. This report can provide useful information to federal policy makers about how to more effectively partner with non-federal partners. It should also be of interest to state and local governments, non-governmental organizations, researchers, and others who are interested in data sharing partnerships, especially those with interests in geospatial data. This research was originally sponsored by the White House Office of Science and Technology Policy (OSTP) through RAND's Science and Technology Policy Institute. Originally created by Congress in 1991 as the Critical Technologies Institute and renamed in 1998, the Science and Technology Policy Institute is a federally funded research and development center sponsored by the National Science Foundation and managed by RAND. The Institute's mission is to help improve public policy by conducting objective, independent research and analysis on policy issues that involve science and technology.
DTIC
Data Management; Policies; Research

20000076589 Army War Coll., Carlisle Barracks, PA USA
Golden Bridge, Golden Gate, or Golden Wall: China Moves into the Information Age
Maliszewski, Jane F.; Apr. 07, 2000; 42p; In English
Report No.(s): AD-A377631; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The People's Republic of China is a developing country poised at the edge of the Information Age frontier. China's progress towards the Information Age is measured by the modernity and pervasiveness of its information infrastructure--specifically, the telephone, computer, and network infrastructure is analyzed--and by the policies it uses to administer this infrastructure. China's current information sector policies epitomize the internal conflicts between reform and control with which the government struggles. China watches Singapore closely as a successful model.
DTIC
China; Information Theory; Information Systems

20000076602 Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA USA
List of U.S. Army Research Institute Research and Technical Publications ***Final Report, 1 Oct. 1994-30 Sep. 1999***
May 2000; 234p; In English
Report No.(s): AD-A378176; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

A bibliography of ARI technical publications from FY95 through FY99, including abstracts, Author and Subject Indexes and a list of acronyms.
DTIC
Bibliographies; Research; Documents

20000076603 Army Armament Research, Development and Engineering Center, Benet Labs., Watervliet, NY USA
Index to Benet Laboratories Technical Reports - 1998 ***Final Report***
Neifeld, R. D.; Apr. 1999; 36p; In English
Report No.(s): AD-A378175; ARCCB-SP-99006; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is a compilation of technical reports published by Benet Laboratories during 1998.
DTIC
Bibliographies; Documentation; Reports

20000078372 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
Mining Existing Assets for Software Product Lines ***Final Report***
Bergey, John; O'Brien, Liam; Smith, Dennise; May 2000; 30p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A378147; CMU/SEI-2000-TN-008; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Mining of existing assets offers an organization the potential to leverage all, or part, of its cumulative system investments, and thus represents a critical practice area in implementing a software product line. However, there are significant risks in achieving success because of the poorly documented and maintained state of many existing systems and the fact that many systems were

initially developed for different paradigms than current distributed, Web-oriented, object-oriented approaches. Four basic steps are required to successfully mine assets: (1) preliminary information gathering, (2) making decisions on whether to mine assets and which type of overall strategy to use, (3) obtaining detailed technical understanding of existing software assets, and (4) rehabilitation of assets. This note outlines basic considerations for each of these steps. It outlines typical information to collect before an analysis. It then outlines a model for making decisions on mining legacy assets, and discusses the technical understanding of assets and the rehabilitation of assets. Because of its importance as a strategy for product lines, architecture reconstruction is discussed, as it is supported by an automated tool set known as the Dali workbench.
DTIC
Object-Oriented Programming; Data Mining; Computer Programs

20000078397 Federal Energy Technology Center, Morgantown, WV USA
Phase III: Implementation and Operation of the repository
Jan. 01, 1998; 7p; In English
Report No.(s): DE00-001445; DE-FG22-97BC14847-04; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In October all three Sun servers (3000, Ultra/II) were loaded, and we were able to demonstrate the complete system databases, web front-page, and GeoTrek to a large audience. All systems required for the web-based metadata catalog are in place and operational. Version 54 of the PetroTrek/GeoTrek software was loaded in December and is being tested. It is expected this version will be placed in the production environment for beta testing in January.
NTIS
Data Bases; Data Management; Data Base Management Systems; Geology

20000078398 Federal Energy Technology Center, Morgantown, WV USA
Phase III: Implementation and Operation of the Repository
Apr. 01, 1998; 10p; In English
Report No.(s): DE00-001446; DE-FG22-97BC14847-05; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

All of the hardware is installed and all available databases are loaded into the metadata repository. The final stages of beta testing of GeoTrek and necessary revisions are underway, with a targeted public release of the NGDRS system in April or May 1998. The Eastern Gulf Region PTTC, Oklahoma Geological Survey, and A2D databases have been converted and loaded into the metadata repository. These are in addition to the four previously installed databases, including the BEG, MMS, PGS, and Fairfield. Data quality improvements, particularly with the MMS and BEG data is continuing, including making the data more intuitive for the typical user. The beta-testing process has resulted in a number of action items that have been reviewed and addressed. Most of these issues have been resolved, and the remaining issues will be resolved early in the second quarter of 1998, leading to the public launch of the NGDRS metadata repository. Installation of GeoTrek at the BEG, in an effort to bring their core holdings into the NDGRS, was completed in December. A review was held concerning the experiences of the BEG with GeoTrek during January. The feedback was largely positive, with only a couple technical details to address. A number of companies have also expressed interest and/or are evaluating PetroTrek, the commercial version of GeoTrek. Thus far, most of those companies, including PGS and Fairfield, which have licensed PetroTrek have simultaneously joined the NGDRS as well. Several data transfer efforts are underway. Vastar has committed to the transfer of 2D Appalachian seismic lines to the NDGRS clearinghouse. Receiving repositories have been identified and the final preparations are being made for transfer to these public repositories. Additionally, discussions continue with the Stapleton Development Corporation concerning the transfer of facilities in Denver for use as a central core repository.
NTIS
Data Bases; Data Management; Data Base Management Systems; Information Management

20000078399 Federal Energy Technology Center, Morgantown, WV USA
Phase III: Implementation and Operation of the Repository
Jul. 01, 1998; 10p; In English
Report No.(s): DE00-001452; DE-FG22-97BC14847-06; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The metadata catalog was brought online for public access May 14, 1998. Since then dozens of users have registered and began to access the system. The system was demonstrated at the AAPG annual meeting in Salt Lake City and the EAGE (European Association of Geoscientists and Engineers) annual meeting in Leipzig, Germany. Hart Publications and PTTC NetworkNews

have published articles about the metadata catalog, and articles for the AAPG Explorer and GSA Today are being developed. A back-up system at AGI headquarters was established. In support of the metadata catalog system, a leased-line Internet connection and two servers were installed. Porting of the GeoTrek server software to the new systems has begun. The back-up system will be operational during the 3 rd quarter of 1998 and will serve the NGDRS needs during periods when access to the site in Houston is down. Additionally, experimentation with new data types and deployment schemes will be tested on the system at AGI. The NGDRS has picked-up additional endorsements from the American Association of State Geologists, the MMS Outer Continental Shelf Policy Committee, and a new endorsement is being formulated by the AAPG Core Preservation Committee for consideration by the AAPG Executive Committee. The Texas Bureau of Economic Geology (BEG) is currently geocoding the well locations for the metadata catalog. Also, they have solicited proposals for the development of a core inventory control system that will work hand-in-hand with GeoTrek. A contract for that system will probably be given during the 3 rd quarter of 1998. The Texas Railroad Commission proposes to test the application of GeoTrek for accessing data in a joint project with the BEG. Several data transfer projects are underway. Vastar has committed to the transfer of 2D Appalachian seismic lines to the NDGRS clearinghouse. Receiving repositories have been identified and the final preparations are being made for transfer to these public repositories. Discussions have been initiated with the State of Oregon concerning listing their 400 oil and gas well and 50 geothermal well cores and logs on the metadata catalog. Additionally, discussions continue with the Stapleton Development Corporation concerning the transfer of facilities in Denver for use as a central core repository. A letter of intent for the facilitys transfer is being reviewed. NTIS

Data Management; Catalogs (Publications); On-Line Systems; Information Retrieval

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ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20000076808 NASA Langley Research Center, Hampton, VA USA

Improving the Discipline of Cost Estimation and Analysis

Piland, William M., NASA Langley Research Center, USA; Pine, David J., NASA Langley Research Center, USA; Wilson, Delano M., NASA Langley Research Center, USA; [2000]; 10p; In English; 51st; 51st International Astronautical Congress, 2-6 Oct. 2000, Rio de Janeiro, Brazil

Report No.(s): IAA-00-IAA.1.1.01; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

The need to improve the quality and accuracy of cost estimates of proposed new aerospace systems has been widely recognized. The industry has done the best job of maintaining related capability with improvements in estimation methods and giving appropriate priority to the hiring and training of qualified analysts. Some parts of Government, and National Aeronautics and Space Administration (NASA) in particular, continue to need major improvements in this area. Recently, NASA recognized that its cost estimation and analysis capabilities had eroded to the point that the ability to provide timely, reliable estimates was impacting the confidence in planning man), program activities. As a result, this year the Agency established a lead role for cost estimation and analysis. The Independent Program Assessment Office located at the Langley Research Center was given this responsibility. Author

Aerospace Systems; Cost Estimates; NASA Programs

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LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes: aviation law; space law and policy; international law; international cooperation; and patent policy

20000074949 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Fiscal 1997 report on the results of the international research cooperation project for a feasibility survey for finding out seeds of the international joint research. Effective use technology of saturated hydrocarbon

Mar. 31, 1998; 313p; In Japanese; In English

Report No.(s): DE99-714267; ETDE/JP-99714267; No Copyright; Avail: Department of Energy Information Bridge

For the purpose of the effective international research cooperation, the paper surveyed in fiscal 1997 the effective use technology of saturated hydrocarbon, technology against the surplus aromatic hydrocarbon and technology of high grade treatment of petroleum coke. In the survey of the effective use technology of saturated hydrocarbon, trends of FT synthesis technology and DME synthesis technology were studied as trends of technology to produce synthetic gas, and a project was proposed for technical

development of using natural gas as liquid fuel in Japan. In the survey of technology against the surplus aromatic hydrocarbon, studied were the benzene law regulation and the supply/demand trend of aromatic hydrocarbon, process to reduce production of aromatic hydrocarbon as much as possible, process to reduce aromatics of the produced petroleum products, and process to effectively use aromatic hydrocarbon as chemical raw material. In the survey of high grade treatment of petroleum coke, studied were a possibility of using HS petroleum coke in the DIOS method, iron bath gasification, and copper bath gasification technology.
NTIS
International Cooperation; Polycyclic Aromatic Hydrocarbons

20000075242 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Specified international joint research. Report for fiscal 1997 on the result of 'Development of Machining Supporting System'
Mar. 31, 1998; 93p; In Japanese; In English
Report No.(s): DE99-714271; ETDE/JP-99714271; No Copyright; Avail: Department of Energy Information Bridge

On the basis of information obtained from actually performed designing of machines with the aid of computers, researches are conducted for the development of a system that automatically designs required machine tools, machining procedures, machining conditions, and tool paths. The research and development efforts made in fiscal 1997 are enumerated below. In the development of man-machine interfaces, one that integrates a machining procedure designing system, machining condition designing system, and a tool path designing system, all of which are subsystems belonging in a machining supporting system, is developed. In a system evaluation performed through actual machining, an interface between CAD (Computer-Aided Design) technology and a machining supporting system is evaluated, when machining is actually performed for experimentation in an environment in which a machining procedure designing system, machining condition designing system, tool path designing system, and CNC (Computerized Numerical Control) technology collaborate as integrated. As the result, the performance expected to be achieved at the beginning is realized. Two scientists of Russian Academy of Sciences are invited, and researches are conducted concerning knowledge processing technology.
NTIS
Computer Aided Design; Man Machine Systems; Systems Analysis

89
ASTRONOMY

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

20000074264 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
First Detection of Methanol in a Class O Protostellar Disk
Velusamy, T., Jet Propulsion Lab., California Inst. of Tech., USA; Langer, William D., Jet Propulsion Lab., California Inst. of Tech., USA; Goldsmith, Paul F., Cornell Univ., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We report the detection of emission from methanol in a compact source coincident with the position of the L1157 infrared source, which we attribute to molecules in the disk surrounding this young, Class O protostellar object. In addition, we identify a spectral feature in the outflow corresponding to an ethanol transition. Using the Caltech Owens Valley Millimeter Array with a synthesized beam size of 2", we detect spatially unresolved methanol in the 2(sub k) - 1(sub k) transitions at 3mm, which is coincident in position with the peak of the continuum emission. The gas phase methanol could be located in the central region (is less than 100 AU radius) of a flat disk, or in an extended heated surface layer (approx. 200 AU radius) of a flared disk. The fractional abundance of methanol X(CH3OH) is approx. 2 x l0(exp -8) in the flat disk model, and 3 x l0(exp -7) for the flared disk. The fractional abundance is small in the disk as a whole, but considerably larger in the warm portions. This difference indicates that substantial chemical processing probably takes place in the disk via depletion and desorption. The methanol desorbed from the grains in the warm surface layers returns to the icy grain mantles in the cooler interior of the disk, where it is available to become part of the composition of solar system-like bodies, such as comets, formed in the outer circumstellar region. This first millimeter-wavelength detection of a complex organic molecule in a young protostellar disk has implications for disk structure and chemical evolution and for potential use as a temperature probe. The research of TV and WL was conducted at the Jet Propulsion Laboratory, California Institute of Technology with support from the National Aeronautics and Space Administration.
Author
Methyl Alcohol; Protostars; Infrared Radiation; Millimeter Waves; Accretion Disks

20000074651 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

High Resolution VLBA Observations of NGC 4261

Jones, D. L., Jet Propulsion Lab., California Inst. of Tech., USA; Wehrle, A. E., California Inst. of Tech., USA; Piner, B. G., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The VLBA's high angular resolution at 22 and 43 GHz allows the nuclei of nearby radio galaxies to be imaged with very high linear resolution (a few hundred Schwarzschild radii or less for central black hole masses of about 10(exp 8) - 10(exp 9) solar mass). This is the scale on which absorption by the dense ionized inner regions of nuclear accretion disk should be detected. We present 8, 22, and 43 GHz VLBA images of the two-sided radio jets in NGC 4261 (2C370) with sub-parsec resolution, and derive constraints on the physical properties of the inner accretion disk. In addition, preliminary results from multi-epoch VLBA observations to detect proper motions in the jet and counterjet, and thus determine the orientation of the radio axis to our line of sight, may be available. Our multi-frequency images show apparent absorption by a nearly edge-on disk at 8 GHz, but not evidence for absorption at 22 or 43 GHz. Assuming that this is due to a lower optical depth for free-free absorption at 22 and 43 GHz, we find an upper limit for the electron density of approximately 10(exp 8)* Square root of(0.1/L)/cubic cm, where L is the path length through the disk in pc. The disk inclination, and therefore the likely path length, will be better determined by the ongoing VLBA proper motions measurements. This research was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.

Author

Accretion Disks; Black Holes (Astronomy); Radio Jets (Astronomy); Radio Astronomy; Radio Galaxies

20000074657 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Determination and Long Term Integration of the Orbits of Caliban and Sycorax, 1.6

Jacobson, R. A., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English, 28 Apr. - 1 May 1999, Estes Park, CO, USA; Sponsored by American Astronautical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The first 2 irregular satellites of Uranus, Caliban and Sycorax, were discovered in late 1997. Subsequently, pre-discovery observations of both satellites were found on plates taken by D. Cruikshank in June of 1984. Recently, P. Nicholson, D. Tholen, and W. Offutt provided observations which they made in late 1998 at Palomar Mountain, Mauna Kea, and Cloudcroft, respectively. I fit a numerical integration perturbed by the Sun, Jupiter, Saturn, and Neptune to the set of available observations. For the 47 observations of Caliban the respective rms values of the Delta alpha (cos delta) and Delta delta residuals axe 0".60 and 0".32, and for the 103 observations of Sycorax the analogous values are 0".57 and 0".59. I extended the integration to span a 6000 year period and computed osculating orbital elements at yearly intervals. An included table contains the mean values of the elements over the 6000 years, the sidereal period, and the precession periods of the argument of periapsis and longitude of the ascending node. The osculating elements (except for a) exhibit a significant long period oscillation with a period roughly half that of the argument of periapsis.

Author

Oscillations; Uranus Satellites; Orbit Calculation

20000074665 NASA Marshall Space Flight Center, Huntsville, AL USA

Timing Noise in SGR 1806-20

Woods, Peter M., NASA Marshall Space Flight Center, USA; Kouveliotou, Chryssa, NASA Marshall Space Flight Center, USA; Finger, Mark H., NASA Marshall Space Flight Center, USA; Gogus, Ersin, NASA Marshall Space Flight Center, USA; Scott, D. Matthew, NASA Marshall Space Flight Center, USA; Dieters, Stefan, NASA Marshall Space Flight Center, USA; Thompson, Christopher, North Carolina Univ., USA; Duncan, Robert C., Texas Univ., USA; Hurley, Kevin, California Univ., USA; Strohmayer, Tod, NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We have phase connected a sequence of Rossi X-ray Timing Explorer Proportional Counter Array observations of SGR 1806-20 covering 178 days. We find a simple secular spin-down model does not adequately fit the data. The period derivative varies gradually during the observations between 8.1 and 11.7 x 10(exp -11) s/s (approx. 40% larger than the long term trend), while the average burst rate as seen with the Burst and Transient Source Experiment drops throughout the time interval. The phase residuals show no evidence for periodicity, but more closely resemble timing noise as seen ill radio pulsars. The magnitude of the timing noise., however, is large relative to the noise level typically found in radio pulsars (Delta(sub 8) = 4.8; frequency derivative average power approx. = 8 X 10(exp -20) Hz/sq s). Combined with the noise levels measured for some AXPs. we find all magnetar candidates have A8 values larger than those expected from a simple extrapolation of the correlation found in radio pulsars. We find the timing noise ill SGR 1806-20 is greater than or equal to the levels found in some accreting systems (e.g., Vela X-1, 4U 1538-52 and 4U 1626-67). Alternatively, an orbital model with a period P(sub orb) = 733 days provides a statistically

acceptable fit to the data. If the phase residuals are created by Doppler shifts from a gravitationally bound companion. then the allowed parameter space for the mass function (small) and orbital separation (large) rule out the possibility of accretion from the companion sufficient to power the persistent emission from the SGR.
Author
Proportional Counters; Noise Intensity; Gamma Ray Bursts; Time Measurement

20000074666 NASA Marshall Space Flight Center, Huntsville, AL USA
Discovery of Spatial and Spectral Structure in the X-Ray Emission from the Crab Nebula
Weisskopf, M., NASA Marshall Space Flight Center, USA; Hester, J. J., NASA Marshall Space Flight Center, USA; Tennant, A. F., NASA Marshall Space Flight Center, USA; Elsner, R. F., NASA Marshall Space Flight Center, USA; Schulz, N. S., NASA Marshall Space Flight Center, USA; Marshall, H. L., NASA Marshall Space Flight Center, USA; Karovska, M., NASA Marshall Space Flight Center, USA; Nichols, J. S., NASA Marshall Space Flight Center, USA; Swartz, D. A., NASA Marshall Space Flight Center, USA; Kolodziejczak, J. J., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Chandra X-ray Observatory observed the Crab Nebula and Pulsar During orbital calibration. Zeroth-order images with the High-Energy Transmission Grating (HETG) read-out by the Advanced CCD Imaging Spectrometer spectroscopy array (ACIS-S) show a striking richness of X-ray structure, at a resolution comparable to that of the best ground-based visible-light observations. The HETG-ACIS-S images reveal, for the first time, an X-ray knots along the inner ring and (perhaps) along the inward extension of the X-ray jet. Although complicated by instrumental effects and the brightness of the Crab Nebula, the spectrometric analysis shows systematic variations of the X-ray spectrum throughout the Nebula.
Author
Crab Nebula; Emission; Light (Visible Radiation); Observatories; Pulsars; X Rays

20000074686 National Radio Astronomy Observatory, USA
Astronomical VLBI: Comparison and Contrast with Geodetic/Astrometric VLBI
Walker, R. Craig, National Radio Astronomy Observatory, USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 42-51; In English; See also 20000074683; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The VLBI technique can be used for both high precision geometric measurements in geodetic and astrometric observations, and to study astronomical sources with high resolution. The equipment required for both types of observations is essentially the same and many telescopes and correlators are used for both. This synergy gives both the geodesy and astronomy communities access to more resources than either could support alone. The IVS membership is familiar with geodetic/astrometric VLBI, but perhaps less so with astronomical VLBI. Therefore, this presentation will begin with an introduction to the existing astronomical VLBI instruments. That will be followed by a number of examples of astronomical VLBI results to give a flavor for the science. Then some direct comparisons between geodetic and astronomical VLBI will be made with emphasis on observing modes and on the importance of various aspects of the data. Finally, the interaction between the groups will be discussed, both in terms of how they are interdependent and how differences in style have created some complications.
Author
Very Long Base Interferometry; Astronomical Interferometry; Astrometry; Geodesy

20000074700 Onsala Space Observatory, Sweden
VLBI Determinations of Local Telescope Displacements
Haas, Ruediger, Onsala Space Observatory, Sweden; Nothnagel, Axel, Bonn Univ., Germany; Behrend, Dirk, Institut d'Estudis Espacials de Catalunya, Spain; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 133-137; In English; See also 20000074683
Contract(s)/Grant(s): FMRX-CT96-0071; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

At three telescopes involved in the European geodetic VLBI network, track and wheel repair work had to be performed during 1996 and 1997, possibly changing the positions of the geodetic reference points. In order to monitor these changes conventional geodetic surveys have been done with respect to the local geodetic footprints of the telescopes. Knowledge of the position and possible change of position of the geodetic reference point of a telescope is of great importance for the geophysical interpretation of the results obtained from geodetic VLBI. In our paper we derive the changes of the geodetic reference points directly from the

VLBI data observed in the European geodetic VLBI network and compare our results to the ones obtained by conventional geodetic surveys.
Author
Geodetic Surveys; Radio Telescopes; Position Errors; Very Long Base Interferometry

20000074964 NASA Marshall Space Flight Center, Huntsville, AL USA
Interferometry for X-Ray Astronomy
Cash, Webster, NASA Marshall Space Flight Center, USA; Shipley, Ann, NASA Marshall Space Flight Center, USA; Osterman, Steve, NASA Marshall Space Flight Center, USA; Joy, Marshall, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

With direct imaging, the nature of distant astronomical objects and the physical mechanisms that control them can be constrained and understood. From Galileo's observations of the solar system, to Hubble Space Telescope's imaging of distant galaxies, improved astronomical imaging has always brought scientific understanding. The x-ray band of the spectrum, where exotic objects can have extremely high surface brightness, is ideally suited for high resolution imaging, but has lacked ultra-high quality telescopes. We report a practical x-ray interferometer that features high efficiency, affordable mirrors, adjustable baseline, and can be scaled to a full size observatory. Our prototype system, with just under one millimeter of baseline, created fringes at 1.25 keV with angular resolution of 100 milli-arcseconds. With a larger version of this interferometer in orbit it will be possible to resolve stars, black holes and other compact constituents of the universe. We can study the environments of pulsars, image and then model relativistic blast waves, study the space-time metric near the surface of a black hole, watch the physical formation of astrophysical jets, and study the dynamos of stellar coronae.
Author
Interferometers; X Ray Astronomy; Prototypes; Stellar Coronas; Spaceborne Telescopes; Imaging Techniques; Angular Resolution

20000075210 NASA Goddard Space Flight Center, Greenbelt, MD USA
Hubble Space Telescope Thermal Blanket Repair Design and Implementation
Ousley, Wes, NASA Goddard Space Flight Center, USA; Skladany, Joseph, Orbital Sciences Corp., USA; Dell, Lawrence, Lockheed Martin Technical Operations, Inc., USA; [2000]; 13p; In English; 30th; 30th International Conference on Environmental Systems (ICES), 10-14 Jul. 2000, Toulouse, France; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Substantial damage to the outer layer of Hubble Space Telescope (HST) thermal blankets was observed during the February 1997 servicing mission. After six years in LEO, many areas of the aluminized Teflon(R) outer blanket layer had significant cracks, and some material was peeled away to expose inner layers to solar flux. After the mission, the failure mechanism was determined, and repair materials and priorities were selected for follow-on missions. This paper focuses on the thermal, mechanical, and EVA design requirements for the blanket repair, the creative solutions developed for these unique problems, hardware development, and testing.
Author
Thermal Insulation; Damage; Hubble Space Telescope; Teflon (Trademark); Thermal Analysis; Space Missions; Spacecraft Maintenance; Multilayer Insulation

20000075644 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Spectroscopic Capabilities and Possibilities of the Far Infrared and Submillimeter Telescope Mission
Pearson, J. C., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Far Infrared and Submillimeter Telescope (FIRST) mission is the fourth European Space Agency corner stone mission. FIRST will be an observatory with a passively cooled (80 Kelvin) 3.5 meter class telescope and three cryogenic instruments covering the 670 to 80 mm spectral region. The mission is slated for a 4.5 year operational lifetime in an L2 orbit. It will share an Arian 5 launch with PLANCK in early 2007. The three payload instruments include the Spectral and Photometric Imaging Receiver (SPIRE), which is a bolometer array with Martin-Puplett FTS for 200-670 microns, the Photoconductor Array Camera and Spectrometer (PACS), which is a photoconductor array with a grating spectrometer for 80-210 microns and the Heterodyne Instrument for FIRST (HIFI), which is a series of seven heterodyne receivers covering 480-1250 GHz and portions of 1410-1910 GHz and 2400-2700 GHz. FIRST will make many detailed spectral surveys of a wide variety of objects previously obscured by the

atmosphere and in regions of the spectrum seldom used for astronomical observations, With all of the spectroscopic capability on FIRST a great deal of laboratory spectroscopic support will be needed for accurate interpretation of the spectral data.
Author
Infrared Telescopes; Submillimeter Waves; Far Infrared Radiation; Imaging Techniques; Emission Spectra

20000075654 Hertfordshire Univ., Dept. of Physical Sciences, Hatfield, UK
A Near Infrared Polarized Bipolar Cone in the CIRCINUS Galaxy
Ruiz, M., Hertfordshire Univ., UK; Alexander, D. M., International School for Advanced Studies, Italy; Young, S., Hertfordshire Univ., UK; Hougn, J. H., Hertfordshire Univ., UK; Lumsden, S. L., Leeds Univ., UK; Heisler, C. A., Mount Stromlo and Siding Spring Observatories, Australia; [2000]; 14p; In English
Contract(s)/Grant(s): CEC-FMRX-CT96-0068; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present near-infrared broad-band polarization images of the nuclear regions of the Circinus galaxy in the J, H and K bands. For the first time the south-eastern reflection cone is detected in polarized light, which is obscured at optical wavelengths behind the galactic disk. This biconical structure is clearly observed in J and H band polarized flux whilst in the K band a more compact structure is detected. Total flux J-K and H-K colour maps reveal a complex colour gradient toward the south east direction (where the Circinus galactic disk is nearer to us). We find enhanced extinction in an arc shaped structure, at about 2OOpc from the nucleus, probably part of the star- formation ring. We model the polarized flux images with the scattering and torus model of Young et al. , with the same basic input parameters as used by Alexander et al. in the spectropolarimetry modelling of Circinus. The best fit to the polarized flux is achieved with a torus radius of approx. 16pc, and a visual extinction AV, through the torus, to the near-infrared emission regions of greater than 66 mags.
Author
Near Infrared Radiation; Bipolarity; Cones; Polarized Light; Infrared Imagery; Starburst Galaxies

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ASTROPHYSICS

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

20000074642 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Stardust Navigation Covariance Analysis
Menon, Premkumar R., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Stardust spacecraft was launched on February 7, 1999 aboard a Boeing Delta-II rocket. Mission participants include the National Aeronautics and Space Administration (NASA), the Jet Propulsion Laboratory (JPL), Lockheed Martin Astronautics (LMA) and the University of Washington. The primary objective of the mission is to collect in-situ samples of the coma of comet Wild-2 and return those samples to the Earth for analysis. Mission design and operational navigation for Stardust is performed by the Jet Propulsion Laboratory (JPL). This paper will describe the extensive JPL effort in support of the Stardust pre-launch analysis of the orbit determination component of the mission covariance study. A description of the mission and it's trajectory will be provided first, followed by a discussion of the covariance procedure and models. Predicted accuracy's will be examined as they relate to navigation delivery requirements for specific critical events during the mission. Stardust was launched into a heliocentric trajectory in early 1999. It will perform an Earth Gravity Assist (EGA) on January 15, 2001 to acquire an orbit for the eventual rendezvous with comet Wild-2. The spacecraft will fly through the coma (atmosphere) on the dayside of Wild-2 on January 2, 2004. At that time samples will be obtained using an aerogel collector. After the comet encounter Stardust will return to Earth when the Sample Return Capsule (SRC) will separate and land at the Utah Test Site (UTTR) on January 15, 2006. The spacecraft will however be deflected off into a heliocentric orbit. The mission is divided into three phases for the covariance analysis. They are 1) Launch to EGA, 2) EGA to Wild-2 encounter and 3) Wild-2 encounter to Earth reentry. Orbit determination assumptions for each phase are provided. These include estimated and consider parameters and their associated a-priori uncertainties. Major perturbations to the trajectory include 19 deterministic and statistical maneuvers planned for the mission. The spacecraft is three axis stabilized and has unbalanced thrusters for attitude control. Accelerations due to the attitude control system are treated stochastically. The tracking scenario for the study is patterned after the actual schedule employed during the different phases of the mission. Conventional X-band two-way Doppler and SRA range data was simulated and the standard accuracy for these data types was assumed throughout most of the mission. However, a deweighting scheme was used for the Doppler data during times of low Sun-Earth-Probe angles, especially in the case of the DSM. Optical data is assumed to be available starting at 50 days prior to the comet encounter. The optical data will be used to improve the ephemeris of Wild-2, which is considered crucial to properly

target the comet flyby. Results of the covariance analysis are presented for all mission phases. Navigation capability will be discussed in terms of the uncertainty in the encounter B-Plane (B.R and B.T) and linearized time of flight. Delivery errors based on the final maneuver prior to the comet encounter will be presented. The most stringent navigation requirement is for the Earth reentry. The uncertainty in the flight path angle must be less than 0.02 degree (orbit determination and maneuver performance) to assure successful recovery of the SRC. Results presented show that this requirement can be met.
Author
Stardust Mission; Comet Nuclei; Wild 2 Comet; Mission Planning; Navigation

20000074687 NASA Goddard Space Flight Center, Greenbelt, MD USA
The International Celestial Reference Frame (ICRF) and the Relationship Between Frames
Ma, Chopo, NASA Goddard Space Flight Center, USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 52-56; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The International Celestial Reference Frame (ICRF), a catalog of VLBI source positions, is now the basis for astrometry and geodesy. Its construction and extension/maintenance will be discussed as well as the relationship of the ICRF, ITRF, and EOP/nutation.
Author
Very Long Base Interferometry; Celestial Reference Systems; Geodesy

20000074707 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Proposed Astrometric Observing Program for Densifying the ICRF in the Northern Hemisphere
Charlot, Patrick, Observatoire de Bordeaux, France; Viateau, Bruno, Jet Propulsion Lab., California Inst. of Tech., USA; Baudry, Alain, Observatoire de Bordeaux, France; Ma, Chopo, NASA Goddard Space Flight Center, USA; Fey, Alan, Naval Observatory, USA; Eubanks, Marshall, Naval Observatory, USA; Jacobs, Christopher, Jet Propulsion Lab., California Inst. of Tech., USA; Sovers, Ojars, Remote Sensing Analysis Systems; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 168-172; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The International Celestial Reference Frame (ICRF) could be of significant importance to the astronomy community for observing weak objects angularly close to ICRF sources with the phase-referencing technique. However, the current distribution of the ICRF sources is found to be largely non-uniform, which precludes the wide use of the ICRF as a catalog of calibrators for phase-referencing observations. We show that adding 150 new sources at appropriate sky locations would reduce the distance to the nearest ICRF source for any randomly-chosen location in the northern sky from up to 13 deg to up to 6 deg, close to the requirement of the phase-referencing technique. Accordingly, a set of 150 such sources, selected from the Jodrell Bank-VLA Astrometric Survey and filtered out using the Very Long Baseline Array Calibrator Survey, has been proposed for observation to the European VLBI Network (EVN) extended with additional geodetic stations. The use of the EVN is essential to this project since most of the new sources will be weaker and thus difficult to observe with standard geodetic networks.
Author
Very Long Base Interferometry; Northern Hemisphere; Celestial Reference Systems; Astrometry; Geodetic Coordinates; Radio Sources (Astronomy)

20000074725 Observatoire de Paris, France
Stability of ICRF, a Time Series Approach
Feissel, Martine, Observatoire de Paris, France; Gontier, Anne-Marie, Observatoire de Paris, France; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 280-284; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The qualification and the maintenance of the International Celestial Reference Frame (ICRF) source directions are currently based on global statistics on the complete data set of observations. As the founding hypothesis in the selection of extragalactic objects for accessing a quasi-inertial reference system is that their directions are fixed in space, the time variability of some of the sources is only used as a rejection criterion. We show that a significant proportion of the sources have apparent motions with non-random noise spectrum. We suggest that time series statistics be introduced in the computation of ICRF in order to take into account the error spectrum of the source motions. Test computations using different statistical approaches are performed. Their results are compared with those of the classical method.
Author
Inertial Reference Systems; Statistical Analysis; Time Series Analysis; Celestial Reference Systems

20000074736 National Taras Shevchenko Univ. of Kiev, Astronomical Observatory, Kiev, Ukraine

Celestial Reference Frame RSC(GAOUA)99 C 03

Molotaj, Olexandr A., National Taras Shevchenko Univ. of Kiev, Ukraine; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 338-341; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The last version of Kyiv compiled series of celestial reference frames RSC(GAO UA)99 C 03 comprises positions of 736 radio sources (RSs). It was formed by Kyiv arc length method on base of 6 various institutions' initial solutions prepared in 1999, namely RSC(USNO) 99 R 01, RSC(GIUB)99 R 01, RSC(SHA)99 R 01, RSC(FFI)99 R 01, RSC(IAA)99 R 01, and RSC(GSFC)99 R 00. Averaged formal uncertainties of 212 defining RSs of the frame are equal to 0.06 and 0.07 mas in right ascension and declination, respectively. Axes of the frame are aligned to those of the ICRF with accuracy of 0.021 mas. This paper discusses accuracy of the ICRF, of all used initial frames, and of Kyiv compiled frames obtained during 1997-1999 span.
Author

Celestial Reference Systems; Radio Sources (Astronomy); Astronomical Coordinates; Very Long Base Interferometry

20000074737 Satellite Geodetic Observatory, Penc, Hungary

Indications for Frequency Dependent Radio Core Position in 1823+568

Paragi, Z., Satellite Geodetic Observatory, Hungary; Fejes, I., Satellite Geodetic Observatory, Hungary; Frey, S., Satellite Geodetic Observatory, Hungary; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 342-345; In English; See also 20000074683; Sponsored in part by Hungarian Space Office; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The International Celestial Reference Frame (ICRF) defining source 1823+568 was observed as a calibrator in our multi-frequency very long baseline interferometry (VLBI) experiment. Images taken at 5, 8.4, 15 and 22 GHz reveal that there is a shift in position of the source between these frequencies. The shift of the "radio core" in this object is qualitatively in agreement with predictions of conical jet models developed for radio-loud active galactic nuclei (AGN). This effect can be quite common in quasars, and "ultra-precise" astrometric projects may require a correction for it in the future.
Author

Astrometry; Very Long Base Interferometry; Astronomical Coordinates; Radio Sources (Astronomy)

20000074747 Raytheon STX Corp., Information Technology and Scientific Services, Greenbelt, MD USA

Geodesy/Astrometry with the VLBA

Gordon, David, Raytheon STX Corp., USA; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 361; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The RDV experiments are a joint effort between VLBI scientists at NASA Goddard Space Flight Center, the U.S. Naval Observatory, and the National Radio Astronomy Observatory (an NSF facility operated by Associated Universities, Inc.). Six RDV geodesy/astrometry experiments are conducted yearly, using the 10 VLBA antennas and up to 10 Mark 4 antennas. Correlation is done on the VLBA correlator, a station-based, geocenter referenced correlator, similar to the new Mark 4 correlators. VLBA correlator output is in the form of cross-spectra phase and amplitude visibility data, which must be further processed using the NRAO AIPS software package to obtain geodetic observables. Most of the geodetic processing has been done at GSFC, using steps developed by NRAO and GSFC staff. These steps are given in a geodesy processing guide, available on-line in AIPS by typing "EXPLAIN ASTROMET". The first 17 RDV experiments, spanning 2.6 years, have been processed and, except for one problem (known as the southern source problem), the results are fairly good. The baseline repeatabilities are generally as good as, or better than, an equivalent span of Mark3/4 data, and many of the experiments can be phase connected between most of the VLBA antennas.
Author

Astrometry; Data Correlation; Geodesy; Very Long Base Interferometry; Very Long Baseline Array (VLBA)

20000075206 NASA Goddard Space Flight Center, Greenbelt, MD USA

The 3C 279 Campaign of Winter 1999: A Gamma-Optical Correlation?

Hartman, R. C., NASA Goddard Space Flight Center, USA; Villata, M., Osservatorio Astronomico, Italy; Raiteri, C. M., Osservatorio Astronomico, Italy; Sobrito, M., Osservatorio Astronomico, Italy; DeFrancesco, G., Osservatorio Astronomico, Italy; Ostorero, L., Osservatorio Astronomico, Italy; Tosti, G., Osservatorio Astronomico di Perugia, Italy; Kurtanidze, O., Abastumani Astrophysical Observatory, USSR; Nikolashvili, M., Abastumani Astrophysical Observatory, USSR; Takalo, L., Tuorla Observatory, Finland; [2000]; 1p; In English; 4th; 4th National Conference on Active Galactic Nuclie, 15-18 May 2000, Trieste, Italy; No Copyright; Avail: Issuing Activity; Abstract Only

Preliminary results are presented from the gamma-optical campaign of January-February 1999 on 3C 279. During this period we obtained good optical sampling of the source, the best ever for a gamma-bright OVV quasar. Its large and fast variations have been compared with the gamma-ray fluxes obtained simultaneously by Energy Gamma Ray Experiment Telescope (EGRET), on Compton Gamma Ray Observatory (CGRO). Despite rather poor counting statistics in the gamma-ray data, a fair correlation is found, with the gamma variations following those in the optical by 3-4 days. This is the first time such a significant day-scale correlation has been observed between the optical and gamma emissions from a OVV quasar. Its implications are currently under study.
Author
Gamma Ray Telescopes; Gamma Ray Observatory; Light Emission; Winter; Quasars

20000075265 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Determination of Eros Physical Parameters for Near Earth Asteroid Rendezvous Orbit Phase Navigation
Miller, J. K., Jet Propulsion Lab., California Inst. of Tech., USA; Antreasian, P. J., Jet Propulsion Lab., California Inst. of Tech., USA; Georgini, J., Jet Propulsion Lab., California Inst. of Tech., USA; Owen, W. M., Jet Propulsion Lab., California Inst. of Tech., USA; Williams, B. G., Jet Propulsion Lab., California Inst. of Tech., USA; Yeomans, D. K., Jet Propulsion Lab., California Inst. of Tech., USA; [1995]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Navigation of the orbit phase of the Near Earth steroid Rendezvous (NEAR) mission will re,quire determination of certain physical parameters describing the size, shape, gravity field, attitude and inertial properties of Eros. Prior to launch, little was known about Eros except for its orbit which could be determined with high precision from ground based telescope observations. Radar bounce and light curve data provided a rough estimate of Eros shape and a fairly good estimate of the pole, prime meridian and spin rate. However, the determination of the NEAR spacecraft orbit requires a high precision model of Eros's physical parameters and the ground based data provides only marginal a priori information. Eros is the principal source of perturbations of the spacecraft's trajectory and the principal source of data for determining the orbit. The initial orbit determination strategy is therefore concerned with developing a precise model of Eros. The original plan for Eros orbital operations was to execute a series of rendezvous burns beginning on December 20,1998 and insert into a close Eros orbit in January 1999. As a result of an unplanned termination of the rendezvous burn on December 20, 1998, the NEAR spacecraft continued on its high velocity approach trajectory and passed within 3900 km of Eros on December 23, 1998. The planned rendezvous burn was delayed until January 3, 1999 which resulted in the spacecraft being placed on a trajectory that slowly returns to Eros with a subsequent delay of close Eros orbital operations until February 2001. The flyby of Eros provided a brief glimpse and allowed for a crude estimate of the pole, prime meridian and mass of Eros. More importantly for navigation, orbit determination software was executed in the landmark tracking mode to determine the spacecraft orbit and a preliminary shape and landmark data base has been obtained. The flyby also provided an opportunity to test orbit determination operational procedures that will be used in February of 2001. The initial attitude and spin rate of Eros, as well as estimates of reference landmark locations, are obtained from images of the asteroid. These initial estimates are used as a priori values for a more precise refinement of these parameters by the orbit determination software which combines optical measurements with Doppler tracking data to obtain solutions for the required parameters. As the spacecraft is maneuvered; closer to the asteroid, estimates of spacecraft state, asteroid attitude, solar pressure, landmark locations and Eros physical parameters including mass, moments of inertia and gravity harmonics are determined with increasing precision. The determination of the elements of the inertia tensor of the asteroid is critical to spacecraft orbit determination and prediction of the asteroid attitude. The moments of inertia about the principal axes are also of scientific interest since they provide some insight into the internal mass distribution. Determination of the principal axes moments of inertia will depend on observing free precession in the asteroid's attitude dynamics. Gravity harmonics are in themselves of interest to science. When compared with the asteroid shape, some insight may be obtained into Eros' internal structure. The location of the center of mass derived from the first degree harmonic coefficients give a direct indication of overall mass distribution. The second degree harmonic coefficients relate to the radial distribution of mass. Higher degree harmonics may be compared with surface features to gain additional insight into mass distribution. In this paper, estimates of Eros physical parameters obtained from the December 23,1998 flyby will be presented. This new knowledge will be applied to simplification of Eros orbital operations in February of 2001. The resulting revision to the orbit determination strategy will also be discussed.
Author
Flyby Missions; Mass Distribution; Navigation; Spacecraft Orbits; Near Earth Asteroid Rendezvous Mission; Eros Asteroid

20000075273 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Can Pseudobreakups be Predicted?
Zhou, X.-Y., Jet Propulsion Lab., California Inst. of Tech., USA; Tsurutani, Bruce T., Jet Propulsion Lab., California Inst. of Tech., USA; Arballo, J. K., Jet Propulsion Lab., California Inst. of Tech., USA; Berdichevsky, D., NASA Goddard Space Flight Center,

USA; Lepping, R. P., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We statistically analyze many interplanetary shock events where there are both WIND interplanetary data and POLAR UV imaging data. We find that the shock compression events trigger pseudobreakups (PBs), substorm onsets, or enhance (pre-existing) substorm intensities. Using WIND interplanetary data and ground-based data, it is now believed that we can predict when PBs will occur and when substorm expansion phases will occur.

Author

Magnetic Storms; Solar Terrestrial Interactions; Magnetic Disturbances; Solar Storms; Earth Magnetosphere

20000075638 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Radar Observations of Asteroid 10115 (1992 SK)

Benner, L. A. M., Jet Propulsion Lab., California Inst. of Tech., USA; Ostro, S. J., Jet Propulsion Lab., California Inst. of Tech., USA; Giorgini, J. D., Jet Propulsion Lab., California Inst. of Tech., USA; Jurgens, R. F., Jet Propulsion Lab., California Inst. of Tech., USA; Rose, R., Jet Propulsion Lab., California Inst. of Tech., USA; Thomas, M. L., Jet Propulsion Lab., California Inst. of Tech., USA; Winkler, R., Jet Propulsion Lab., California Inst. of Tech., USA; Choate, D., Jet Propulsion Lab., California Inst. of Tech., USA; Frye, R., Jet Propulsion Lab., California Inst. of Tech., USA; Franck, C. R., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The approach of 1992 SK to within 0.056 AU of Earth on 1999 March 26 provided an excellent opportunity for radar observations. We observed it daily between March 22-26 at Goldstone at a transmitter frequency of 8560 MHz (3.50 cm). Weighted, optimally smoothed sums of cw (Doppler-only) echoes achieve a signal-to-noise ratio of about 300. Our highest resolution cw setup places up to approx. 30 0.5-Hz Doppler cells on the target at echo powers exceeding two standard deviations of the noise. Our highest resolution imaging setup places about 20 0.25-us (37.5 m) x 2.0 Hz pixels on 1992 SK at echo powers above the same threshold. We completed nearly 300 runs with each setup and obtained thorough rotational phase coverage (period = 7.320 h, P. Pravec, pers. comm.). The dispersion of the echoes in time delay indicates a lower bound on 1992 SK's maximum pole-on breadth of approx. 0.4 km that is consistent with the echo bandwidth and rotation period. Variations in the cw spectral bandwidths and shapes and in the delay-Doppler images as a function of rotation phase are evident on each day, are consistent in bandwidth with each other and with the rotation period, and indicate that the asteroid is asymmetric and modesty elongated.

Derived from text

Asteroids; Radar Tracking; Continuous Radiation; Imaging Techniques; Standard Deviation; Time Lag

20000075648 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

An Analysis of the Torsion-Rotation-Vibration Rotational Spectrum of the Lowest In-Plane Bend and First Excited Torsional State of the C(3V) Internal Rotor C2H5CN

Pearson, J. C., Jet Propulsion Lab., California Inst. of Tech., USA; Pickett, Herbert M., Jet Propulsion Lab., California Inst. of Tech., USA; Sastry, K. V. L. N., New Brunswick Univ., Canada; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

C2H5CN (Propionitrile or ethyl cyanide) is a well known interstellar species abundantly observed in hot cores during the onset of star formation. The onset of star formation generally results in elevated temperature, which thermally populates may low lying vibrational states such as the 206/cm in-plane bend and the 212/cm first excited torsional state in C2H5CN. Unfortunately, these two states are strongly coupled through a complex series of torsion-vibration-rotation interactions, which dominate the spectrum. In order to understand the details of these interactions and develop models capable of predicting unmeasured transitions for astronomical observations in C2H5CN and similar molecules, several thousand rotational transitions in the lowest excited in-plane bend and first excited torsional state have been recorded, assigned and analyzed. The analysis reveals very strong a- and b-type Coriolis interactions and a number of other smaller interactions and has a number of important implications for other C3V torsion-rotation-vibration systems. The relative importance and the physical origins of the coupling among the rotational, vibrational and torsional motions will be presented along with a full spectroscopic analysis and supporting astronomical observations.

Author

Vibrational States; Torsion; Rotation; Cyanides; Ethyl Compounds; Spectroscopic Analysis

20000075652 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Science Observations of Deep Space One

Nelson, Robert M., Jet Propulsion Lab., California Inst. of Tech., USA; Baganal, Fran, Colorado Univ., USA; Boice, Daniel C., Southwest Research Inst., USA; Britt, Daniel T., Arizona Univ., USA; Brown, Robert H., Arizona Univ., USA; Buratti, Bonnie J., Jet Propulsion Lab., California Inst. of Tech., USA; Creary, Frank, Colorado Univ., USA; Ip, Wing-Huan, Max-Planck-Inst.

fuer Aeronomie, Germany; Meier, Roland, Hawaii Univ., USA; Oberst, Juergen, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; [1999]; 2p; In English; 24th, 19-23 Apr. 1999, Unknown; Sponsored by European Geophysical Society, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

During the Deep Space One (DS1) primary mission, the spacecraft will fly by asteroid 1992 KD and possibly comet Borrelly. There are two technologies being validated on DS1 that will provide science observations of these targets, the Miniature Integrated Camera Spectrometer (MICAS) and the Plasma Experiment for Planetary Exploration (PEPE). MICAS encompasses a camera, an ultraviolet imaging spectrometer and an infrared imaging spectrometer. PEPE combines an ion and electron analyzer designed to determine the three-dimensional distribution of plasma over its field of view. MICAS includes two visible wavelength imaging channels, an ultraviolet imaging spectrometer, and an infrared imaging spectrometer all of which share a single 10-cm diameter telescope. Two types of visible wavelength detectors, both operating between about 500 and 1000 nm are used: a CCD with 13-microrad pixels and an 18-microrad-per-pixel, metal-on-silicon active pixel sensor (APS). Unlike the CCD the APS includes the timing and control electronics on the chip along with the detector. The UV spectrometer spans 80 to 185 nm with 0.64-nm spectral resolution and 316-microrad pixels. The IR spectrometer covers the range from 1200 to 2400 nm with 6.6-nm resolution and 54-microrad pixels PEPE includes a very low-power, low-mass micro-calorimeter to help understand plasma-surface interactions and a plasma analyzer to identify de individual molecules and atoms in the immediate vicinity of the spacecraft that have been eroded off the surface of asteroid 1992 KD. It employs common apertures with separate electrostatic energy analyzers. It measures electron and ion energies spanning a range of 3 eV to 30 keV, with a resolution of five percent. and measures ion mass from one to 135 atomic mass units with 5 percent resolution. It electrostatically sweeps its field of view both in elevation and azimuth. Both MICAS and PEPE represent a new direction for the evolution of science instruments for interplanetary spacecraft. These two instruments incorporate a large fraction of the capability of five instruments that had typically flown on NASA's deep space missions The Deep Space One science team acknowledges the support of Philip Varghese, David H. Lehman, Leslie Livesay, and Marc Rayman for providing invaluable assistance in making the science observations possible.

Author

Space Exploration; Plasma Interactions; Infrared Imagery; Charge Coupled Devices; Asteroids; Electron Energy; Imaging Techniques; Deep Space

20000076006 NASA Goddard Space Flight Center, Greenbelt, MD USA

Nonlinear Shock Acceleration and Photon Emission in Supernova Remnants

Ellison, Donald C., North Carolina State Univ., USA; Berezhko, Evgeny G., Institute of Cosmophysical Research and Aeronomy, Russia; Baring, Matthew G., NASA Goddard Space Flight Center, USA; [2000]; 18p; In English; Copyright; Avail: Issuing Activity

We have extended a simple model of nonlinear diffusive shock acceleration (Berezhko & Ellison 1999: Ellison &, Berezhko 1999a) to include the injection and acceleration of electrons and the production of photons from bremsstrahlung, synchrotron, inverse Compton, and pion-decay processes. We argue that, the results of this model, which is simpler to use than more elaborate ones, offer a significant improvement, over test-particle, power-law spectra which are often used in astrophysical applications of diffusive shock acceleration. With an evolutionary supernova remnant (SNR) model to obtain shock parameters as functions of ambient interstellar medium parameters and time, we predict broad-band continuum photon emission from supernova remnants in general, and SN1006 in particular, showing that our results compare well with the more complete time-dependent and spherically symmetric nonlinear model of Berezhko, Ksenofontov, & Petukhov (1999a). We discuss the implications nonlinear shock acceleration has for X-ray line emission, and use our model to describe how ambient conditions determine the TeV/radio flux ratio, an important parameter for gamma-ray observations of radio SNRs.

Author

Supernova Remnants; Interstellar Matter; Diffusivity; Acceleration (Physics); Nonlinearity; Photons

20000076814 NASA Goddard Space Flight Center, Greenbelt, MD USA

Structure of the Circumnuclear Region of Seyfert 2 Galaxies Revealed by RXTE Hard X-Ray Observations of NGC 4945

Madejski, G., NASA Goddard Space Flight Center, USA; Zycki, P., Polish Academy of Sciences, Poland; Done, C., Durham Univ., UK; Valinia, A., NASA Goddard Space Flight Center, USA; Blanco, P., California Univ., San Diego, USA; Rothschild, R., California Univ., San Diego, USA; Turek, B., NASA Goddard Space Flight Center, USA; [2000]; 12p; In English

Contract(s)/Grant(s): NSF PHY-94-07194; KBN-2P03D01816

Report No.(s): astro-ph/0002063; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NGC 4945 is one of the brightest Se.yfert galaxies on the sky at 100 keV, but is completely absorbed below 10 keV, implying an optical depth of the absorber to electron scattering of a few; its absorption column is probably the largest which still allows a direct view of the nucleus at hard X-ray energies. Our observations of it with the Rossi X-ray Timing Explorer (RXTE) satellite

confirm the large absorption, which for a simple phenomenological fit using an absorber with Solar abundances implies a column of 4.5(sup 0.4, sub -0.4) x 10(exp 24) /sq cm. Using a a more realistic scenario (requiring Monte Carlo modeling of the scattering), we infer the optical depth to Thomson scattering of approximately 2.4. If such a scattering medium were to subtend a large solid angle from the nucleus, it should smear out any intrinsic hard X-ray variability on time scales shorter than the light travel time through it. The rapid (with a time scale of approximately a day) hard X-ray variability of NGC 4945 we observed with the RXTE implies that the bulk of the extreme absorption in this object does not originate in a parsec-size, geometrically thick molecular torus. Limits on the amount of scattered flux require that the optically thick material on parsec scales must be rather geometrically thin, subtending a half-angle is less than 10 deg. This is only marginally consistent with the recent determinations of the obscuring column in hard X-rays, where only a quarter of Seyfert 2s have columns which are optically thick, and presents a problem in accounting for the Cosmic X-ray Background primarily with AGN possessing the geometry as that inferred by us. The small solid angle of the obscuring material, together with the black hole mass (of approximately 1.4 x 10(exp 6) solar mass) from megamaser measurements. allows a robust determination of the source luminosity, which in turn implies that the source radiates at approximately 10% of the Eddington limit.
Author
Seyfert Galaxies; X Ray Timing Explorer

20000076829 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette, France
Chaos in Superstring Cosmology
Damour, T.; Henneaux, M.; Mar. 16, 2000; 10p; In English
Report No.(s): PB2000-106225; IHES/P/00/20; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
It is shown that the general solution near a spacelike singularity of the Einstein-dilaton-p-form field equations relevant to superstring theories and M-theory exhibits an oscillatory behavior of the Belinski-Khalatnikov-Lifshitz type. String dualities play a significant role in the analysis.
NTIS
Chaos; Mathematical Models; String Theory; Cosmology

20000078422 Chicago Univ., Dept. of Physics, Chicago, IL USA
Nonthermal Supermassive Dark Matter
Chung, Daniel J. H., Chicago Univ., USA; Kolb, Edward W., Fermi National Accelerator Lab., USA; Riotto, Antonio, European Organization for Nuclear Research, Switzerland; Physical Review Letters; Nov. 09, 1999; ISSN 0031-9007; Volume 81, No. 19, pp. 4048-4051; In English
Contract(s)/Grant(s): NAG5-7092; Copyright; Avail: Issuing Activity
We discuss several cosmological production mechanisms for nonthermal supermassive dark matter and argue that dark matter may he elementary particles of mass much greater than the weak scale. Searches for dark matter should ma be limited to weakly interacting particles with mass of the order of the weak scale, but should extend into the supermassive range as well.
Author
Nonthermal Radiation; Dark Matter; Supermassive Stars; Cosmology

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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.

20000074241 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Cassini/Huygens Mission to the Saturnian System
Matson, D. L., Jet Propulsion Lab., California Inst. of Tech., USA; Lebreton, J.-P., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; [1999]; 1p; In English; Planetary Exploration, 1999, Unknown; Sponsored by International Council of Scientific Unions, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only
Cassini/Huygens will carry out an in-depth exploration of the Saturnian system. On October 15, 1996 the spacecraft was launched on its interplanetary journey. On the way to Saturn, Cassini/Huygens, will flyby Venus, twice (April 26, 1998; June 24, 1999), the Earth once (August 18, 1999), and Jupiter (December 30, 2000). On approach to Saturn, the small satellite Phoebe will be encountered on June 11, 2004. Upon arrival at Saturn on July 1, 2004, Cassini/Huygens will fire its main engine and go into orbit about the planet. Huygens will be delivered to Titan on November 27, 2004. After deceleration in the upper atmosphere,

Huygens will deploy a parachute system and its six instruments will make scientific measurements and observations as it descends to the surface. These data then will be transmitted to the Orbiter which, in turn, will relay them to the Earth. The Orbiter will then commence a four year long tour of the Saturnian system. With its complement of 12 instruments, Cassini is capable of making a wide range of in situ and remote sensing observations. There will be repeated close flybys of Titan both to make measurements and for gravity-assisted orbit changes that will enable Cassini to visit other satellites, various parts of the magnetosphere, and obtain occultations of the rings and atmospheres of Saturn and Titan. During the span of the mission, Cassini will also record temporal changes in many of the properties that it can observe. The presentation will emphasize current status and plans for the mission. (The Cassini mission is a joint undertaking by NASA and ESA. This work was carried out at Jet Propulsion Laboratory, California Institute of Technology, under contract to NASA.)
Author
Cassini Mission; Saturn (Planet); Saturn Atmosphere; Saturn Satellites; Titan

20000074243 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Trade Study and Metric for Penetration and Sampling Devices for Possible Use on the NASA 2003 and 2005 Mars Sample Return Missions
McConnell, Joshua B., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The scientific exploration of Mars will require the collection and return of subterranean samples to Earth for examination. This necessitates the use of some type of device or devices that possesses the ability to effectively penetrate the Martian surface, collect suitable samples and return them to the surface in a manner consistent with imposed scientific constraints. The first opportunity for such a device will occur on the 2003 and 2005 Mars Sample Return missions, being performed by NASA. This paper reviews the work completed on the compilation of a database containing viable penetrating and sampling devices, the performance of a system level trade study comparing selected devices to a set of prescribed parameters and the employment of a metric for the evaluation and ranking of the traded penetration and sampling devices, with respect to possible usage on the 03 and 05 sample return missions. The trade study performed is based on a select set of scientific, engineering, programmatic and socio-political criterion. The use of a metric for the various penetration and sampling devices will act to expedite current and future device selection.
Author
Mars Sample Return Missions; Mars Surface; Mars Probes; Data Bases

20000074245 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Mars Comm/Nav MicroSat Network Using the Multi-Mission Bus Launched Piggyback by Ariane 5
Hastrup, R. C., Jet Propulsion Lab., California Inst. of Tech., USA; Cesarone, R. J., Jet Propulsion Lab., California Inst. of Tech., USA; Morabito, D. D., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; Small Satellites, 23-26 Aug. 1999, Logan, UT, USA; Sponsored by American Astronautical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Recently, NASA's Jet Propulsion Laboratory completed a Mars Exploration Program Architecture Definition Study with strong international participation. The recommendations of this study include establishment of a low cost in-situ communications and navigation satellite network to provide enabling and enhancing support for the international exploration of Mars. This would be the first step toward establishing a "virtual presence throughout the solar system" as called for in NASA's Strategic Plan. Response to the proposed comm/nav satellite network has been very favorably received, as reflected by the inclusion of a line item in NASA's budget submittal to Congress, which provides funding for implementation of the network with first launch in the 2003 opportunity. Funding has already been provided for a phase A study being conducted this year. This paper presents the planned implementation of the comm/nav network, which will utilize microsats based on a multi-mission spacecraft bus being designed for launch by the Ariane 5 as a secondary payload. A companion paper at this conference, entitled "The Multi-Purpose Mars Micro-Mission System Design Utilizing Ariane 5 Piggyback Launch", describes the multimission bus design. This paper addresses the application of the multi-mission bus to the comm/nav microsat mission. Following an introduction, which provides the background that has led to the proposed comm/nav network, the paper discusses the projected user needs with emphasis on the various possible robotic missions (landers, rovers, ascent vehicles, balloons, aircraft, etc.) progressing toward eventual piloted missions. Next, the paper describes the concept for an evolving network of comm/nav microsats and the expected capability to satisfy the user needs. Results of communications and navigation performance analysis are summarized for attractive satellite constellation configurations. The important comm/nav microsat functional requirements on the multi-mission spacecraft bus are described with discussion of the mission-system tradeoffs for the driving requirements. The functional design of the in-situ com-

munications / navigation package, which constitutes the payload of the microsat, is also described. The paper also includes discussion of technologies which are of specific importance to the implementation of the comm/nav microsat network.
Author
Functional Design Specifications; Mars Missions; Mission Planning; Navigation Satellites; Satellite Constellations; Satellite Networks; Microsatellites; Communication Satellites

20000074247 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Navigation Strategy for the Mars 2001 Lander Mission
Mase, Robert A., Jet Propulsion Lab., California Inst. of Tech., USA; Spencer, David A., Jet Propulsion Lab., California Inst. of Tech., USA; Smith, John C., Jet Propulsion Lab., California Inst. of Tech., USA; Braun, Robert D., NASA Langley Research Center, USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Mars Surveyor Program (MSP) is an ongoing series of missions designed to robotically study, map and search for signs of life on the planet Mars. The MSP 2001 project will advance the effort by sending an orbiter, a lander and a rover to the red planet in the 2001 opportunity. Each vehicle will carry a science payload that will Investigate the Martian environment on both a global and on a local scale. Although this mission will not directly search for signs of life, or cache samples to be returned to Earth, it will demonstrate certain enabling technologies that will be utilized by the future Mars Sample Return missions. One technology that is needed for the Sample Return mission is the capability to place a vehicle on the surface within several kilometers of the targeted landing site. The MSP'01 Lander will take the first major step towards this type of precision landing at Mars. Significant reduction of the landed footprint will be achieved through two technology advances. The first, and most dramatic, is hypersonic aeromaneuvering; the second is improved approach navigation. As a result, the guided entry will produce in a footprint that is only tens of kilometers, which is an order of magnitude improvement over the Pathfinder and Mars Polar Lander ballistic entries. This reduction will significantly enhance scientific return by enabling the potential selection of otherwise unreachable landing sites with unique geologic interest and public appeal. A landed footprint reduction from hundreds to tens of kilometers is also a milestone on the path towards human exploration of Mars, where the desire is to place multiple vehicles within several hundred meters of the planned landing site. Hypersonic aeromaneuvering is an extension of the atmospheric flight goals of the previous landed missions, Pathfinder and Mars Polar Lander (MPL), that utilizes aerodynamic lift and an autonomous guidance algorithm while in the upper atmosphere. The onboard guidance algorithm will control the direction of the lift vector, via bank angle modulation, to keep the vehicle on the desired trajectory. While numerous autonomous guidance algorithms have been developed for use during hypersonic flight at Earth, this will be the first flight of an autonomously directed lifting entry vehicle at Mars. However, without sufficient control and knowledge of the atmospheric entry conditions, the guidance algorithm will not perform effectively. The goal of the interplanetary navigation strategy is to deliver the spacecraft to the desired entry condition with sufficient accuracy and knowledge to enable satisfactory guidance algorithm performance. Specifically, the entry flight path angle must not exceed 0.27 deg. to a 3 sigma confidence level. Entry errors will contribute directly to the size of the landed footprint and the most significant component is entry flight path angle. The size of the entry corridor is limited on the shallow side by integrated heating constraints, and on the steep side by deceleration (g-load) and terminal descent propellant. In order to meet this tight constraint it is necessary to place a targeting maneuver seven hours prior to the time of entry. At this time the trajectory knowledge will be quite accurate, and the effects of maneuver execution errors will be small. The drawback is that entry accuracy is dependent on the success of this final late maneuver. Because propulsive maneuvers are critical events, it is desirable to minimize their occurrence and provide the flight team with as much response time as possible in the event of a spacecraft fault. A mission critical maneuver at Entry - 7 hours does not provide much fault tolerance, and it is desirable to provide a strategy that minimizes reliance on this maneuver. This paper will focus on the Improvements in interplanetary navigation that will decrease entry errors and will reduce the landed footprint, even in the absence of aeromaneuvering. The easiest to take advantage of are Improvements In the knowledge of the Mars ephemeris and gravity field due to the MGS and MSP'98 missions. Improvements In data collection and reduction techniques such as "precislon ranging' and near-simultaneous tracking will also be utilized. In addition to precise trajectory control, a robust strategy for communications and flight operations must also be demonstrated. The result Is a navigation and communications strategy on approach that utilizes optimal maneuver placement to take advantage of trajectory knowledge, minimizes risk for the flight operations team, is responsive to spacecraft hardware limitations, and achieves the entry corridor. The MSP2001 mission Is managed at JPL under the auspices of the Mars Exploration Directorate. The spacecraft flight elements are built and managed by Lockheed-Martin Astronautics in Denver, Colorado.
Author
Interplanetary Navigation; Landing Sites; Mars Landing; Earth-Mars Trajectories; Orbital Mechanics; Orbit Calculation; Mars Surveyor 2001 Mission

20000074263 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Potential of Phased Arrays for Planetary Exploration

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

Phased array antennas provide a set of operational capabilities which are very attractive for certain mission applications and not very attractive for others. Such antennas are by no means a panacea for telecommunications. In this paper the features of phased arrays are reviewed and their implications for space missions are considered in terms of benefits and costs. The primary capability provided by a phased array is electronic beam agility. The beam direction may be controlled at electronic speeds (vs. mechanical actuation) permitting time division multiplexing of multiple ”users.” Moreover, the beam direction can be varied over a full hemisphere (for a planar array). On the other hand, such antennas are typically much more complicated than the more commonly used reflectors and horns and this implies higher cost. In some applications, this increased cost must be accepted if the mission is to be carried out at all. The SIR-C radar is an example of such a case albeit not for deep space. Assuming for the sake of argument that the complexity and cost of a phased array can be significantly reduced, where can such antennas be of value in the future of planetary exploration? Potential applications to be discussed are planetary rovers, landers, and orbiters including both the areosynchronous and low orbit varieties. In addition, consideration is given to links from deep space to earth. As may be fairly obvious, the deep space link to earth would not benefit from the wide angle steering capability provided by a phase array whereas a rover could gain advantage from the capability to steer a beam anywhere in the sky. In the rover case, however, physical size of the aperture becomes a significant factor which, of course, has implications regarding the choice of frequency band. Recent research work concerning phased arrays has suggested that future phased arrays might be made less complex and, therefore, less costly. Successful realization of such phased arrays would enable many of the planetary missions discussed in this paper and significantly broaden the telecommunications capabilities available to the mission designers of the future.

Author

Planar Structures; Phased Arrays; Space Exploration; Shuttle Imaging Radar; Antenna Arrays

20000074265 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

On the Fast Evaluation Method of Temperature and Gas Mixing Ratio Weighting Functions for Remote Sensing of Planetary Atmospheres in Thermal IR and Microwave

Ustinov, E. A., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Evaluation of weighting functions in the atmospheric remote sensing is usually the most computer-intensive part of the inversion algorithms. We present an analytic approach to computations of temperature and mixing ratio weighting functions that is based on our previous results but the resulting expressions use the intermediate variables that are generated in computations of observable radiances themselves. Upwelling radiances at the given level in the atmosphere and atmospheric transmittances from space to the given level are combined with local values of the total absorption coefficient and its components due to absorption of atmospheric constituents under study. This makes it possible to evaluate the temperature and mixing ratio weighting functions in parallel with evaluation of radiances. This substantially decreases the computer time required for evaluation of weighting functions. Implications for the nadir and limb viewing geometries are discussed.

Author

Mixing Ratios; Weighting Functions; Planetary Atmospheres; Remote Sensing

20000074636 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Cassini/Huygens Mission to Saturn

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

The Cassini/Huygens mission is an international cooperative effort between NASA, the European Space Agency, and the Italian Space Agency to conduct a scientific investigation of the Saturnian system. The spacecraft, which was launched in October of 1997, will use a Venus-Venus-Earth-Jupiter gravity assisted trajectory to arrive at Saturn in July of 2004. The spacecraft, composed of an orbiter and an atmospheric entry probe, will be placed in orbit about Saturn, after which the Huygens probe will be released to enter the atmosphere of Titan, the largest moon of Saturn. The probe data is transmitted during its descent and possible survival on the surface to the orbiter overhead, where it is stored and later relayed to Earth. The orbiter then continues in a four-year mission about Saturn, conducting detailed studies of the atmosphere, the rings, the magnetosphere, Titan, and the icy satellites. The probe carries six instruments to explore the atmosphere and surface of Titan; the orbiter carries twelve instruments for its investigations. This paper characterizes the performance of the Cassini/Huygens spacecraft during its first year and three-quarters

of flight, up through the second of the two Venus flybys. The flight system, including the 18 scientific instruments, is described, as well as the detailed overall objectives of the mission.
Author
Cassini Mission; Huygens Probe; Space Probes; Saturn (Planet); Titan; European Space Agency; NASA Space Programs

20000074646 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Interaction of the Galilean Satellites with Jupiter's Magnetosphere
Kliore, Arvydas J., Jet Propulsion Lab., California Inst. of Tech., USA; Anabtawi, Aseel, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; 1999 Magnetospheres of the Outer Planets: Session, Auroral Phenomena and Ionosphere/ Magnetosphere Coupling, 9-14 Aug. 1999, Paris, France; Sponsored by Centre National de la Recherche Scientifique, France; No Copyright; Avail: Issuing Activity; Abstract Only

The Galileo orbiter has provided radio occultation measurements of the electron density profiles of the plasma surrounding lo and Europa. There have been six occultations of Io, providing twelve electron density profiles at various locations relative to the ram direction of the impinging particles of the Jupiter magnetosphere on Io, and eight profiles on Europa. The two satellites were found to have very different plasma environments, with Io having a proper ionosphere produced on top of an endogenous SO2 atmosphere by magnetospheric particle precipitation and solar EUV, while Europa has a tenuous plasma environment produced by the same mechanisms from an oxygen atmosphere itself also produced by sputtering of water ice from its surface by impinging magnetospheric particles. In both cases the observed electron density profiles are highly asymmetrical, with a compressed profile on the ram side, and an extended one on the wake side. The presence of several measurements for each satellite at different ram-to-wake directions provided data for estimating an approximate distribution of ionization from the ram direction to the wake direction.
Author
Galilean Satellites; Jupiter (Planet); Io; Galileo Spacecraft; Electron Density Profiles; Extreme Ultraviolet Radiation; Planetary Magnetospheres

20000074647 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Exploration of the Saturnian System with Cassini Radio Science
Kliore, Arvydas J., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; IUGG General Asssembly: Session JSA-10, Planetary Exploration, 18-30 Jul. 1999, Birmingham, UK; Sponsored by International Association of Machinists and Aerospace Workers, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The ongoing Galileo mission has provided many new insights into the Jovian system. Among them are new discoveries from the Radio Science investigations , including multiple measurements of the Jovian ionosphere, the ionospheres and plasma environments of Io, Europa, Ganymede, and Callisto, and the internal structure of the Galilean satellites. The Cassini spacecraft, which will be placed in orbit about Saturn in 2004, will conduct Radio Science investigations of many aspects of the Saturnian system with a radio instrument of unprecedented stability and versatility. It will use radio links at three wavelengths : S-band(13 cm), X-band (3.5 cm), and Ka-band (1 cm) to probe the atmospheres and ionospheres of Saturn and Titan and Saturn's rings by means of radio occultations, and to measure the masses and gravity fields of Saturn, Titan, and selected icy satellites by precision tracking. In addition, the stability of the radio instrument will be utilized to conduct a search for gravitational waves during solar oppositions, and to precisely measure general relativistic effects during solar conjunctions during the interplanetary cruise prior to arrival at Saturn.
Author
Cassini Mission; Saturn (Planet); Saturn Atmosphere; Titan; Extremely High Frequencies; Galilean Satellites; Superhigh Frequencies; Space Probes

20000074648 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Interaction of Io and Europa With Jupiter's Magnetosphere
Kliore, Arvydas J., Jet Propulsion Lab., California Inst. of Tech., USA; Anabtawi, Aseel, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; IUGG General Assembly:Session GA4.10, Planetary Atmospheres, Ionospheres, Magnetos, 18-30 Jul. 1999, Birmingham, UK; Sponsored by International Association of Machinists and Aerospace Workers, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Galileo orbiter has provided radio occultation measurements of the electron density profiles of the plasma surrounding Io and Europa. There have been six occultations of Io, providing twelve electron density profiles at various locations relative to the ram direction of the impinging particles of the Jupiter magnetosphere on Io, and eight profiles on Europa. The two satellites were found to have very different plasma environments, with Io having a proper ionosphere produced on top of an endogenous

SO2 atmosphere by magnetospheric particle precipitation and solar EUV, while Europa has a tenuous plasma environment produced by the same mechanisms from an oxygen atmosphere itself also produced by sputtering of water ice from its surface by impinging magnetospheric particles. In both cases the observed electron density profiles are highly asymmetrical, with a compressed profile on the ram side, and an extended one on the wake side. The presence of several measurements for each satellite at different ram-to-wake directions provided data for estimating an approximate distribution of ionization from the ram direction to the wake direction, which were compared with the results of MHD simulations.
Author
Io; Jupiter (Planet); Europa; Planetary Magnetospheres; Radio Occultation

20000074649 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Enhancement of Directional Ambiguity Removal Skill in Scatterometer Data Processing Using Planetary Boundary Layer Models
Kim, Young-Joon, Jet Propulsion Lab., California Inst. of Tech., USA; Pak, Kyung S., Jet Propulsion Lab., California Inst. of Tech., USA; Dunbar, R. Scott, Jet Propulsion Lab., California Inst. of Tech., USA; Hsiao, S. Vincent, Jet Propulsion Lab., California Inst. of Tech., USA; Callahan, Philip S., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; 10th; 10th Conference on Satellite Meteorology and Oceanography, 9-14 Jan. 2000, Long Beach, CA, USA; Sponsored by American Meteorological Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Planetary boundary layer (PBL) models are utilized to enhance directional ambiguity removal skill in scatterometer data processing. The ambiguity in wind direction retrieved from scatterometer measurements is removed with the aid of physical directional information obtained from PBL models. This technique is based on the observation that sea level pressure is scalar and its field is more coherent than the corresponding wind. An initial wind field obtained from the scatterometer measurements is used to derive a pressure field with a PBL model. After filtering small-scale noise in the derived pressure field, a wind field is generated with an inverted PBL model. This derived wind information is then used to remove wind vector ambiguities in the scatterometer data. It is found that the ambiguity removal skill can be improved when the new technique is used properly in conjunction with the median filter being used for scatterometer wind dealiasing at JPL. The new technique is applied to regions of cyclone systems which are important for accurate weather prediction but where the errors of ambiguity removal are often large.
Author
Planetary Boundary Layer; Scatterometers; Data Processing; Ambiguity; Wind Direction

20000074650 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Study of Short-Term Variations in Jupiter's Synchrotron Emission
Klein, M.J., Jet Propulsion Lab., California Inst. of Tech., USA; Gulkis, S., Jet Propulsion Lab., California Inst. of Tech., USA; Bolton, S. J., Jet Propulsion Lab., California Inst. of Tech., USA; Levin, S. M., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; Magnetospheres of the Outer Planets, 9-14 Aug. 1999, Paris, France; No Copyright; Avail: Issuing Activity; Abstract Only

Earth-based observations of the flux density and polarization of Jupiter's microwave emission provide useful data to test and constrain computational models of synchrotron radio emission from the inner regions of the Jovian magnetosphere. Stimulated by the sudden brightening of the synchrotron emission caused by the impacts of comet Shoemaker-Levy 9 in 1994, the observational techniques of the NASA-JPL Jupiter Patrol were modified to search for other short-term variations unrelated to the SL-9 event. The characteristics of the improved data base are described and the results of the search for variability on timescales of 5 to 100 days are reported. The first results of Jupiter observations from the Goldstone-Apple Valley Radio Telescope (GAVRT) project are reported and included in the data base. GAVRT is a new project in science education that engages middle- and high school students in science research. The paper also includes new observations of Jupiter's rotational beamed emission, commonly known as the "beaming curve", that describes the observed flux density as a function of System III longitude. The shape of the "beaming curve" is known to change with the parameter D(sub E), the declination of the earth relative to Jupiter's rotational equator. While the history of Jupiter's beaming curve exhibits remarkable stability and repeatability as a function of D(sub E), there may be evidence for short term departures from the nominal curves. Data supporting this tentative conclusion are presented. Preliminary results of a study comparing the observations and computer simulations of the synchrotron beaming curve will also be presented and discussed (see companion paper, "Modeling Jupiter's Synchrotron Emission", by Bolton et. al.). The research reported in this paper was performed by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.
Author
Jupiter (Planet); Synchrotron Radiation; Variability; Microwave Emission; Planetary Magnetic Fields; Shoemaker-Levy 9 Comet

20000074654 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Vertical Structure of Major Meteorological Features on Jupiter: The Great Red Spot and White Ovals BC and DE

Baines, Kevin H., Jet Propulsion Lab., California Inst. of Tech., USA; Carlson, Robert W., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Multi-spectral imagery of Jupiter's Great Red Spot (GRS) and two White ovals acquired by the Galileo/NIMS are used to constrain the spatial variability of the vertical aerosol structure and the distribution of ammonia in and around these most-prominent anti-cyclonic features. All three features exhibit a high-altitude core spanning about 3/4 of their visual size when viewed with moderate absorption wavelengths, indicating a bulk elliptical, "wedding cake" shape in their overall three-dimensional cloud structure. A distinctive spiral pattern within the GRS core is seen in moderate methane and hydrogen absorption bandpasses. This pattern - which has been modelled to show a 2 km variation in cloudtop pressure within the GRS - is inconsistent with a different spiral-shaped pattern observed in ammonia-sensitive wavelengths, thus indicating spatial variability not only in the column abundance of ammonia within the GRS, but in its mixing ratio as well. White Ovals BC and DE were observed in February 1997, just a year before their unusual merger into a single feature. At the time of these observations, the centers of the two anti-cyclones were about 16 degrees apart, separated by a complex cyclonic feature which exhibited unusual spatial variability in its appearance in images acquired at ammonia-sensitive wavelengths. In particular, the northern half of this feature has the largest ammonia column abundance seen within the environs around the white ovals, indicating unusual variability in either cloud structure/altitude and/or ammonia humidity within the cyclone.

Author

Jupiter Red Spot; Vertical Distribution; Planetary Meteorology; Atmospheric Circulation; Jupiter Atmosphere; Planetary Atmospheres; Anticyclones

20000074705 National Astronomical Observatory, Div. of Earth Rotation, Japan

Differential VLBI Observations Among a Lunar Orbiter, the Moon and a QSO

Kawano, Nobuyuki, National Astronomical Observatory, Japan; Hanada, Hideo, National Astronomical Observatory, Japan; Iwata, Takahiro, Communications Research Lab., Japan; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 160-163; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The Japanese lunar explorer, SELENE will be launched in 2004. It will send two radio transmitters to the Moon for differential VLBI. One is a mission instrument on board the orbiter, and the other is placed on the Moon or on board another free flyer. They transmit carrier signals at three frequencies of S-band and one of X-band. It is expected that many VLBI stations take part in the observations of these transmitters for selenodesy. In addition to the VLBI observations, it is also expected that a lunar orbit and lunar libration will be observed at LLR stations.

Author

Lunar Orbiter; Radio Transmitters; Very Long Base Interferometry; Differential Interferometry

20000074738 Graduate Univ. for Advanced Studies, Dept. of Astronomical Science, Japan

The Differential VLBI Observation of Lunar Prospector

Kono, Yusuke, Graduate Univ. for Advanced Studies, Japan; Hanada, Hideo, National Astronomical Observatory, Japan; Iwadate, Kenzaburo, Mizusawa Astrogeodynamics Observatory, Japan; Araki, Hiroshi, Mizusawa Astrogeodynamics Observatory, Japan; Kawano, Nobuyuki, National Astronomical Observatory, Japan; Koyama, Yasuhiro, Communications Research Lab., Japan; Fukuzaki, Yoshihiro, Geographical Survey Inst., Japan; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 346-349; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

We performed a differential VLBI observation of Lunar Prospector (LP) and a QSO as a test observation for SELENE. Purpose of such observations for SELENE is estimation of the orbit and lunar gravity field. We developed a software for correlation of signals from LP. This software correlates carrier signal and calculates change of fringe phases. On the other hand, signals from a QSO were correlated by a conventional VLBI correlator. In correlation of LP, we could see the phase variation caused by the orbital motion around the Moon. The phase error was within about 0.6 degrees. This phase error suggests that we can determine position of LP within accuracy of 20 cm, if we could solve 2 ambiguity of phases. Because LP transmitted only one frequency signal, we could not solve the ambiguity. This 2 ambiguity can be solved by multi-frequency differential VLBI observations in SELENE project.

Author

Lunar Gravitation; Very Long Base Interferometry; Phase Error; Differential Interferometry; Space Observations (From Earth)

20000075274 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Microwave Investigation of the Mars Atmosphere and Surface

Gulkis, S., Jet Propulsion Lab., California Inst. of Tech., USA; Forget, F., Paris VI Univ., France; Janssen, M., Jet Propulsion Lab., California Inst. of Tech., USA; Riley, A. L., Jet Propulsion Lab., California Inst. of Tech., USA; Hartogh, P., Max-Planck-Inst. fuer Astronomie, Germany; Clancy, T., Colorado Univ., USA; Allen, M., Jet Propulsion Lab., California Inst. of Tech., USA; Frerking, M., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Microwave Investigation of the Mars Atmosphere and Surface Experiment (MIMAS) is designed to address two major scientific goals: 1) to understand the three dimensional general circulation of the Martian atmosphere, and 2) To understand the hydrologic cycle of water on Mars, including the time-variable sources, sinks, and atmospheric transport of water vapor. The proposed instrument is a submillimeter wave, heterodyne receiver, with both continuum and very high spectral resolution capability. A small reflector antenna will be used to feed the receiver. Instrument heritage comes from the MIRO receiver, currently under design for the ESA Rosetta Mission, and from SWAS, a NASA astrophysics mission. The instrument will be able to measure atmospheric spectral lines from both water and carbon monoxide and use these lines as tracers of atmospheric winds. Measurement objectives of MIMAS are to measure surface temperature, atmospheric temperature from the surface up to an altitude of 60 km or more, the distribution of CO and H2O in the atmosphere, and certain wind fields (zonal and meridional). The global distribution of CO, as well as temperature distributions, will be used as input data for GCMs (general circulation models). Water vapor profiles will be used to understand the sources and sinks of water on Mars and to understand how it is transported globally by the general circulation. Zonal and meridional wind fields will provide further tests of the GCMs. An important aspect of this experiment is that the temperature and humidity measurements are insensitive to dust and ice condensates thereby making the measurement capability independent of the presence of dust clouds and ice particles. Temperature measurements derived from the data can be used in conjunction with infrared measurements to determine dust profiles.

Author

Research; Microwaves; Mars Atmosphere; Surface Temperature; Three Dimensional Motion; Hydrological Cycle; Experiment Design

20000075275 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Radar Images of the Kuiper Quadrangle (Mercury) from Goldstone Radar Data

Jurgens, R. F., Jet Propulsion Lab., California Inst. of Tech., USA; Rojas, F., Jet Propulsion Lab., California Inst. of Tech., USA; Slade, M. A., Jet Propulsion Lab., California Inst. of Tech., USA; Standish, E. M., Jet Propulsion Lab., California Inst. of Tech., USA; Haldemann, A. F. C., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We have assembled all currently processed radar data from 1989 to 1998 into crude images covering the Kuiper (H6) region on Mercury. The data used were taken to support the ephemeris improvement and gravitational physics programs; however, the resolution is good enough in some cases to make north/south ambiguous images that show some features that can be identified with the Mariner 10 features. Topography profiles along the apparent equator are also available; some of these profiles show ridges and rills as well as crater depths and diameters. The combination of the optical imaging and the radar imaging can be helpful in understanding similar features in radar images of the optically unimaged hemisphere.

Author

Radar Imagery; Ambiguity; Gravitational Effects; Imaging Techniques; Radar Data

20000075634 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Venus and Beyond Using the Ariane ASAP Launch Capability

Penzo, Paul A., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 4p; In English; Astrodynamics Specialist, 16-18 Aug. 1999, Girdwood, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The cost of executing planetary missions in the next ten years is expected to decrease significantly. The principle reason is that new technology is reducing spacecraft mass while increasing capability. Another reason is that launch costs are expected to decrease. A move in this direction is to permit important planetary missions to fly as secondary payloads, and this opportunity is now provided by the French on the Ariane 5 using the Ariane Structure for Auxiliary Payloads (ASAP). The ASAP will fly on GEO missions, and can boost up to eight 100 kg (or 200 kg, if paired) payloads into the elliptical geosynchronous transfer orbit (GTO), which delivers large communication satellites to GEO. An efficient multi-burn method has been developed by this author to deliver these small spacecraft from GTO to Mars and other destinations. This method, referred to here as Moon-Earth Gravity Assist (MEGA), requires 3 or more major maneuvers together with close flybys of the earth and moon. An example for a Mars

2003 mission (not to scale) is shown in Figure 1, where, once in GTO, the first burn sends the spacecraft beyond the Moon to a distance of 1.2 million kilometers. At apogee, the second burn targets to an encounter with the Moon such that a swingby returns the spacecraft to the Earth with a 300 km perigee, and with an inclination such that a perigee burn will send the spacecraft off to Mars with the required escape velocity vector. Details of this method, specifically for Mars missions, can be found in Reference 3. A similar strategy works for Venus, with some caveats. This method is required to work for any Ariane 5 launch date over a three month period, to ensure a high probability of getting off the ground. The launch period is provided by fixing the Earth escape date (3rd burn), but allowing the high ellipse (beyond the Moon) period to vary by one or two months, and also allowing a one to two month wait time in GTO (or other orbit) before the first burn is performed. Figure 2 shows the trajectory profiles for the early and late GTO launch dates for a Mars 2003 mission. Venus. which is an inner planet, poses special problems for the MEGA process. The escape direction is reverse that of Earth's motion, and the GTO apogee arrival
Author
Communication Satellites; Ariane Launch Vehicle; Gravitation; Mars Missions; Payloads

20000075639 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
MECA Electrometer: An Old Instrument Finds a New Application
Buehler, Martin, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Mars '01 binder contains an electrometer designed to evaluate the electrostatic nature of the Martian regolith (soil) and atmosphere. The electrometer is part of MECA (Mars Environmental Compatibility Assessment) project. The objective is to gain a better understanding of the hazards related to the human exploration of Mars. The electrometer was designed to fit into the heel of the scoop of the robotic arm. The instrument has four sensor types: (a) triboelectric field, (b) electric-field, (c) ion current, and (d) temperature. The triboelectric field sensor array contains five insulating materials to determine material charging effects as the scoop is dragged through the Martian regolith. The sensor has an electric field sensitivity of 35 kV/cm-V and room temperature drift of approx.3 micro V/sec. The sensor has been operated as low as -60 C where the drift is undetected. This talk with focus on the operating principles of the triboelectric sensors and present some of test results.
Author
Electrometers; Electrostatics; Electric Fields; Sensitivity; Transferring

92
SOLAR PHYSICS

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

20000074267 NASA Marshall Space Flight Center, Huntsville, AL USA
Sunspots and Giant-Cell Convection
Moore, Ron L., NASA Marshall Space Flight Center, USA; Hathaway, David H., NASA Marshall Space Flight Center, USA; Reichmann, Ed J., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 31st, 18-22 Jun. 2000, South Lake Tahoe, NV, USA; Sponsored by American Astronomical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

From analysis of Doppler velocity images from SOHO/MDI, Hathaway et al (2000, Solar Phys., in press) have found clear evidence for giant convection cells that fill the solar surface, have diameters 3 - 10 times that typical of supergranules, and have lifetimes approx. greater than 10 days. Analogous to the superposition of the granular convection on the supergranular convection, the approx. 30,000 km diameter supergranules are superposed on these still larger giant cells. Because the giant cells make up the large-scale end of a continuous power spectrum that peaks at the size scale of supergranules, it appears that the giant cells are made by the same mode of convection as the supergranules. This suggests that the giant cells are similar to supergranules, just longer-lived, larger in diameter, and deeper. Here we point out that the range of lengths of large bipolar sunspot groups is similar to the size range of giant cells. This, along with the long lives (weeks) of large sunspots, suggests that large sunspots sit in long-lived, deep downflows at the corners of giant cells, and that the distance from leader to follower sunspots in large bipolar groups is the distance from one giant-cell corner to the next. by this line of reasoning, an unusually large and strong downdraft might pull in both legs of a rising spot-group magnetic flux loop, resulting in the formation of a delta sunspot. This leads us to suggest that a large, strong giant-cell corner downdraft should be present at the birthplaces of large delta sunspots for some time (days to weeks) before the birth. Thus, early detection of such downdrafts by local helioscismology might provide an early warning for the forma-

tion of those active regions (large delta sunspot groups) that produce the Sun's most violent flares and coronal mass ejections. This work is supported by NASA's Office of Space Science through the Solar Physics Branch of its Sun-Earth Connection Program. Author

Continuous Spectra; Convection Cells; Early Warning Systems; Magnetic Flux; Sunspots

20000074661 NASA Marshall Space Flight Center, Huntsville, AL USA

Onset of the Magnetic Explosion in Filament-Eruption Flares and Coronal Mass Ejections: Single-Bipole Events

Moore, Ron L., NASA Marshall Space Flight Center, USA; Sterling, Alphonse C., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; SHINE, 14-17 Jun. 2000, South Lake Tahoe, NV, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We present three-dimensional sketches of die magnetic field before and during filament eruptions in flares and coronal mass ejections. Before the eruption, the overall magnetic field is a closed bipole in which the core field (the field rooted along the bipole's neutral line in the photospheric magnetic flux) is strongly sheared and has oppositely curved "elbows" that bulge out from the opposite ends of the neutral line. This core-field sigmoid runs under and is pressed down in the middle by the rest of the field in the bipole, the less-sheared envelope field rooted outside the core field (as in the model of Antiochos, Dahlburg, & Klimchuk. A filament of chromospheric-temperature plasma is often held in the core field over the neutral line. In a filament eruption, the core field undergoes an explosive eruption, the frozen-in filament plasma providing a visible tracer of the erupting field. The core-field explosion may be either confined (as in some flares) or ejective (as in CMEs that begin together with the onset of a long-duration two-ribbon flare). We present examples of each of these two kind of events as observed in sequences of coronal X-ray images from the Yohkoh SXT, and consider (1) how the explosion begins, and (2) whether confined eruptions begin in basically the same way as ejective eruptions.

Author

Magnetic Flux; Filament Winding; Coronas; Three Dimensional Models; Magnetic Fields; Stellar Mass Ejection; Solar Flares

20000074663 NASA Marshall Space Flight Center, Huntsville, AL USA

Solar Wind Influence on the Oxygen Content of Ion Outflow in the High Altitude Polar Cap During Solar Minimum Conditions

Elliott, Heather A., NASA Marshall Space Flight Center, USA; Comfort, Richard H., NASA Marshall Space Flight Center, USA; Craven, Paul D., NASA Marshall Space Flight Center, USA; Chandler, Michael O., NASA Marshall Space Flight Center, USA; Moore, Thomas E., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Copyright; Avail: Issuing Activity; Abstract Only

We correlate solar wind and IMF properties with the properties of O(+) and H(+) in the polar cap in early 1996 during solar minimum conditions at altitudes between 5.5 and 8.9 Re geocentric using the Thermal Ion Dynamics Experiment (TIDE) on the POLAR satellite. Throughout the high altitude polar cap, we observe H(+) to be more abundant than O(+). H(+) is a significant fraction of both the ionosphere and the solar wind, and O(+) is not a significant species in the solar wind. O(+) is the major species in the ionosphere so the faction of O(+) present in the magnetosphere is commonly used as a measure of the ionospheric contribution to the magnetosphere. For these reasons, 0+ is of primary interest in this study. We observe O(+) to be most abundant at lower latitudes when the solar wind speed is low (and low KP), and at higher solar wind speeds (and high KP) O(+) is observed across most of the polar cap. We also find that O(+) density and parallel flux are well organized by solar wind dynamic pressure; they both increase with solar wind dynamic pressure. H(+) is not as highly correlated with solar wind and IMF parameters, but H(+) density and parallel flux have some negative correlation with IMF By, and some positive correlation with VswBIMF. In this solar minimum data set, H(+) is dominant so that contributions of this plasma to the plasma sheet would have a very low O(+) to H(+) ratio.

Author

Solar Wind; Oxygen Ions; Polar Caps; Solar Activity Effects; Wind Velocity; Hydrogen Ions

20000074664 NASA Marshall Space Flight Center, Huntsville, AL USA

Correlative Aspects of the Solar Electron Neutrino Flux and Solar Activity

Wilson, Robert M., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Between 1970 and 1994, the Homestake Solar Neutrino Detector obtained 108 observations of the solar electron neutrino flux (less than 0.814 MeV). The "best fit" values derived from these observations suggest an average daily production rate of about 0.485 Ar-37 atom per day, a rate equivalent to about 2.6 SNU (solar neutrino units) or about a factor of 3 below the expected rate from the standard solar model. In order to explain, at least, a portion of this discrepancy, some researchers have speculated that

the flux of solar neutrinos is variable, possibly being correlated with various markers of the solar cycle (e.g., sunspot number, the Ap index, etc.). In this paper, using the larger ”standard data set,” the issue of correlative behavior between solar electron neutrino flux and solar activity is re-examined. The results presented here clearly indicate that no statistically significant association exists between any of the usual markers of solar activity and the solar electron neutrino flux.
Author
Solar Neutrinos; Solar Flux; Argon Isotopes; Solar Cycles

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.

20000074280 NASA Goddard Inst. for Space Studies, New York, NY USA
Does Turbulence in the Iron Convection Zone Cause the Massive Outbursts of Eta Carinae?
Stothers, Richard B., NASA Goddard Inst. for Space Studies, USA; [1999]; 16p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Taken at face value, the observed properties of the central object in Eta-Car suggest a very massive, hot main-sequence star, only slightly evolved. If this is so, the star’s extraordinarily high steady rate of mass loss must dynamically perturb its outer envelope down to the iron convection zone, where the kinetic energy associated with turbulent convection can be directly fed into mass ejection. Runaway mass loss, triggered by either internal (pulsational, rotational) or external (tidal) forcing, would produce a secular oscillation of the outer envelope. In either case, the oscillation is potentially able to account for the observed approximately 5 yr cycles of visual outbursts in Eta-Car, including the giant eruption of 1843.
Author
Convection; Massive Stars; Oscillations; Blue Stars; Stellar Composition

20000074403 Smithsonian Astrophysical Observatory, Cambridge, MA USA
The X-Ray Core of the Low-Luminosity Radio Galaxy 3C346 and ASCA Spectroscopy to Test BL LAC/Radio Galaxy Unification *Final Report, 15 Jun. 1995 - 31 Jan. 2000*
Worrall, Diana, Smithsonian Astrophysical Observatory, USA; June 2000; 24p; In English
Contract(s)/Grant(s): NAG5-2961; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Radio galaxies are relatively faint sources for Advanced Spacecraft for Cosmology Astrophysics (ASCA), and so in order to get the best possible results from the observations two things have been necessary, both of which delayed the fast preparation of papers. Firstly, the best possible data screening and background subtraction were necessary to improve the signal-to-noise, and all our several initial analysis trials were discarded in favor of using FTOOLS versions 4.1 and above. Secondly, we found that the ASCA spectra were statistically too poor to discriminate well between non-thermal and thermal models, never mind the mixture of the two which we expected on the basis of our ROSAT spatial separation of components in radio galaxies. This means that in each case we have needed to combine the ASCA spectroscopy with analysis of data from other X-ray or radio observations in order to exploit the ASCA data to the full. Our analysis for 3C 346 has yielded the cleanest final result. This powerful radio galaxy at a redshift of 0.161, lies in a poor cluster, which we have separated well from the dominant X-ray component of unresolved emission using a spatial analysis of archival ROSAT data. We were then able to fix the thermal component in our ASCA spectral analysis, and have found evidence that the unresolved emission varied by 32 +/- 13% over the 18 months between the ROSAT and ASCA observations. The unresolved X-ray emission does not suffer from intrinsic absorption, and we have related it to radio structures on both milliarcsecond scales and the arcsecond scales which Chandra can resolve. The source is a target of a Chandra AO2 proposal which we have recently submitted to follow up on our ASCA (and ROSAT) work. 3C 346’s orientation to the line of sight is uncertain. However, the absence of X-ray absorption, and the radio/optical/X-ray colors, when combined with with previous radio evidence that the source is a foreshortened radio galaxy of the FRII class, suggest that the radio jets are seen at an angle to the line of sight of about 30 deg, intermediate between the radio-galaxy and quasar classes. The relatively hard ASCA response has allowed us to place an upper limit of 5.6 x 10(exp 43) ergs/ s on the 2-10 keV luminosity of any central X-ray component absorbed bN, gas which might be obscuring the broad-line emission region. Attached to this report is an almost final draft of a paper which we have prepared for submission to the Astrophysical Journal. Our combined ASCA and ROSAT results for NGC 6251 rule out our previously preferred flat-spectrum model and inverse-Compton interpretation for the source based on ROSAT data alone, but a softer X-ray spectrum and moderate absorption bring all the available data (including our early VLA HI measurements) into consistency, and we are reasonably confident that we understand the processes responsible for the X-ray

emission. We have made some more sensitive HI absorption measurements which are currently being analyzed, and our plans are to publish our ASCA analysis in conjunction with the new HI results. The ASCA data for NGC 4261 have been difficult to interpret. A re-analysis of our ROSAT data with a wider range of physical parameters brings the ROSAT and ASCA results into reasonable agreement only if the emission from hot gas dominates more than suggested by our earlier work, which is itself unexpected since the radio core is bright and a large jet-related X-ray component would bring the source into agreement with results for others of its type. However, we have recently received our Chandra A01 data for this source, with the spatial resolution which allows us to separate thermal and non-thermal emission components. Our ASCA results will be re-interpreted once the analysis of our Chandra data is complete. The interpretation of the ASCA data for BL Lac object 3C 371 is ongoing, in conjunction with analysis of archival multifrequency data. Radio galaxies are complex in their X-ray properties, and hindsight has shown that the spatial resolution of ASCA is too poor for a reliable interpretation of the data without drawing on other observations. However, the ASCA spectra have made a useful contribution to the interpretation of these sources, and the groundwork is now there for more sensitive work using Chandra and XMM-Newton.
Derived from text
Radio Galaxies; Quasars; X Ray Astronomy; Radio Astronomy; Astronomical Models; X Ray Sources

20000074731 Academy of Sciences (USSR), Inst. of Applied Astronomy, Saint Petersburg, USSR
A Catalogue of Radio Source Coordinates Obtained from NEOS and CORE VLBI Programs
Sokolskaya, Maria, Academy of Sciences (USSR), USSR; Malkin, Zinovy, Academy of Sciences (USSR), USSR; International VLBI Service for Geodesy and Astrometry: 2000 General Meeting Proceedings; May 2000, pp. 314-318; In English; See also 20000074683; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

A new catalogue of radio source coordinates is constructed as a combination of catalogues derived from NEOS and CORE VLBI programs for the period 1997-1999 using ERA package. One of the main goals of this study was an attempt to investigate systematic differences between source coordinates derived from geodetic VLBI observations made by various sets of stations and estimate a possible proper or apparent motion of radio sources. At the first stage nine catalogues were obtained from observations of NEOS-A, CORE-A and CORE-B programs for 1997, 1998 and 1999. At the next stage six catalogues were derived: three catalogues for years 1997, 1998, 1999 using all observations for these years and three catalogues for each program NEOS-A, CORE-A, and CORE-B for the whole period 1997-1999. Finally, after analysis of differences between catalogues and time variations of source coordinates a combined catalogue was made.
Author
Astronomical Catalogs; Very Long Base Interferometry; Astrometry; Astronomical Coordinates; Radio Sources (Astronomy)

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