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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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- Domestic and foreign dissertations and theses.

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

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Table of Contents

Subject Divisions

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

A. Aeronautics
B. Astronautics
C. Chemistry and Materials
D. Engineering
E. Geosciences
F. Life Sciences
G. Mathematical and Computer Sciences
H. Physics
I. Social 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

Document Availability

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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 7

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 11

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

05 Aircraft Design, Testing and Performance 11

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

07 Aircraft Propulsion and Power 19

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 Aircraft Stability and Control 21

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

Subject Categories of the Division B. Astronautics

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12 Astronautics (General) 22

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 23

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

14 Ground Support Systems and Facilities (Space) 24

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 24

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 26

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information, see also *03 Air Transportation and Safety* and *15 Launch Vehicles and Launch Vehicles*, and *18 Spacecraft Design, Testing and Performance*. For space suits, see *54 Man/System Technology and Life Support*.

17 Space Communications, Spacecraft Communications, Command and Tracking 33

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

18 Spacecraft Design, Testing and Performance 33

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 38

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 39

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

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23 Chemistry and Materials (General) 42

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

24 Composite Materials 43

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

25 Inorganic, Organic, and Physical Chemistry 46

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 55

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

27 Nonmetallic Materials 59

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

28 Propellants and Fuels 70

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 71

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) 72

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 77

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 97

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 110

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 114

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 119

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 137

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 140

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

39 Structural Mechanics 141

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) 147

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 149

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 168

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 182

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

46 Geophysics 189

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 194

Includes weather observation forecasting and modification.

48 Oceanography 198

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) 200

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 206

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*.

53 Behavioral Sciences 217

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

54 Man/System Technology and Life Support 224

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) 233

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

60 Computer Operations and Hardware 234

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

61 Computer Programming and Software 237

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 249

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 252

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 264

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

65 Statistics and Probability 268

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

66 Systems Analysis and Operations Research 269

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

67 Theoretical Mathematics 270

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

Subject Categories of the Division H. Physics

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

70 Physics (General) 271

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 272

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 276

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

73 Nuclear Physics 284

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*.

74 Optics 285

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

75 Plasma Physics 291

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

76 Solid-State Physics 301

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

77 Physics of Elementary Particles and Fields 312

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) 313

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

81 Administration and Management 316

Includes management planning and research.

82 Documentation and Information Science 318

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

Subject Categories of the Division J. Space Sciences

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

89 Astronomy 322

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

90 Astrophysics 327

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

91 Lunar and Planetary Science and Exploration 330

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

92 Solar Physics 331

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

93 Space Radiation 332

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.*

Subject Categories of the Division K. General

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99 General 336

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

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Typical Report Citation and Abstract

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

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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VOLUME 38, MAY 8, 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.

20000032341 Nebraska Univ., Omaha, NE USA

Facilitating Student Involvement in NASA Research: The NASA Space Grant Aeronautics Example

Bowen, Brent D., Nebraska Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 960-970; In English; See also 20000032189; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche; C01, CD-ROM

Many consider NASA programs to be exclusively space-oriented. However, NASA's roots originated in the aeronautical sciences. Recent developments within NASA elevated the declining role of aeronautics back to a position of priority. On a parallel pattern, aeronautics was a priority in the legislation which authorized the National Space Grant College and Fellowship Program. This paper outlines the development of the aeronautics aspect of the National Space Grant College and Fellowship Program, and the resulting student opportunities in research. Results from two aeronautics surveys provide a baseline and direction for further development. A key result of this work is the increase in student research opportunities which now exist in more states and at the national level.

Author

NASA Programs; Research; Research and Development; Project Management; Priorities

20000032683 Research and Technology Organization, Human Factors and Medicine, Neuilly-sur-Seine, France

Human Consequences of Agile Aircraft ***Cycle de conferences sur les facteurs humains lies au pilotage des avions de combat tres manoeuvrants***

March 2000; 92p; In English, 20-21 Mar. 2000, Neubiberg, Preston, Ohio, Germany, UK, USA; See also 20000032684 through 20000032689

Report No.(s): RTO-EN-12; AC/323(HFM)TP/32; ISBN 92-837-1036-3; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche; C01, CD-ROM

This Lecture Series evaluates the human factors implications for pilots of "superagile flight", specifically with regard to agile airframes, agile weapons, and rapidly configurable systems. During interviews, experienced pilots have confirmed the operational need for military aircraft agility. Although pilots have noted that their experiences to date have not caused them any major concerns regarding the potential for physiological problems, significant gaps remain in our understanding of the effects of multi-axis accelerations. Human consequences are also anticipated in the area of situational awareness. Presentation of aircraft attitude and energy state in a helmet mounted display will be a design challenge. The minimal constraints on aircraft incidence angles and the expanded weapon launch envelopes anticipated with the forthcoming and next generations of air systems requires the provision of novel displays to enable pilots to effectively operate such air systems. Decision aids, intelligent interfaces and automated subsystems are required to enable pilots to maintain situational awareness whilst coping with dramatic increases in the tempo of the tactical situation and the 'data deluge'. Moreover, many of the current pilot protection systems will be inadequate for everyday use in such an unconstrained flight envelope and during ejection. Additional challenges in selection, simulation, and training are also anticipated.

Derived from text

Human Factors Engineering; Decision Support Systems; Aircraft Pilots; Pilot Training; Lectures; Human-Computer Interface

20000032685 Office National d'Etudes et de Recherches Aerospatiales, System Control and Flight Dynamics Dept., Salon Air, France

Agility: History, Definitions and Basic Concepts

LeBlaye, Patrick, Office National d'Etudes et de Recherches Aerospatiales, France; Human Consequences of Agile Aircraft; March 2000, pp. 2 - 1 - 2 - 13; In English; See also 20000032683; Copyright Waived; Avail: CASI; A03, Hardcopy

The purpose of this presentation is to provide some engineering basis of the concept of agility. We'll see that the definition of agility has evolved across recent aviation history, from the well known area of airframe agility to a global concept of operational agility. We'll give some consensus definition, some of which have been proposed by the working group 19 of the Flight Mechanics Panel of AGARD. We'll briefly examine the concepts of agility relative to each component of the system (airframe, systems, weapons) and give some orders of magnitude of present and future weapon systems performances, which may have particular consequences on the human in flight. We'll then examine the concept of operational agility and conclude with some perspectives for potential areas of preoccupation relative to the role of human pilots in the future combat scenarios and information environment.

Author

Aircraft Performance; Aircraft Maneuvers; Flight Characteristics; Flight Mechanics; Flight Control

20000032859 Research and Technology Organization, Applied Vehicle Technology, Neuilly-sur-Seine, France

Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft ***l'Application des principes de la tolerance a l'endommagement pour une meilleure aptitude au vol des aeronefs and voilure tournante***

February 2000; 202p; In English, 21-22 Apr. 1999, Corfu, Greece; See also 20000032860 through 20000032874

Report No.(s): RTO-MP-24; AC/323(AVT)TP/12; ISBN 92-837-1024-X; Copyright Waived; Avail: CASI; A10, Hardcopy; A03, Microfiche; C01, CD-ROM

The Specialists' Meeting dealt with Aging Systems and more specifically Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft. These proceedings include a Keynote Address and fifteen papers having the objective of discussing and presenting the applicability of the new design approach to major rotorcraft components such as the dynamic system, primary load carrying structures, and flight control systems. Both metal and composite structures including special material related topics such as crack growth models and delamination modelling were examined. There were three sessions covering the following topics: Material Data and Crack Growth Models for DT-Approaches fo Helicopter Structures; Design Application of DT-Principle; and Operator Experience and Certification Issues. A Technical Evaluation Report of this meeting is also included.

Author

Conferences; Rotary Wing Aircraft; Aircraft Reliability; Damage; Tolerances (Mechanics); Fatigue (Materials); Aircraft Structures; Systems Health Monitoring; Structural Reliability; Structural Failure

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.

20000032094 NASA Langley Research Center, Hampton, VA USA

Wake Vortex Transport and Decay in Ground Effect: Vortex Linking with the Ground

Proctor, Fred H., NASA Langley Research Center, USA; Hamilton, David W., NASA Langley Research Center, USA; Han, Jongil, North Carolina State Univ., USA; [2000]; 15p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-0757; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Numerical simulations are carried out with a three-dimensional Large-Eddy Simulation (LES) model to explore the sensitivity of vortex decay and transport in ground effect (IGE). The vortex decay rates are found to be strongly enhanced following maximum descent into ground effect. The nondimensional decay rate is found to be insensitive to the initial values of circulation, height, and vortex separation. The information gained from these simulations is used to construct a simple decay relationship. This relationship compares well with observed data from an IGE case study. Similarly, a relationship for lateral drift due to ground effect is constructed from the LES data. In the second part of this paper, vortex linking with the ground is investigated. Our numerical simulations of wake vortices for IGE show that a vortex may link with its image beneath the ground,

if the intensity of the ambient turbulence is moderate to high. This linking with the ground (which is observed in real cases)gives the appearance of a vortex tube that bends to become vertically oriented and which terminates at the ground. From the simulations conducted, the linking time for vortices in the free atmosphere; i.e., a function of ambient turbulence intensity.
Author
Vortices; Ground Effect (Aerodynamics); Aircraft Wakes

20000032182 NASA Langley Research Center, Hampton, VA USA
Contributions of the Langley Transonic Dynamics Tunnel to Rotorcraft Technology and Development
Yeager, William T., Jr., Army Research Lab., USA; Kvaternik, Raymond G., NASA Langley Research Center, USA; [2000]; 60p; In English; Dynamics Specialists, 5-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1771; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

A historical account of the contributions of the Langley Transonic Dynamics Tunnel (TDT) to rotorcraft technology and development since the tunnel's inception in 1960 is presented. The paper bet,ins with a summary of the major characteristics of the TDT and a description of the unique capability offered by the TDT for testing aeroelastic models by virtue of its heavy gas test medium. This is followed by some remarks on the role played by scale models in the design and development of rotorcraft vehicles and a review of the basic scaling relationships important for designing and building dynamic aeroelastic models of rotorcraft vehicles for testing in the TDT. Chronological accounts of helicopter and tiltrotor research conducted in the TDT are then described in separate sections. The discussions include a description of the various models employed, the specific objectives of the tests, and illustrative results.
Author
Transonic Wind Tunnels; Aeroelasticity; Rotary Wing Aircraft; Scale Models

20000032313 North Carolina Agricultural and Technical State Univ., NASA CAR, Greensboro, NC USA
Incompressible Turbulent Wing-Body Junction Flow
Krishnamurthy, R., North Carolina Agricultural and Technical State Univ., USA; Cagle, Corey D., North Carolina Agricultural and Technical State Univ., USA; Chandra, S., North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 301-305; In English; See also 20000032189
Contract(s)/Grant(s): NAG3-1734
Report No.(s): 98URC055; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

The overall objective of this study is to contribute to the optimized design of fan bypass systems in advanced turbofan engines. Increasing the engine bypass ratios have provided a major boost in engine performance improvement over the last fifty years. An engine with high bypass ratio (11-16:1) such as the Advanced Ducted Propulsion (ADP) is being developed and is expected to provide an additional 25% improvement in overall efficiency over the early turbofans. Such significant improvements in overall efficiency would reduce the cost per seat mile, which is a major government and Industry challenge for the 21th century. The research is part of the Advanced Subsonic Technology (AST) program that involves a NASA, U.S. Industry and FAA partnership with the goal of a safe and highly productive global air transportation system. The immediate objective of the study is to perform numerical simulation of duct-strut interactions to elucidate the loss mechanisms associated with this configuration that is typical of advanced turbofan engines such as ADP. However, at present experimental data for a duct-strut configuration are not available. Thus, as a first step a wing-body junction flow would be studied and is the specific objective of the present study. At the outset it is to be recognized that while duct-strut interaction flow is similar to that of wing-body junction flows, there are some differences owing to the presence of a wall at both ends of the strut. Likewise, some differences are due to the sheared inflow (as opposed to a uniform inflow) velocity profile. It is however expected that some features of a wing-body junction flow would persist. Next, some of the salient aspects of the complex flow near a wing-body junction, as revealed by various studies reported in the literature will be reviewed. One of the principle characteristics of the juncture flow, is the presence of the mean flow components in a plane perpendicular to the direction of the oncoming free-stream flow. The lateral curvature of the wing/strat causes the oncoming turbulent layer to skew about am axis (x-axis) parallel to the plane (xz-plane) of the mean shear. This is the principle mechanism for the generation of secondary flow. Such skew-induced secondary flows are slow to be attenuated by Reynolds stresses. Additional contribution to the generation of secondary flow comes from anisotropies in Reynolds stresses. Upstream of the strut, the mean-vorticity is directed span wise (along the y-direction). The presence of secondary flow in the vicinity of the strut causes the vorticity to stretch around the obstacle in a horse-shoe shape, with each leg having a vorticity of the opposite sense. The blockage effect of the strut imposes a severe adverse pressure gradient on the oncoming turbulent shear layer, causing boundary layer separation ahead of the leading edge, resulting in a vortex that rolls up and flows downstream into the juncture region. The

separation vortices trailing in the wake of the wing can alter the lift or drag characteristics of the surfaces downstream of the wing-body juncture. Likewise, on submarines, the wake flow behind the appendage can degrade the performance of the propeller located downstream. The complex nature of this flow is caused by the presence of all six components of Reynolds stresses. Devenport and Simpson report that in the vicinity of the horse-shoe vortex there is intense recirculation with turbulent stresses being much larger than those normally observed in turbulent flows. These features contribute to making this flow a challenge to predict numerically. Some of the past studies provide useful insights into this flow that would guide our numerical efforts. In measurements reported by Shabaka and Bradshaw, the eddy viscosity tensor is seen to be non-isotropic and has negative components in certain regions. In an effort to evaluate the closure assumptions of various turbulence models, Devenport and Simpson used their own extensive measurements in juncture flows around the nose of a wing-body junction. Measured values of mean-velocity and/or turbulence kinetic energy was used to predict the magnitude of the shear stress vector. Algebraic stress models performed the best followed by Cebeci-Smith eddy viscosity model. The flow is reported to be dominated by a pressure field produced by the wing and the velocity field generated by the horseshoe vortex that is wrapped around the junction between the wing and wall. Kubendran et al. conclude from an experimental study that the shape of leading edge of the wing as characterized by its slenderness ratio is a major factor in determining the flow fields in the juncture region. The more thinner the leading edge of the juncture, the weaker the horseshoe vortex is. Also, with a slender leading edge, the secondary flow in the juncture would be due mainly to the cross-stream gradients of Reynolds stresses rather than due to a lateral skewing of the shear layer.

Derived from text

Body-Wing Configurations; Incompressible Flow; Free Flow; Pressure Gradients; Secondary Flow; Turbofan Engines; Turbulent Flow; Wakes; Bypass Ratio; Turbofans

20000032455 Virginia Polytechnic Inst. and State Univ., Mechanical Engineering Dept., Blacksburg, VA USA

Effects of Flow Control on the Aerodynamics of a Tandem Inlet Guide Vane

Vandeputte, Thomas W., Virginia Polytechnic Inst. and State Univ., USA; Jan. 19, 2000; 98p; In English

Contract(s)/Grant(s): NAG3-2191; Copyright; Avail: Issuing Activity

An aerodynamic investigation was performed to assess the effectiveness of combined boundary layer suction and trailing edge blowing at reducing the blade profile losses and the wake momentum deficit of a cascade of tandem Inlet Guide Vane's (IGV's) operating at realistic flow conditions. Two trailing edge blowing designs were tested: metal-angle blowing, which oriented the blowing jets very near to the blade exit angle, and deviation-angle blowing, which oriented the blowing jets at a significant deviation angle from the blade exit angle. Both blowing designs used the same boundary layer suction arrangement. A linear cascade of five IGV's was tested with a flap deflection angle of 40 deg and an inlet Mach number of 0.3. The Reynolds number based on the overall IGV chord length for these experiments was greater than 500,000. The inlet and exit angles of the IGV at this flap setting were 0' and 55 deg respectively. Tests performed with no flow control showed significant suction surface flow separation that generated large wakes with high losses and large momentum deficits. The application of boundary layer suction reduced the baseline pressure loss coefficient and wake momentum thickness by 22%. A suction mass flow of 0.4 % of the passage flow was used to obtain these results. The addition of metal-angle blowing with the suction resulted in total reductions of 48 % and 38 % for the pressure loss coefficient and wake momentum thickness. A blowing mass flow of 3.1 % of the passage flow was used in addition to 0.4 % suction mass flow to obtain these results. The application of the deviation-angle blowing was detrimental to the aerodynamics of the IGV, as both the pressure loss coefficient and wake momentum thickness increased slightly over their suction-only values. This was attributed to a manufacturing defect which distorted the flow of the blowing jet. The results of the deviation-angle blowing experiments were not considered representative of the design intent and reinforced the importance of the hole design for creating a proper blowing jet. While low speed tests of this cascade showed results and trends very similar to those of previous research, the application of flow control proved to be less effective at higher speeds due to the generation of significantly larger wakes.

Author

Flow Characteristics; Aerodynamics; Inlet Flow; Boundary Layer Separation; Trailing Edges; Blowing; Deflection; Performance Tests; Guide Vanes; Intake Systems

20000032523 NASA Glenn Research Center, Cleveland, OH USA

A Numerical Evaluation of Icing Effects on a Natural Laminar Flow Airfoil

Chung, James J., Institute for Computational Mechanics in Propulsion, USA; Addy, Harold E., Jr., NASA Glenn Research Center, USA; January 2000; 20p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 548-20-23

Report No.(s): NASA/TM-2000-209775; NAS 1.15:209775; AIAA Paper 2000-0096; E-12055; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

As a part of CFD code validation efforts within the Icing Branch of NASA Glenn Research Center, computations were performed for natural laminar flow (NLF) airfoil, NLF-0414. with 6 and 22.5 minute ice accretions. Both 3-D ice castings and 2-D machine-generated ice shapes were used in wind tunnel tests to study the effects of natural ice is well as simulated ice. They were mounted in the test section of the Low Turbulence Pressure Tunnel (LTPT) at NASA Langley that the 2-dimensionality of the flow can be maintained. Aerodynamic properties predicted by computations were compared to data obtained through the experiment by the authors at the LTPT. Computations were performed only in 2-D and in the case of 3-D ice, the digitized ice shape obtained at one spanwise location was used. The comparisons were mainly concentrated on the lift characteristics over Reynolds numbers ranging from 3 to 10 million and Mach numbers ranging from 0.12 to 0.29. WIND code computations indicated that the predicted stall angles were in agreement with experiment within one or two degrees. The maximum lift values obtained by computations were in good agreement with those of the experiment for the 6 minute ice shapes and the minute 3-D ice, but were somewhat lower in the case of the 22.5 minute 2-D ice. In general, the Reynolds number variation did not cause much change in the lift values while the variation of Mach number showed more change in the lift. The Spalart-Allmaras (S-A) turbulence model was the best performing model for the airfoil with the 22.5 minute ice and the Shear Stress Turbulence (SST) turbulence model was the best for the airfoil with the 6 minute ice and also for the clean airfoil. The pressure distribution on the surface of the iced airfoil showed good agreement for the 6 minute ice. However, relatively poor agreement of the pressure distribution on the upper surface aft of the leading edge horn for the 22.5 minute ice suggests that improvements are needed in the grid or turbulence models. Author

Ice Formation; Laminar Flow Airfoils; Wind Tunnel Tests; Computational Fluid Dynamics; Mathematical Models; Aerodynamic Characteristics

20000032567 Office National d'Etudes et de Recherches Aerospatiales, Chatillon, France

Performance prediction and flow-field analysis of rotors in hover using a coupled Euler/boundary layer method

Beaumier, P.; Castellin, C.; Arnaud, G.; Dec. 31, 1998; 15p; In English; 24th; European rotor-craft forum

Report No.(s): DE99-765497; ONERA-TP-1998-190; No Copyright; Avail: Department of Energy Information Bridge

The performance prediction of helicopter in hover is of key importance for manufacturers because hover is a design configuration for the definition of a rotor-craft. A lot of efforts have been made for more than 10 years all over the world in order to develop and validate numerical methods based on CFD. An Euler method (WAVES) developed by ONERA and coupled with a boundary layer code (MI3DI) is presented, validated and applied to compute the total performance of rotors with different tip shapes. A new boundary condition for the Euler code has been tested and enables better calculation by eliminating 'numerical' recirculation. The code has demonstrated its ability to rank two rotors with different planforms in good agreement with experiment. Under industrial requirements new grid strategies have been studied and should allow to reduce CPU time consumption. It is shown that WAVES/MI3DI can be efficiently used in the aerodynamic design process of a new rotor. NTIS

Performance Prediction; Flow Distribution; Rotors; Helicopters

20000032580 NASA Langley Research Center, Hampton, VA USA

Test-to-Test Repeatability of Results From a Subsonic Wing-Body Configuration in the National Transonic Facility

Mineck, Raymond E., NASA Langley Research Center, USA; Pendergraft, Odis C., Jr., NASA Langley Research Center, USA; March 2000; 81p; In English

Contract(s)/Grant(s): RTOP 538-14-12-01

Report No.(s): NASA/TM-2000-210079; NAS 1.15:210079; L-17774; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Results from three wind tunnel tests in the National Transonic Facility of a model of an advanced-technology, subsonic-transport wing-body configuration have been analyzed to assess the test-to-test repeatability of several aerodynamic parameters. The scatter, as measured by the prediction interval, in the longitudinal force and moment coefficients increases as the Mach number increases. Residual errors with and without the ESP tubes installed suggest a bias leading to lower drag with the tubes installed. Residual errors as well as average values of the longitudinal force and moment coefficients show that there are small bias errors between the different tests.

Author

Subsonic Speed; Wind Tunnel Tests; Transonic Wind Tunnels; Body-Wing Configurations

20000032920 NASA Lewis Research Center, Cleveland, OH USA

Correlation Between Geometric Similarity of Ice Shapes and the Resulting Aerodynamic Performance Degradation: A Preliminary Investigation Using WIND

Wright, William B., DYNACS Engineering Co., Inc., USA; Chung, James, NASA Lewis Research Center, USA; December 1999; 30p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS3-98008; RTOP 548-20-23

Report No.(s): NASA/CR-1999-209417; NAS 1.26:209417; E-12057; AIAA Paper 2000-0097; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Aerodynamic performance calculations were performed using WIND on ten experimental ice shapes and the corresponding ten ice shapes predicted by LEWICE 2.0. The resulting data for lift coefficient and drag coefficient are presented. The difference in aerodynamic results between the experimental ice shapes and the LEWICE ice shapes were compared to the quantitative difference in ice shape geometry presented in an earlier report. Correlations were generated to determine the geometric features which have the most effect on performance degradation. Results show that maximum lift and stall angle can be correlated to the upper horn angle and the leading edge minimum thickness. Drag coefficient can be correlated to the upper horn angle and the frequency-weighted average of the Fourier coefficients. Pitching moment correlated with the upper horn angle and to a much lesser extent to the upper and lower horn thicknesses.

Author

Ice; Ice Formation; Shapes; Thickness; Performance Prediction; Computer Programs; Software Engineering

20000033134 NASA Ames Research Center, Moffett Field, CA USA

Putting the Aero Back into Aeroelasticity

Bousman, William G., Army Aviation and Missile Command, USA; March 2000; 24p; In English; Aeroelasticity of Rotorcraft Systems, 18-20 Oct. 1999, University Park, PA, USA

Contract(s)/Grant(s): RTOP 505-59-87

Report No.(s): NASA/TM-2000-209589; NAS 1.15:209589; A-00V0012; USAAMCOM-TR-00-A-005; AFDD/TR-00-A-005; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The lack of progress in understanding the physics of rotorcraft loads and vibration over the last 30 years is addressed in this paper. As befits this extraordinarily difficult problem, the reasons for the lack of progress are complicated and difficult to ascertain. It is proposed here that the difficulty lies within at least three areas: 1) a loss of perspective as to what are the key factors in rotor loads and vibration, 2) the overlooking of serious unsolved problems in the field, and 3) cultural barriers that impede progress. Some criteria are suggested for future research to provide a more concentrated focus on the problem.

Author

Aeroelasticity; Rotary Wing Aircraft; Vibratory Loads; Aerodynamic Loads

20000033218 NASA Langley Research Center, Hampton, VA USA

A Reynolds Number Study of Wing Leading-Edge Effects on a Supersonic Transport Model at Mach 0.3

Williams, M. Susan, NASA Langley Research Center, USA; Owens, Lewis R., Jr., NASA Langley Research Center, USA; Chu, Julio, NASA Langley Research Center, USA; December 1999; 110p; In English

Contract(s)/Grant(s): RTOP 537-03-22-06

Report No.(s): NASA/TP-1999-209695; NAS 1.60:209695; L-17281; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A representative supersonic transport design was tested in the National Transonic Facility (NTF) in its original configuration with small-radius leading-edge flaps and also with modified large-radius inboard leading-edge flaps. Aerodynamic data were obtained over a range of Reynolds numbers at a Mach number of 0.3 and angles of attack up to 16 deg. Increasing the radius of the inboard leading-edge flap delayed nose-up pitching moment to a higher lift coefficient. Deflecting the large-radius leading-edge flap produced an overall decrease in lift coefficient and delayed nose-up pitching moment to even higher angles of attack as compared with the undeflected large- radius leading-edge flap. At angles of attack corresponding to the maximum untrimmed lift-to-drag ratio, lift and drag coefficients decreased while lift-to-drag ratio increased with increasing Reynolds number. At an angle of attack of 13.5 deg., the pitching-moment coefficient was nearly constant with increasing Reynolds number for both the small-radius leading-edge flap and the deflected large-radius leading-edge flap. However, the pitching moment

coefficient increased with increasing Reynolds number for the undeflected large-radius leading-edge flap above a chord Reynolds number of about 35 x 10 (exp 6).
Author
Leading Edge Flaps; Reynolds Number; Supersonic Transports; Transonic Wind Tunnels; Mach Number; Wings; Aerodynamic Coefficients

20000033256 NASA Langley Research Center, Hampton, VA USA
Contributions of the NASA Langley Transonic Dynamics Tunnel to Launch Vehicle and Spacecraft Development
Cole, Stanley R., NASA Langley Research Center, USA; Keller, Donald F., NASA Langley Research Center, USA; Piatak, David J., NASA Langley Research Center, USA; [2000]; 62p; In English; Dynamics Specialists Conference, 5-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1772; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The NASA Langley Transonic Dynamics Tunnel (TDT) has provided wind-tunnel experimental validation and research data for numerous launch vehicles and spacecraft throughout its forty year history. Most of these tests have dealt with some aspect of aeroelastic or unsteady-response testing, which is the primary purpose of the TDT facility. However, some space-related test programs that have not involved aeroelasticity have used the TDT to take advantage of specific characteristics of the wind-tunnel facility. In general. the heavy gas test medium, variable pressure, relatively high Reynolds number and large size of the TDT test section have made it the preferred facility for these tests. The space-related tests conducted in the TDT have been divided into five categories. These categories are ground wind loads, launch vehicle dynamics, atmospheric flight of space vehicles, atmospheric reentry. and planetary-probe testing. All known TDT tests of launch vehicles and spacecraft are discussed in this report. An attempt has been made to succinctly summarize each wind-tunnel test, or in the case of multiple. related tests, each wind-tunnel program. Most summaries include model program discussion, description of the physical wind-tunnel model, and some typical or significant test results. When available, references are presented to assist the reader in further pursuing information on the tests.
Author
Wind Tunnel Tests; Transonic Wind Tunnels; Launch Vehicles; Ground Wind; Gas Pressure; Dynamic Response

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.

20000032388 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
Models for Aircrew Safety Assessment: Uses, Limitations and Requirements *La Modelisation des Conditions de Securite des Equipages: Applications, Limitations et Cahiers des Charges*
August 1999; 360p; In English, 26-28 Oct. 1998, Wright AFB, OH, USA; See also 20000032389 through 20000032420; Original contains color illustrations
Report No.(s): RTO-MP-20; AC/323(HFM)TP/7; ISBN 92-837-1017-7; Copyright Waived; Avail: CASI; A16, Hardcopy; A03, Microfiche

These proceedings include the Technical Evaluation Report, a tribute to Dr. Henning E. von Gierke, Director Emeritus, Wright-Patterson Air Force Base (WPAFB), OH, three Keynote Addresses and 32 invited papers of a Specialists' Meeting sponsored by the NATO/RTO Human Factors and Medicine Panel. It was held at WPAFB from 26-28 October 1998. Significant advances have been made in modelling human physical and physiological responses to extreme environments. Technological advances in computer speed and power have made modelling a feasible research and design tool. Computer simulations are being used extensively for predicting human physical and physiological responses, for reducing testing requirements, for rapidly designing improved protective systems, and for performing human safety-systems analyses. A variety of models were reviewed at this Specialists' Meeting including lumped-parameter, rigid-body, finite-element, statistical, physiologic, and empirical models. Topics covered included modelling human-body responses to environmental stressors, and the systems with which the body interacts to impact, emergency escape, sustained acceleration, vibration, mechanical shock, motion sickness, high altitude, blast, extreme thermal conditions, directed energy, and live firing. These proceedings will be of interest to military and civilian

scientists and engineers interested in exploiting data bases, tolerance critefia, and new models and methods in the research of physiological systems and in simulating the design, test set up and evaluation of safety systems.
Author
Computerized Simulation; Conferences; Human Factors Engineering; Mathematical Models; Flight Crews; Safety Factors; Human Body; Physiological Responses

20000032400 Missouri Univ., Dept. of Mechanical and Aerospace Engineering and Engineering Mechanics, Rolla, MO USA
Forces and Deformed Configurations of an Airbag During Inflation and Impact
Avula, Xavier J. R., Missouri Univ., USA; Kaleps, Ints, Air Force Research Lab., USA; Mysore, Prasad, Missouri Univ., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 12-1 - 12-14; In English; See also 20000032388
Contract(s)/Grant(s): F41624-95-C-6014; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In this work, the evolution of forces and deformed configurations of an airbag during inflation and impact with a rigid sphere were investigated for various airbag parameters. The parameters considered were fabric density, bag elasticity, input gas temperature and vent size. The computations were performed using a non-linear finite element method coded in the LS-DYNA3D package. The influence of the above mentioned parameters on the contact during the impact was significant: lowering the fabric density resulted in higher bag velocity which in turn resulted in higher rebound velocity of an impacting sphere; fabrics of lower elasticity had shown increased contact time and higher rebound velocity; the lower the input gas temperature, the longer was the contact time and the lower the rebound velocity of the sphere. The acceleration and rebound velocity had an inverse relationship with vent area. These observations with additional studies could be used in the development of better occupant safety systems.
Author
Air Bag Restraint Devices; Finite Element Method; Human Factors Engineering; Deformation; Loads (Forces); Inflatable Structures; Impact Damage

20000032466 Hynes and Associates, Inc., Frederick, OK USA
Evacuee Injuries and Demographics in Transport Airplane Precautionary Emergency Evacuations
Hynes, Michael K., Hynes and Associates, Inc., USA; March 2000; 22p; In English
Contract(s)/Grant(s): DTFA96-P-51602; DTFA02-99-VO5793; AM-B-97-PRS-93
Report No.(s): DOT/FAA/AM-00/11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During a nine-year period from January 1, 1988, through December 31, 1996, there were more than 500 transport airplane precautionary emergency evacuations (PEEvacs), occurring on average about once a week. Each year as many as 6,000 persons participated in these events. In many cases, passenger and crewmember injuries resulted from the PEEvacs, resulting in large personal costs to passengers and crewmembers, as well as financial costs estimated to be in excess of $1 1 million annually to airlines. This study was undertaken to sample available evacuee and injury data related to a subset of those PEEvacs, including information on types and causes of evacuee injuries, and evacuee age and gender. Other demographics were sought, but that information was generally unavailable. Unique, direct contacts with airport management were used to supplement publicly available information on certain of the PEEvacs, including activation of emergency escape slides during PEEvacs, injuries caused by the PEEvacs, and outcomes. of the 136 airports identified as experiencing PEEvacs, 24 were selected to provide detailed data on injured evacuees for a 34-month interval lasting from December 1994 through November 1996. During this time frame, there were 109 precautionary evacuations at the 24 airports selected, i.e., approximately 70% of all reported evacuation events that occurred during the study period. Specific information on 193 persons injured during 19 of these evacuations was obtained and analyzed. The results of this study confirm the need for improved incident reporting and continued research into preventing injuries associated with the use of emergency egress systems and precautionary emergency evacuations of transport airplanes. The results should be additionally useful when considering proposed changes to applicable regulations and to airline training programs and aircraft emergency operations.
Author
Transport Aircraft; Flight Operations; Emergencies; Injuries; Airline Operations; Crews

20000032489 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Safety Recommendations Adopted during the Month of December, 1999
Dec. 1999; 20p; In English
Report No.(s): PB99-916612; NTSB/REC-99/12; No Copyright; Avail: National Technical Information Service (NTIS)

This publication contains safety recommendations in aviation mode (only) of transportation adopted by the National Transportation Safety Board during the month of December, 1999.
NTIS
Safety Management; Air Transportation

20000032865 Textron Bell Helicopter, Fort Worth, TX USA
Application of Damage Tolerance to Increase Safety of Helicopters in Service
Krasnowski, Bogdan R., Textron Bell Helicopter, USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 7 - 1 - 7 - 8; In English; See also 20000032859; Copyright Waived; Avail: CASI; A02, Hardcopy

In the past, all helicopters have been designed to safe-life requirements. Introduced in October 1989, FAR 29.571 at Amendment 28 requires damage tolerance substantiation for transport category helicopters. Therefore, the majority of helicopters currently in service were designed to safe-life requirements. In general, the safe-life approach has proven to be adequate. However, there have been a number of field problems with cracking components, which lend themselves to the application of a damage tolerance approach. Damage tolerance analysis allows addressing the safety of the cracking components by: Evaluation of the field cracking, supported by the laboratory evaluation of the field-returned cracks; Establishment of the inspection interval in conjunction, if necessary, with operation limitations; and Specification of fixes to be applied to the structure to either increase the inspection limit and/or lift the operation limitations. to accomplish the above listed tasks, crack growth analysis is performed using the appropriate usage spectrum and the flight load survey data. If necessary, usage spectrum reviews and additional flight load surveys could be required. The crack growth analysis results are verified by the laboratory evaluation of the cracked components, and if necessary by the additional crack growth testing of the field-returned components with cracks or the pre-cracked components.
Author
Crack Propagation; Tolerances (Mechanics); Damage; Helicopters; Cracks; Aircraft Safety; Helicopter Design

20000032866 Agusta A. Finmeccanica Co., Cascina Costa di Samarate, Italy
AGUSTA Experience on Damage Tolerance Evaluation of Helicopter Components
Mariani, Ugo, Agusta A. Finmeccanica Co., Italy; Candiani, Luigi, Agusta A. Finmeccanica Co., Italy; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 8 - 1 - 8 - 12; In English; See also 20000032859; Copyright Waived; Avail: CASI; A03, Hardcopy

Within the fatigue evaluation of the EHL0l, Agusta has carried out a specific program of flaw tolerance evaluation of the primary loading path. The program is close to completion and this paper provides a summary of the most relevant results. For composite components, damage size was increased considering both manufacturing discrepancies greater than the minimum quality standard and impact damages clearly detectable during visual inspections. The favourable data achieved are based on the ”no growth” concept. The metal parts of the main rotor head were evaluated by enhanced safe life method and fail safe capability. The slow crack growth approach was instead applied for the Rear Fuselage End Fittings, which connect the Tail Unit. All these evidences can be used in addition to the comprehensive safe life evaluation of the aircraft to improve the maintenance and the repair actions. Based on this experience, application of flaw tolerance criteria will be carried out on the new helicopters in development phase.
Author
Eh-101 Helicopter; Composite Materials; Crack Propagation; Impact Damage; Tolerances (Mechanics); Helicopters; Aircraft Structures; Fiber Composites

20000032979 NASA Ames Research Center, Moffett Field, CA USA
Transition to Glass: Pilot Training for High-Technology Transport Aircraft
Wiener, Earl L., Miami Univ., USA; Chute, Rebecca D., Raytheon ITSS Corp., USA; Moses, John H., Miami Univ., USA; May 1999; 254p; In English
Contract(s)/Grant(s): RTOP 548-40-12
Report No.(s): NASA/CR-1999-208784; NAS 1.26:208784; A-990105; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This report examines the activities of a major commercial air carrier between 1993 and late 1996 as it acquired an advanced fleet of high-technology aircraft (Boeing 757). Previously, the airline’s fleet consisted of traditional (non-glass) aircraft, and this report examines the transition from a traditional fleet to a glass one. A total of 150 pilots who were entering the B-757 transition training volunteered for the study, which consisted of three query phases: (1) first day of transition training, (2) 3 to 4 months after transition training, and (3) 12 to 14 months after initial operating experience. of these initial 150 pilots, 99 completed all three

phases of the study, with each phase consisting of probes on attitudes and experiences associated with their training and eventual transition to flying the line. In addition to the three questionnaires, 20 in-depth interviews were conducted. Although the primary focus of this study was on the flight training program, additional factors such as technical support, documentation, and training aids were investigated as well. The findings generally indicate that the pilot volunteers were highly motivated and very enthusiastic about their training program. In addition, the group had low levels of apprehension toward automation and expressed a high degree of satisfaction toward their training. However, there were some concerns expressed regarding the deficiencies in some of the training aids and lack of a free-play flight management system training device.
Author
Education; Glass; Pilot Training; Transport Aircraft; Cockpits; Human Factors Engineering

20000033133 NASA Ames Research Center, Moffett Field, CA USA
A Comparison of Center/TRACON Automation System and Airline Time of Arrival Predictions
Heere, Karen R., Raytheon Co., USA; Zelenka, Richard E., NASA Ames Research Center, USA; February 2000; 26p; In English
Contract(s)/Grant(s): RTOP 727-01-24
Report No.(s): NASA/TM-2000-209584; NAS 1.15:209584; A-00V0006; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Benefits from information sharing between an air traffic service provider and a major air carrier are evaluated. Aircraft arrival time schedules generated by the NASA/FAA Center/TRACON Automation System (CTAS) were provided to the American Airlines System Operations Control Center in Fort Worth, Texas, during a field trial of a specialized CTAS display. A statistical analysis indicates that the CTAS schedules, based on aircraft trajectories predicted from real-time radar and weather data, are substantially more accurate than the traditional airline arrival time estimates, constructed from flight plans and en route crew updates. The improvement offered by CTAS is especially advantageous during periods of heavy traffic and substantial terminal area delay, allowing the airline to avoid large predictive errors with serious impact on the efficiency and profitability of flight operations.
Author
Automatic Control; Flight Operations; Airline Operations

20000033363 NASA Langley Research Center, Hampton, VA USA
Flow Environment Study Near the Empennage of a 15-Percent Scale Helicopter Model
Gorton, Susan Althoff, NASA Langley Research Center, USA; Berry, John D., Army Aviation and Missile Command, USA; Hodges, W. Todd, Army Aviation and Missile Command, USA; Reis, Deane G., Army Aviation and Missile Command, USA; March 2000; 30p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 581-10-11-01
Report No.(s): NASA/TP-2000-210085; L-17940; NAS 1.60:210085; AFDD/TR-00-A-004; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Development of advanced rotorcraft configurations has highlighted a need for high-quality experimental data to support the development of flexible and accurate analytical design tools. to provide this type of data, a test program was conducted in the Langley 14- by 22-Foot Subsonic Tunnel to measure the flow near the empennage of a 15-percent scale powered helicopter model with an operating tail fan. Three-component velocity profiles were measured with laser velocimetry (LV) one chord forward of the horizontal tail for four advance ratios to evaluate the effect of the rotor wake impingement on the horizontal tail angle of attack. These velocity data indicate the horizontal tail can experience unsteady angle of attack variations of over 30 degrees due to the rotor wake influence. The horizontal tail is most affected by the rotor wake above advance ratios of 0.10. Velocity measurements of the flow on the inlet side of the tail fan were made for a low-speed flight condition using conventional LV techniques. The velocity data show an accelerated flow near the tail fan duct, and vorticity calculations track the passage of main rotor wake vortices through the measurement plane.
Author
Helicopters; Design Analysis; Horizontal Tail Surfaces; Rotary Wing Aircraft; Scale Models; Angle of Attack

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.

20000033433 National Central Univ., Center for Space and Remote Sensing Research, Chung-Li, Taiwan, Province of China
Ambiguity and Position Search Algorithms of GPS Carrier Phase Processing
Wu, Joz, National Central Univ., Taiwan, Province of China; Lin, Shiou–Gwo, National Central Univ., Taiwan, Province of China; Yiu, Fong–Gee, National Central Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Nov. 1997; ISSN 0253-3839; Volume 20, No. 6, pp. 643-650; In English; Sponsored in part by E-CTCI Corp.
Contract(s)/Grant(s): NSC-86-2621-E-008-004; Copyright; Avail: Issuing Activity

For high-precision GPS satellite positioning, two search algorithms are compared in this paper. One algorithm, which is based on an approach for resolving phase ambiguities, uses a least-squares search technique. The other algorithm is related to an ambiguity function method but differs from it in that the final positional convergence is achieved by employing the same least-squares technique. The search for a true position solution is conducted either in phase ambiguity space or in three-dimensional geometric space. The two algorithms are tested, using both single- and dual-frequency carrier phase measurements. The former phase processing is susceptible to cycle slips, but the latter has relatively small convergence ranges. Methodological performance for both rapid static and kinematic GPS positioning experiments is analyzed, leading not only to centimeter-level, but also comparable position solutions for short-range baselines. The algorithms can fulfill supportive functions, which increases the reliability of the GPS-based point determination.
Author
Global Positioning System; Algorithms; Navigation Satellites; Positioning; Ambiguity; Carrier Waves; Signal Processing

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.

20000032437 Florida Univ., Dept. of Aerospace Engineering, Mechanics and Engineering Science, Gainesville, FL USA
Adjoint Techniques for Topology Optimization of Structures Under Damage Conditions
Akgun, Mehmet A., Florida Univ., USA; Haftka, Raphael T., Florida Univ., USA; March 2000; 3p; In English
Contract(s)/Grant(s): NCC1-268; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of this cooperative agreement was to seek computationally efficient ways to optimize aerospace structures subject to damage tolerance criteria. Optimization was to involve sizing as well as topology optimization. The work was done in collaboration with Steve Scotti, Chauncey Wu and Joanne Walsh at the NASA Langley Research Center. Computation of constraint sensitivity is normally the most time-consuming step of an optimization procedure. The cooperative work first focused on this issue and implemented the adjoint method of sensitivity computation (Haftka and Gurdal, 1992) in an optimization code (runstream) written in Engineering Analysis Language (EAL). The method was implemented both for bar and plate elements including buckling sensitivity for the latter. Lumping of constraints was investigated as a means to reduce the computational cost. Adjoint sensitivity computation was developed and implemented for lumped stress and buckling constraints. Cost of the direct method and the adjoint method was compared for various structures with and without lumping. The results were reported in two papers (Akgun et al., 1998a and 1999). It is desirable to optimize topology of an aerospace structure subject to a large number of damage scenarios so that a damage tolerant structure is obtained. Including damage scenarios in the design procedure is critical in order to avoid large mass penalties at later stages (Haftka et al., 1983). A common method for topology optimization is that of compliance minimization (Bendsoe, 1995) which has not been used for damage tolerant design. In the present work, topology optimization is treated as a conventional problem aiming to minimize the weight subject to stress constraints. Multiple damage configurations (scenarios) are considered. Each configuration has its own structural stiffness matrix and, normally, requires factoring of the matrix and solution of the system of equations. Damage that is expected to be tolerated is local and represents a small change in the stiffness matrix compared to the baseline (undamaged) structure. The exact solution to a slightly modified set of equations can be obtained from the baseline solution economically without actually solving the modified system..

Shennan-Morrison-Woodbury (SMW) formulas are matrix update formulas that allow this (Akgun et al., 1998b). SMW formulas were therefore used here to compute adjoint displacements for sensitivity computation and structural displacements in damaged configurations.
Author
Damage; Aircraft Structures; Optimization; Topology

20000032524 NASA Langley Research Center, Hampton, VA USA
Concept Development of a Mach 1.6 High-Speed Civil Transport
Shields, Elwood W., Lockheed Engineering and Sciences Co., USA; Fenbert, James W., NASA Langley Research Center, USA; Ozoroski, Lori P., Lockheed Engineering and Sciences Co., USA; Geiselhart, Karl A., Lockheed Engineering and Sciences Co., USA; December 1999; 26p; In English
Contract(s)/Grant(s): RTOP 537-03-22-02
Report No.(s): NASA/TP-1999-209697; NAS 1.60:209697; L-17242; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A high-speed civil transport configuration with a Mach number of 1.6 was developed as part of the NASA High-Speed Research Program to serve as a baseline for assessing advanced technologies required for an aircraft with a service entry date of 2005. This configuration offered more favorable solutions to environmental concerns than configurations with higher Mach numbers. The Mach 1.6 configuration was designed for a 6500 n.mi. mission with a 250-passenger payload. The baseline configuration has a wing area of 8732 square feet a takeoff gross weight of 591570 lb, and four 41000-lb advanced turbine bypass engines defined by NASA. These engines have axisymmetric mixer-ejector nozzles that are assumed to yield 20 dB of noise suppression during takeoff, which is assumed to satisfy, the FAR Stage III noise requirements. Any substantial reduction in this assumed level of suppression would require oversizing the engines to meet community noise regulations and would severly impact the gross weight of the aircraft at takeoff. These engines yield a ratio of takeoff thrust to weight of 0.277 and a takeoff wing loading of 67.8 lb/square feet that results in a rotation speed of 169 knots. The approach velocity of the sized configuration at the end of the mission is 131 knots. The baseline configuration was resized with an engine having a projected life of 9000 hr for hot rotating parts and 18000 hr for the rest of the engine, as required for commercial use on an aircraft with a service entry date of 2005. Results show an increase in vehicle takeoff gross weight of approximately 58700 lb. This report presents the details of the configuration development, mass properties, aerodynamic design, propulsion system and integration, mission performance, and sizing.
Author
Mach Number; Supersonic Speed; Aerodynamic Configurations; Turbine Engines; Weight (Mass); Civil Aviation

20000032553 NASA Langley Research Center, Hampton, VA USA
IMAGE: A Design Integration Framework Applied to the High Speed Civil Transport
Hale, Mark A., NASA Langley Research Center, USA; Craig, James I., Georgia Inst. of Tech., USA; [1993]; 6p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Effective design of the High Speed Civil Transport requires the systematic application of design resources throughout a product's life-cycle. Information obtained from the use of these resources is used for the decision-making processes of Concurrent Engineering. Integrated computing environments facilitate the acquisition, organization, and use of required information. State-of-the-art computing technologies provide the basis for the Intelligent Multi-disciplinary Aircraft Generation Environment (IMAGE) described in this paper. IMAGE builds upon existing agent technologies by adding a new component called a model. With the addition of a model, the agent can provide accountable resource utilization in the presence of increasing design fidelity. The development of a zeroth-order agent is used to illustrate agent fundamentals. Using a CATIA(TM)-based agent from previous work, a High Speed Civil Transport visualization system linking CATIA, FLOPS, and ASTROS will be shown. These examples illustrate the important role of the agent technologies used to implement IMAGE, and together they demonstrate that IMAGE can provide an integrated computing environment for the design of the High Speed Civil Transport.
Author
Concurrent Engineering; Supersonic Transports; Systems Engineering; Aircraft Design; Computer Aided Design; Computer Aided Manufacturing; Multidisciplinary Research

20000032560 Georgia Inst. of Tech., Atlanta, GA USA
A Multilevel Decomposition Procedure for the Preliminary Wing Design of a High-Speed Civil Transport Aircraft
Rohl, Peter J., Georgia Inst. of Tech., USA; Marvis, Dimitri N., Georgia Inst. of Tech., USA; Schrage, Daniel P., Georgia Inst. of Tech., USA; 1994; 7p; In English; 1st; High Speed Civil Transport Vehicles, December 1994, Greensboro, NC, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A multilevel decomposition approach for the preliminary design of a High Speed Civil Transport Aircraft wing structure is described. The wing design is decomposed into three levels. The top level uses the FLOPS aircraft synthesis program to generate preliminary weights, mission, and performance information. The optimization criterion is productivity expressed by a productivity index for the specified mission. The second level of the system performs a finite-element based structural optimization of the wing box with the help of the ASTROS structural optimization tool. The wing structure is sized subject to strength, buckling, and aeroelastic constraints. The buckling constraint information is supplied by the third level where a detailed buckling optimization of individual skin cover panels is performed.
Author
Aircraft Design; Supersonic Transports; Wings; Multidisciplinary Design Optimization; Systems Engineering; Computer Aided Design

20000032561 NASA Langley Research Center, Hampton, VA USA
Integrating Design and Manufacturing for a High Speed Civil Transport Wing
Marx, William J., NASA Langley Research Center, USA; Mavris, Dimitri N., Georgia Inst. of Tech., USA; Schrage, Daniel P., Georgia Inst. of Tech., USA; 1994; 10p; In English; 19th; Aircraft Systems, Sep. 1994, Anaheim, CA, USA; Sponsored by International Council of the Aeronautical Sciences; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The aerospace industry is currently addressing the problem of integrating design and manufacturing. Because of the difficulties associated with using conventional, procedural techniques and algorithms, it is the authors' belief that the only feasible way to integrate the two concepts is with the development of an appropriate Knowledge-Based System (KBS). The authors propose a methodology for an aircraft producibility assessment, including a KBS, that addresses both procedural and heuristic aspects of integrating design and manufacturing of a High Speed Civil Transport (HSCT) wing. The HSCT was chosen as the focus of this investigation since it is a current NASA/aerospace industry initiative full of technological challenges involving many disciplines. The paper gives a brief background of selected previous supersonic transport studies followed by descriptions of key relevant design and manufacturing methodologies. Georgia Tech's Concurrent Engineering/Integrated Product and Process Development methodology is discussed with reference to this proposed conceptual producibility assessment. Evaluation criteria are presented that relate pertinent product and process parameters to overall product producibility. In addition, the authors' integration methodology and reasons for selecting a KBS to integrate design and manufacturing are presented in this paper. Finally, a proposed KBS is given, as well as statements of future work and overall investigation objectives.
Author
Concurrent Engineering; Knowledge Based Systems; Supersonic Transports; Wings; Aircraft Design; Systems Engineering; Computer Aided Manufacturing; Computer Aided Design

20000032562 NASA Langley Research Center, Hampton, VA USA
Knowledge-Based Manufacturing and Structural Design for a High Speed Civil Transport
Marx, William J., NASA Langley Research Center, USA; Mavris, Dimitri N., Georgia Inst. of Tech., USA; Schrage, Daniel P., Georgia Inst. of Tech., USA; 1994; 6p; In English; 1st; Research for Future Supersonic and Hypersonic Vehicles, Dec. 1994, Greensboro, NC, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The aerospace industry is currently addressing the problem of integrating manufacturing and design. to address the difficulties associated with using many conventional procedural techniques and algorithms, one feasible way to integrate the two concepts is with the development of an appropriate Knowledge-Based System (KBS). The authors present their reasons for selecting a KBS to integrate design and manufacturing. A methodology for an aircraft producibility assessment is proposed, utilizing a KBS for manufacturing process selection, that addresses both procedural and heuristic aspects of designing and manufacturing of a High Speed Civil Transport (HSCT) wing. A cost model is discussed that would allow system level trades utilizing information describing the material characteristics as well as the manufacturing process selections. Statements of future work conclude the paper.
Author
Knowledge Based Systems; Computer Aided Manufacturing; Expert Systems; Mathematical Models; Structural Design; Supersonic Transports; Decision Support Systems

20000032581 NASA Langley Research Center, Hampton, VA USA
Simulation of X-38 Landing Scenarios With Landing Gear Failures
Fasanella, Edwin L., Army Research Lab., USA; Lyle, Karen H., Army Research Lab., USA; Pritchard, Jocelyn I., Army Research Lab., USA; Stockwell, Alan E., Lockheed Martin Engineering and Science Services, USA; March 2000; 41p; In English
Contract(s)/Grant(s): RTOP 577-50-10-01

Report No.(s): NASA/TM-2000-210078; NAS 1.15:210078; L-17935; ARL-TR-2144; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Abnormal landing scenarios of the X-38 prototype Crew Rescue Vehicle (CRV) were modeled for three different cases involving non-deployment of landing gear with an explicit dynamic nonlinear finite element code, MSC/DYTRAN. The goal of this research was to develop models to predict the probability of crew injuries. The initial velocity conditions for the X-38 with chute deployed were 10 ft/s vertical and 57 ft/s longitudinal velocity. An MSC/NASTRAN structural model was supplied by JSC and was converted to a dynamic MSC/DYTRAN model. The MSC/NASTRAN model did not include seats or floor structure; thus, the acceleration of a lumped-mass attached to the bulkhead near each assumed occupant location was used to determine injury risk for each occupant. The worst case for injury was nondeployment of all gears. The mildest case was nondeployment of one main gear. Although a probability for minor injury was predicted for all cases, it is expected that the addition of energy-absorbing floor structure and seats would greatly diminish the probability of injury.

Author

Computerized Simulation; Flight Simulation; X-38 Crew Return Vehicle; Rescue Operations; Landing Gear; Failure

20000032684 Asian Office of Aerospace Research and Development, Tokyo, Japan

Operational Need

Lyons, T. J., Asian Office of Aerospace Research and Development, Japan; Human Consequences of Agile Aircraft; March 2000, pp. 1 - 1 - 1 - 4; In English; See also 20000032683; Copyright Waived; Avail: CASI; A01, Hardcopy

Between April 1997 and October 1998, Working Group #27 conducted discussions with experienced military fighter pilots and test pilots concerning the human factor implications of agile aircraft flight. Aircrews interviewed included 23 U.S.pilots (consisting of 5 NASA Test Pilots, 13 USAF Air Warfare Center Pilots, and 5 USAF Pilot-Physicians), 11 Swedish Air Force operational pilots, 3 German Air Force test pilots, and 2 French pilots. After the discussions, the aircrews were asked to complete an anonymous questionnaire. (Note, the French pilots were interviewed before the questionnaire was completed and so their views are represented in the pilot comments, but not in the actual questionnaire results.) In addition to the questionnaire results, one-on-one interviews were conducted with many of the pilots. A world wide representation of most agile aircraft was achieved by surveying pilots experienced with the X-31, F-18 HARV, F-15 Active, MATV, Harrier, F-22, F-18, MIG-29, Rafale, Gripen, and Eurofighter. As a part of the questionnaire, the aircrew members were asked background questions concerning their flying experience. The remainder of the questionnaire involved rating the utility of various aircraft capabilities (e.g., high AOA/post-stall maneuvering, negative G maneuvering, high (+12) Gz maneuvering) with regard to their contribution to air-to-air combat performance. A seven point scale was used to rate the perceived contributions to air combat effectiveness. Specifically, ratings ranged from I for ”Not at all useful”, 3 for ”Slightly useful”, 5 for ”Moderately useful”, to 7 for ”Very useful.” The aircrews were, on the average, very experienced with an average flying time of 2,589 hours (range 900-9,000). Note that some pilots did not have experience with helmet mounted sights or advanced anti-G suits. Hence, they did not rate these systems. Combat Edge (the USAF positive pressure breathing system for G protection) and the Advanced Technology Anti-G suit were included as known benchmarks against which to judge the pilot responses. Pilots rated helmet-mounted sights, high AOA maneuvering, and high G capability all highly. Ratings of negative Gs varied widely among the responders. Some interesting differences were noted in the responses of the Swedish pilots compared with the U.S. and German pilots. On the average, Swedish pilots valued airframe agility (capability to pull +12 Gz and -Gz) less. This could be due to several factors including: (1) lower average flying experience (flying hours) in the Swedish pilots interviewed; (2) the Swedish pilots included mainly operational pilots rather than test pilots; or (3) national differences. In summary, the pilots surveyed viewed the capabilities afforded by agile aircraft as useful for combat. The following sections provide additional detail from the questionnaire data and debriefing comments that specifically pertains to human factors issues, including physiologic problems, the pilot-vehicle interface, selection, and training. The final section reexamines the pilots’ view of agile flight.

Author

Aircraft Pilots; Human Factors Engineering; Surveys; Aircraft Equipment; Flight Instruments; Physiological Factors; Pilot Performance

20000032860 NASA Langley Research Center, Hampton, VA USA

The Significance of Small Cracks in Fatigue Design Concepts as Related to Rotorcraft Metallic Dynamic Components

Everett, R. A., Jr., NASA Langley Research Center, USA; Elber, W., NASA Langley Research Center, USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 1 - 1 - 1 - 14; In English; See also 20000032859; Copyright Waived; Avail: CASI; A03, Hardcopy

In this paper the significance of the ”small” crack effect as defined in fracture mechanics will be discussed as it relates to life managing rotorcraft dynamic components using the conventional safe-life, the flaw tolerant safe-life, and the damage tolerance

design philosophies. These topics will be introduced starting with an explanation of the small-crack theory, then showing how small-crack theory has been used to predict the total fatigue life of fatigue laboratory test coupons with and without flaws, and concluding with how small cracks can affect the crack-growth damage tolerance design philosophy. As stated in this paper the ”small” crack effect is defined in fracture mechanics where it has been observed that cracks on the order of 300 microns or less in length will propagate at higher growth rates than long cracks and also will grow at AK values below the long crack AK threshold. The small-crack effect is illustrated herein as resulting from a lack of crack closure and is explained based on continuum mechanics principles using crack-closure concepts in fracture mechanics.
Author
Crack Propagation; Cracks; Damage; Fatigue Life; Fatigue Tests; Fracture Mechanics; Rotary Wing Aircraft; Tolerances (Mechanics); Aircraft Reliability

20000032869 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
The US Navy’s Helicopter Integrated Diagnostics System (HIDS) Program: Power Drive Train Crack Detection Diagnostics and Prognostics, Life Usage Monitoring, and Damage Tolerance; Techniques, Methodologies, and Experiences
Hess, Andrew, Naval Air Warfare Center, USA; Hardman, William, Naval Air Warfare Center, USA; Chin, Harrison, Goodrich (B. F.) Aerospace, USA; Gill, John, Goodrich (B. F.) Aerospace, USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 13 - 1 - 13 - 22; In English; See also 20000032859; Copyright Waived; Avail: CASI; A03, Hardcopy

The evolution of automated diagnostic systems for helicopter mechanical systems has been greatly advanced by the Navy, in a program of systematic testing of drive train components having known anomalies (seeded faults) while simultaneously executing a suite of diagnostic techniques to identify and classify the mechanical anomalies. This program, called the Helicopter Integrated Diagnostic System (HIDS) was carried out using both an iron bird test stand and SH-6OB/F flight vehicles. The SH-60 HIDS program has been the Navy’s cornerstone effort to develop, demonstrate, and justify integrated mechanical diagnostic system capabilities for its various helicopter fleets. The objectives of the original program were to: (1) Acquire raw data for multiple cases of ”good” and seeded fault mechanical components on a fully instrumented drive train to support the evaluation of diagnostic algorithms and fault isolation matrices. Data is being acquired from 32 vibration channels simultaneously at 100 kHz per channel while a continuous usage monitoring system records parametric steady state data from the power plant and air&ante. (2) Analyze vibration and other diagnostic indicators to evaluate sensitivity and performance of all available diagnostic methods when analyzing well-documented parts and their associated failure modes. Evaluate relative effectiveness of these various diagnostic methods, indicators, and their associated algorithms to identify and optimize sensor location combinations. (3) Demonstrate the ability to integrate and automate the data acquisition, diagnostic, fault evaluation and communication processes in a flight worthy system. (4) Integrate and evaluate comprehensive engine monitoring, gearbox and drive train vibration diagnostics, advanced oil debris monitoring, in-flight rotor track and balance, parts life usage tracking, automated flight regime recognition, power assurance checks and trending, and automated maintenance forecasting in a well-coordinated on-board and ground-based system. (5) Provide an extensive library of high quality vibration data on baseline and seeded fault components. This data can be made available to anyone wanting to prove their diagnostic techniques or develop new capability. (6) Provide a ”showcase”, state-of-the-art, fully functional Integrated Mechanical Diagnostic system to act as a catalyst demonstration which might lead to interest in a fleet wide production application. This paper will describe the HIDS program background, development, system capabilities, and accomplishments; but will also focus on the most recent demonstrated drive train crack detection diagnostic techniques; aircraft component life usage monitoring philosophies and capabilities; and damage tolerance methodologies. Data and results from both the seeded fault ”iron bird” test cell rig and flight test aircraft will be presented. Experience, results, and lessons learned will be emphasized. HIDS initiated functions and capabilities being applied to the commercial off-the-shelf (COTS) SH-60 Integrated Mechanical Diagnostics System (IMDS) production program will be described. Conclusions and lessons learned that can be applied to future Helicopter Usage Monitoring Systems (HUMS) and/or Integrated Mechanical Diagnostic (IMD) systems will also be discussed.
Author
Systems Health Monitoring; Helicopters; Tolerances (Mechanics); Rotor Aerodynamics; Failure Modes; Flight Tests; Aircraft Reliability

20000032872 Federal Aviation Administration, Los Angeles Aircraft Certificaion Office, Lakewood, CA USA
Strategies for Ensuring Rotorcraft Structural Integrity
Eastin, Robert G., Federal Aviation Administration, USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 17 - 1 - 17 - 6; In English; See also 20000032859; Copyright Waived; Avail: CASI; A02, Hardcopy

Part 29.571 contains several strategies that, with certain qualification, applicants are allowed to adopt to ensure adequate structural integrity throughout the operational life of a rotorcraft. There has been a continuing debate concerning the merits of the various strategies. Much of the discussion has centered on the damage tolerance versus the flaw tolerance philosophies and the pros and cons of each. Additionally, the appropriate role of the traditional safe-life philosophy has been debated at length. This paper begins by considering what the objective of Part 29.571 is and then examines each of the strategies and their strengths and weaknesses. Following this a recommended strategy is proposed which is believed to offer the most rational path at the present time to achieving the stated objective.
Derived from text
Damage; Rotary Wing Aircraft; Structural Failure; Tolerances (Mechanics); Structural Reliability; Aircraft Structures; Systems Health Monitoring; Cracks

20000032874 Westland Helicopters Ltd., Yeovil, UK
Application of Damage Tolerance to the EH101 Airframe
Matthew, David, Westland Helicopters Ltd., UK; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 9 - 1 - 9 - 8; In English; See also 20000032859; Copyright Waived; Avail: CASI; A02, Hardcopy
This paper presents the work carried out by GKN Westland Helicopters in the damage tolerance evaluation of the EH101 airframe. A comprehensive programme of crack growth testing and analysis was undertaken and is described in this paper. A simplified analysis method was developed and used to predict flaw growth in the Main Load Path structure of the EH101. The analysis showed that high frequency vibratory loads exceed the crack growth threshold at relatively short crack lengths. This has been confirmed by a full-scale airframe crack growth test in which a 4mm crack was propagated under representative loading. These results have led to the adoption of the ”Flaw Tolerant (Enhanced) Safe Life” approach for fatigue critical components on the EH101 airframe.
Author
Damage; Tolerances (Mechanics); Cracks; Crack Propagation; Eh-101 Helicopter; Fracturing

20000032960 Virginia Polytechnic Inst. and State Univ., Dept. of Aerospace and Ocean Engineering, Blacksburg, VA USA
Multidisciplinary Design Investigation of Truss-Braced Wing Aircraft, Phase 4 ***Final Report, 1 Jul. - 31 Oct. 1999***
Grossman, B., Virginia Polytechnic Inst. and State Univ., USA; Kapania, R. K., Virginia Polytechnic Inst. and State Univ., USA; Mason, W. H., Virginia Polytechnic Inst. and State Univ., USA; Schetz, J. A., Virginia Polytechnic Inst. and State Univ., USA; April 2000; 48p; In English
Contract(s)/Grant(s): NAG1-2217; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The subject grant was in effect from 7/l/99 to 10/31/99. The objective of this grant was to complete a strut-braced wing study which began, which was in effect from 6/27/96 until 9/15/99. While the initial grant was on-going, we were also under subcontract to Lockheed-Martin, Aerospace Systems Division, Marietta, GA to do additional studies related to the strut-braced wing grant ”A Structural and Aerodynamic Investigation of a Strut-Braced Wing Transonic Aircraft Concept”, 4/l/98-11/15/98. Lockheed-Martin was under contract to NASA Langley. Finally the research under this grant has led to a joint proposal from NASA Langley, Locheed-Martin, Virginia Tech and NASA Dryden to develop a transonic strut-braced wing demonstration aircraft in response to Flight Research for Revolutionary Aeronautical Concepts (REVCON). This final report summarizes the research done, augmented by the additional concommitant research projects mentioned above.
Derived from text
Trusses; Wings; Multidisciplinary Design Optimization; Aircraft Design; Supersonic Aircraft

20000032961 NASA Ames Research Center, Moffett Field, CA USA
Potential Flow Theory and Operation Guide for the Panel Code PMARC, Version 14
Ashby, Dale L., NASA Ames Research Center, USA; December 1999; 152p; In English
Contract(s)/Grant(s): RTOP 538-15-11
Report No.(s): NASA/TM-1999-209582; A-00V0005; NAS 1.15:209582; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
The theoretical basis for PMARC, a low-order panel code for modeling complex three-dimensional bodies, in potential flow, is outlined. PMARC can be run on a wide variety of computer platforms, including desktop machines, workstations, and supercomputers. Execution times for PMARC vary tremendously depending on the computer resources used, but typically range from several minutes for simple or moderately complex cases to several hours for very large complex cases. Several of the advanced features currently included in the code, such as internal flow modeling, boundary layer analysis, and time-dependent flow analysis, including problems involving relative motion, are discussed in some detail. The code is written in FORTRAN77,

using adjustable-size arrays so that it can be easily redimensioned to match problem requirements and computer hardware constraints. An overview of the program input is presented. A detailed description of the input parameters is provided in the appendices. PMARC results for several test cases are presented along with analytic or experimental data, where available. The input files for these test cases are given in the appendices. PMARC currently supports plotfile output formats for several commercially available graphics packages. The supported graphics packages are Plot3D, Tecplot, and PmarcViewer.
Author
Flow Theory; Panel Method (Fluid Dynamics); Applications Programs (Computers); Mathematical Models; Three Dimensional Bodies; Potential Flow

20000033169 NASA Langley Research Center, Hampton, VA USA
Yawed-Rolling Tire Mechanical Properties Testing of the Navy T-45 Aircraft Tires
Daugherty, Robert H., NASA Langley Research Center, USA; March 2000; 210p; In English
Contract(s)/Grant(s): RTOP 706-11-02
Report No.(s): NASA/TM-2000-209869; NAS 1.15:209869; L-17933; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The T-45 Goshawk is a USA Navy Jet aircraft used primarily as a trainer. The aircraft design makes use of ”off the shelf” hardware as much as possible and was found to have unusual directional control issues during around operations. The aircraft was involved in numerous pilot-induced-oscillation incidents as well as observed to have unusual directional control reactions to failed main gear tires, a condition that is normally handled relatively easily by conventional aircraft steering control techniques. The behavior of the aircraft’s tires had previously been modeled in simulators as a result of approximations provided in 40-year-old reference publications. Since knowledge of the true tire cornering and braking behavior is essential to modeling, understanding, and fixing directional control problems, the USA Navy requested assistance from the NASA Langley Research Center’s (LARC) Aircraft Landing Dynamics Facility (ALDF) to define the yawed-rolling mechanical properties of the T-45 aircraft tires. The purpose of this report is to document the results of testing the subject tires at the NASA LaRC ALDF in September 1998. Brief descriptions of the Instrumented Tire Test Vehicle (ITTV) are included to familiarize the reader with the ITTV capabilities, data acquisition system, test and measurement techniques, data accuracy, and analysis and presentation of the testing results.
Author
Aircraft Design; Aircraft Landing; Aircraft Tires; Control Systems Design; Data Acquisition; Mechanical Properties; Simulators

20000033217 NASA Langley Research Center, Hampton, VA USA
Overview of Conceptual Design of Early VentureStar(TM) Configurations
Lockwood, M. K., NASA Langley Research Center, USA; [2000]; 14p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA; Original contains color illustrations
Report No.(s): AIAA Paper 2000-1042; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

One of NASA’s goals is to enable commercial access to space at a cost of $1000/lb (an order of magnitude less than today’s cost) by approximately 2010. Based on results from the 1994 Congressionally mandated, NASA led, Access-to-Space Study, an all rocket-powered single-stage-to-orbit reusable launch vehicle was, selected as the best option for meeting the goal. to address the technology development issues and the follow-on development of an operational vehicle, NASA initiated the X-33 program. The focus of this paper is on the contributions made by the NASA Langley Research Center (LaRC), from 1997-1998, to the conceptual design of the Lockheed Martin Skunk Work’s (LMSW) operational reusable single-stage-to-orbit VentureStar(sup TM) vehicle. The LaRC effort has been in direct support of LMSW and NASA Marshall Space Flight Center (MSFC). The primary objectives have been to reduce vehicle dry weight and improve flyability of the VentureStar(sup TM) concepts. This paper will briefly describe the analysis methods used and will present several of the concepts analyzed and design trades completed.
Author
Design Analysis; Venturestar Launch Vehicle; Commercial Spacecraft; X-33 Reusable Launch Vehicle

20000033438 NASA Dryden Flight Research Center, Edwards, CA USA
Hyper-X Model Testing with Animation
Mar. 21, 1996; In English; Videotape: 6 min. 25 sec. playing time, in color, with partial sound
Report No.(s): NONP-NASA-VT-2000043976; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Live footage shows the Hyper-X program modeling at NASA Langley Research Center. The Hyper-X craft is shown on top of a Pegasus booster in a 20” Mach 6 Wind Tunnel. Visualization data runs are performed in the wind tunnel. Also seen is a brief interview with Vincent Rausch the Hyper-X Program Manager. Animation includes the flight model of the Hyper-X vehicle.
CASI
Hypersonic Flight; X-43 Vehicle; Pegasus Air-Launched Booster; Air Launching

20000033466 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Closely Supervised Reactive Control of an Uninhabited Aerial Vehicle
Glassco, Roy G.; Jan. 25, 2000; 141p; In English
Report No.(s): AD-A374174; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Currently, control of an uninhabited aerial vehicle (UAV) in flight is accomplished by manual control or a prior prescription of waypoints. The use of waypoints requires knowledge of vehicle position from either an Internal Navigation System (INS) or by using the Global Positioning System (GPS). This thesis proposes an alternative control method that incorporates some of the beneficial aspect of both fully manual and fully autonomous operation. Utilizing an on-board camera, an operator can control an uninhabited aerial vehicle by manually choosing desired targets of interest. The flight path of the uninhabited vehicle is determined autonomously from the camera gimbal angles. Specifically, the camera azimuth angle and elevation angle are transformed by an autopilot, providing commands to the aircraft. In this shared control operation, the operator of the payload (i.e. camera), has close supervision of the aircraft. The aircraft using an on-board computer is given autonomous control of aircraft flight, reducing personnel requirements. The aircraft controls the operations to alter flight path to reorient the aircraft to fly towards a target and at a specified range, loiter over the target. In the most basic mode of operation, the camera operator must manually track the target providing continuous updates to the camera angles. In an advanced mode of operation with the use of an INS or GPS, the aircraft autonomously determines the camera angles from a single locked target position that the operator specifies. The camera angles autonomously determined are referred to as virtual camera angles and are used to control the aircraft in the same manner as real camera angles. With the use of the virtual camera angles, the operator is free to look for other targets or perform other tasks. As an added safe mode, in the event of data transmission loss, the aircraft will fly straight and level in its current direction.
DTIC
Remotely Piloted Vehicles; Global Positioning System; Data Transmission; Manual Control; Inertial Navigation; Drone Vehicles

20000033472 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Crew Systems Analysis of Unmanned Aerial Vehicle (UAV) Future Job and Tasking Environments
Barnes, Michael J.; Knapp, Beverly G.; Tillman, Barry W.; Walters, Brett A.; Velicki, Darlene; Jan. 2000; 57p; In English
Report No.(s): AD-A374230; ARL-TR-2081; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of the research project was to understand the future crew environments for developing unmanned aerial vehicle (UAV) systems. A variety of human engineering tools job assessment software system JASS, enhanced computer-aided testing ECAT, and MicroSaint(TM) were used to address crew issues related to the utility of having rated aviators as crew members, supplementing current crews with imagery and intelligence specialists, and the use of automation to improve systems efficiency. Data from 70 soldiers and experts from Fort Huachuca, Arizona, Fort Hood, Texas, and Hondo, Texas, were collected as part of this effort. The general finding was that the use of cognitive methods and computerized tool sets to understand future crew environments proved to be cost effective and useful. Specifically, no evidence was found to support a requirement for rated aviators in future Army missions, but the use of cognitively oriented embedded training simulators was suggested to aid novices in developing the cognitive skills evinced by experts. The efficacy of adding imagery specialists to 96U crews was discussed, and specific recommendations related to automation were derived from the workload modeling.
DTIC
Computer Techniques; Aircraft Pilots; Pilotless Aircraft; Workloads (Psychophysiology)

20000033622 Florida Univ., Dept. of Aerospace Engineering, Mechanics and Engineering Science, Gainesville, FL USA
Optimization of Aerospace Structure Subject to Damage Tolerance Criteria *Final Report*
Akgun, Mehmet A., Florida Univ., USA; [1999]; 3p; In English
Contract(s)/Grant(s): NCC1-268; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of this cooperative agreement was to seek computationally efficient ways to optimize aerospace structures subject to damage tolerance criteria. Optimization was to involve sizing as well as topology optimization. The work was done in collaboration with Steve Scotti, Chauncey Wu and Joanne Walsh at the NASA Langley Research Center. Computation of constraint sensitivity is normally the most time-consuming step of an optimization procedure. The cooperative work first focused on this issue and implemented the adjoint method of sensitivity computation in an optimization code (runstream) written in

Engineering Analysis Language (EAL). The method was implemented both for bar and plate elements including buckling sensitivity for the latter. Lumping of constraints was investigated as a means to reduce the computational cost. Adjoint sensitivity computation was developed and implemented for lumped stress and buckling constraints. Cost of the direct method and the adjoint method was compared for various structures with and without lumping. The results were reported in two papers. It is desirable to optimize topology of an aerospace structure subject to a large number of damage scenarios so that a damage tolerant structure is obtained. Including damage scenarios in the design procedure is critical in order to avoid large mass penalties at later stages. A common method for topology optimization is that of compliance minimization which has not been used for damage tolerant design. In the present work, topology optimization is treated as a conventional problem aiming to minimize the weight subject to stress constraints. Multiple damage configurations (scenarios) are considered. Each configuration has its own structural stiffness matrix and, normally, requires factoring of the matrix and solution of the system of equations. Damage that is expected to be tolerated is local and represents a small change in the stiffness matrix compared to the baseline (undamaged) structure. The exact solution to a slightly modified set of equations can be obtained from the baseline solution economically without actually solving the modified system. Sherrnan-Morrison-Woodbury (SMW) formulas are matrix update formulas that allow this. SMW formulas were therefore used here to compute adjoint displacements for sensitivity computation and structural displacements in damaged configurations.
Derived from text
Aircraft Structures; Damage; Optimization; Computation; Aeronautical Engineering; Impact Tolerances

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.

20000032747 NASA Glenn Research Center, Cleveland, OH USA
Performance and Durability of High Temperature Foil Air Bearings for Oil-Free Turbomachinery
DellaCorte, C., NASA Glenn Research Center, USA; Lukaszewicz, V., Akima Corp., USA; Valco, M. J., Army Research Lab., USA; Radil, K. C., Army Research Lab., USA; Heshmat, H., Mohawk Innovative Technology, Inc., USA; March 2000; 20p; In English, 7-11 May 2000, Nashville, TN, USA; Sponsored by Society of Tribologists and Lubrication Engineers, USA
Contract(s)/Grant(s): RTOP 523-18-13
Report No.(s): NASA/TM-2000-209187/REV1; NAS 1.15:209187/REV1; ARL-TR-2202; E-11697-1/REV1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The performance and durability of advanced, high temperature foil air bearings are evaluated under a wide range (10-50 kPa) of loads at temperatures from 25 to 650 C. The bearings are made from uncoated nickel based superalloy foils. The foil surface experiences sliding contact with the shaft during initial start/stop operation. to reduce friction and wear, the solid lubricant coating, PS304, is applied to the shaft by plasma spraying. PS304 is a NiCr based Cr2O3 coating with silver and barium fluoride/calcium fluoride solid lubricant additions. The results show that the bearings provide lives well in excess of 30,000 cycles under all of the conditions tested. Several bearings exhibited lives in excess of 100,000 cycles. Wear is a linear function of the bearing load. The excellent performance measured in this study suggests that these bearings and the PS304 coating are well suited for advanced high temperature, oil-free turbomachinery applications.
Author
Durability; High Temperature; Foil Bearings; Turbomachinery; Lubrication; Friction Reduction

20000032786 NASA Marshall Space Flight Center, Huntsville, AL USA
Thermodynamic Cycle Analysis of Magnetohydrodynamic-Bypass Airbreathing Hypersonic Engines
Litchford, Ron J., NASA Marshall Space Flight Center, USA; Bityurin, Valentine A., Academy of Sciences (USSR), USSR; Lineberry, John T., LyTec, Inc., USA; Aug. 02, 1999; 17p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Established analyses of conventional ramjet/scramjet performance characteristics indicate that a considerable decrease in efficiency can be expected at off-design flight conditions. This can be explained, in large part, by the deterioration of intake mass flow and limited inlet compression at low flight speeds and by the onset of thrust degradation effects associated with increased

burner entry temperature at high flight speeds. In combination, these effects tend to impose lower and upper Mach number limits for practical flight. It has been noted, however, that Magnetohydrodynamic (MHD) energy management techniques represent a possible means for extending the flight Mach number envelope of conventional engines. by transferring enthalpy between different stages of the engine cycle, it appears that the onset of thrust degradation may be delayed to higher flight speeds. Obviously, the introduction of additional process inefficiencies is inevitable with this approach, but it is believed that these losses are more than compensated through optimization of the combustion process. The fundamental idea is to use MHD energy conversion processes to extract and bypass a portion of the intake kinetic energy around the burner. We refer to this general class of propulsion system as an MHD-bypass engine. In this paper, we quantitatively assess the performance potential and scientific feasibility of MHD-bypass airbreathing hypersonic engines using ideal gasdynamics and fundamental thermodynamic principles. Derived from text

Bypasses; Hypersonics; Magnetohydrodynamics; Air Breathing Engines; Thermodynamic Cycles

20000032789 NASA Marshall Space Flight Center, Huntsville, AL USA

Engine System Loads Development for the Fastrac 60K Flight Engine

Frady, Greg, Sverdrup Technology, Inc., USA; Christensen, Eric R., Sverdrup Technology, Inc., USA; Mims, Katherine, NASA Marshall Space Flight Center, USA; Harris, Don, NASA Marshall Space Flight Center, USA; Parks, Russell, NASA Marshall Space Flight Center, USA; Brunty, Joseph, NASA Marshall Space Flight Center, USA; [2000]; 12p; In English; 41st; 41st Structures, Structural Dynamic and Materials Conference, 4-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 00-XXXX; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Early implementation of structural dynamics finite element analyses for calculation of design loads is considered common design practice for high volume manufacturing industries such as automotive and aeronautical industries. However, with the rarity of rocket engine development programs starts, these tools are relatively new to the design of rocket engines. In the new Fastrac engine program, the focus has been to reduce the cost to weight ratio; current structural dynamics analysis practices were tailored in order to meet both production and structural design goals. Perturbation of rocket engine design parameters resulted in a number of Fastrac load cycles necessary to characterize the impact due to mass and stiffness changes. Evolution of loads and load extraction methodologies, parametric considerations and a discussion of load path sensitivities are discussed.

Author

X-34 Reusable Launch Vehicle; Loads (Forces); Rocket Engine Design; Dynamic Structural Analysis

20000032862 Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA

Material Allowables for High Cycle Fatigue in Gas Turbine Engines

Nicholas, T., Air Force Research Lab., USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 4 - 1 - 4 - 9; In English; See also 20000032859; Copyright Waived; Avail: CASI; A02, Hardcopy

HCF failures in materials used in both static and rotating components of gas turbine engines have often been found to be attributable to fatigue loading on materials which have sustained some type of damage. Damage can be present from initial material or manufacturing defects, or can develop during service operation. In-service damage, while not catastrophic by itself, can degrade the HCF resistance of the material below that for which it was designed. Three major sources of in-service damage which can alter the HCF capability individually or in conjunction with one another are low cycle fatigue (LCF), foreign object damage (FOD), and contact fatigue. Other types of damage include creep, corrosion and thermal fatigue. The present design methodology is highly empirical and relies heavily on service experience to establish material allowable knockdown factors for each type of damage. to reduce HCF failures, the U.S. Air Force is developing a damage tolerant approach which addresses these issues in a less empirical manner. The effects of damage on HCF capability and a discussion of the material allowables under HCF are presented.

Author

Gas Turbine Engines; Damage; Structural Analysis; Systems Health Monitoring; Fatigue Tests; Structural Failure; Fatigue (Materials); Metals

08
AIRCRAFT STABILITY AND CONTROL

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

20000032102 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA

Development of An Intelligent Flight Propulsion Control System ***Final Report, 1 Sep. 1998 - 31 Aug. 1999***

Calise, A. J., Georgia Inst. of Tech., USA; Rysdyk, R. T., Georgia Inst. of Tech., USA; Leonhardt, B. K., Georgia Inst. of Tech., USA; Oct. 01, 1999; 65p; In English

Contract(s)/Grant(s): NAG2-1174; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The initial design and demonstration of an Intelligent Flight Propulsion and Control System (IFPCS) is documented. The design is based on the implementation of a nonlinear adaptive flight control architecture. This initial design of the IFPCS enhances flight safety by using propulsion sources to provide redundancy in flight control. The IFPCS enhances the conventional gain scheduled approach in significant ways: (1) The IFPCS provides a back up flight control system that results in consistent responses over a wide range of unanticipated failures. (2) The IFPCS is applicable to a variety of aircraft models without redesign and,(3) significantly reduces the laborious research and design necessary in a gain scheduled approach. The control augmentation is detailed within an approximate Input-Output Linearization setting. The availability of propulsion only provides two control inputs, symmetric and differential thrust. Earlier Propulsion Control Augmentation (PCA) work performed by NASA provided for a trajectory controller with pilot command input of glidepath and heading. This work is aimed at demonstrating the flexibility of the IFPCS in providing consistency in flying qualities under a variety of failure scenarios. This report documents the initial design phase where propulsion only is used. Results confirm that the engine dynamics and associated hard nonlineaaities result in poor handling qualities at best. However, as demonstrated in simulation, the IFPCS is capable of results similar to the gain scheduled designs of the NASA PCA work. The IFPCS design uses crude estimates of aircraft behaviour. The adaptive control architecture demonstrates robust stability and provides robust performance. In this work, robust stability means that all states, errors, and adaptive parameters remain bounded under a wide class of uncertainties and input and output disturbances. Robust performance is measured in the quality of the tracking. The results demonstrate the flexibility of the IFPCS architecture and the ability to provide robust performance under a broad range of uncertainty. Robust stability is proved using Lyapunov like analysis. Future development of the IFPCS will include integration of conventional control surfaces with the use of propulsion augmentation, and utilization of available lift and drag devices, to demonstrate adaptive control capability under a greater variety of failure scenarios. Further work will specifically address the effects of actuator saturation.

Author

Adaptive Control; Control Systems Design; Flight Control; Simulation; Propulsion System Performance; Propulsion System Configurations; Aircraft Control; Flight Simulation

20000033626 NASA Langley Research Center, Hampton, VA USA

Active Control by Conservation of Energy Concept

Maestrello, Lucio, NASA Langley Research Center, USA; [2000]; 11p; 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 2000-2045; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Three unrelated experiments are discussed; each was extremely sensitive to initial conditions. The initial conditions are the beginnings of the origins of the information that nonlinearity displays. Initial conditions make the phenomenon unstable and unpredictable. With the knowledge of the initial conditions, active control requires far less power than that present in the system response. The first experiment is on the control of shocks from an axisymmetric supersonic jet; the second, control of a nonlinear panel response forced by turbulent boundary layer and sound; the third, control of subharmonic and harmonics of a panel forced by sound. In all three experiments, control is achieved by redistribution of periodic energy response such that the energy is nearly preserved from a previous uncontrolled state. This type of active control improves the performance of the system being controlled.

Author

Active Control; Energy Conservation

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.

20000032783 NASA Johnson Space Center, Houston, TX USA
New Mission Control Center Briefing
May 16, 1995; In English; Videotape: 58 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039783; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage shows panelists, Chief Center Systems Division John Muratore, and Acting Chief, Control Center Systems Division, Linda Uljon, giving an overview of the new Mission Control Center. Muratore and Uljon talk about the changes and modernization of the new Center. The panelists mention all the new capabilities of the new Center. They emphasize the Distributed real time command and control environment, the reduction in operation costs, and even the change from coaxial cables to fiber optic cables. Uljon also tells us that the new Control Center will experience its first mission after the launch of STS-70 and its first complete mission (both launching and landing) during STS-71.
CASI
Command and Control; Ground Based Control; Flight Control; Ground Operational Support System; Control Systems Design; Systems Integration

20000032813 NASA Goddard Space Flight Center, Greenbelt, MD USA
Goddard Space Flight Center Solar Array Missions, Requirements and Directions
Gaddy, Edward, NASA Goddard Space Flight Center, USA; Day, John, NASA Goddard Space Flight Center, USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 1-12; In English; See also 20000032812; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Goddard Space Flight Center (GSFC) develops and operates a wide variety of spacecraft for conducting NASA's communications, space science, and earth science missions. Some are "in house" spacecraft for which the GSFC builds the spacecraft and performs all solar array design, analysis, integration, and test. Others are "out of house" spacecraft for which an aerospace contractor builds the spacecraft and develops the solar array under direction from GSFC. The experience of developing flight solar arrays for numerous GSFC "in house" and "out of house" spacecraft has resulted in an understanding of solar array requirements for many different applications. This presentation will review those solar array requirements that are common to most GSFC spacecraft. Solar array technologies will be discussed that are currently under development and that could be useful to future GSFC spacecraft.
Author
Spacecraft Communication; Solar Arrays; Design Analysis; Requirements

20000032918 NASA Langley Research Center, Hampton, VA USA
GRACE Mission Design: Impact of Uncertainties in Disturbance Environment and Satellite Force Models
Mazanek, Daniel D., NASA Langley Research Center, USA; Kumar, Renjith R., Analytical Mechanics Associates, Inc., USA; Seywald, Hans, Analytical Mechanics Associates, Inc., USA; Qu, Min, Analytical Mechanics Associates, Inc., USA; [2000]; 22p; In English; Space Flight Mechanics Meeting, 23-26 Jan. 2000, Clearwater, FL, USA; Sponsored by American Astronautical Society, USA
Report No.(s): AAS Paper 00-163; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Gravity Recovery and Climate Experiment (GRACE) primary mission will be performed by making measurements of the inter-satellite range change between two co-planar, low altitude, near-polar orbiting satellites. Understanding the uncertainties in the disturbance environment, particularly the aerodynamic drag and torques, is critical in several mission areas. These include an accurate estimate of the spacecraft orbital lifetime, evaluation of spacecraft attitude control requirements, and estimation of the orbital maintenance maneuver frequency necessitated by differences in the drag forces acting on both satellites. The FREEMOL simulation software has been developed and utilized to analyze and suggest design modifications to the GRACE spacecraft. Aerodynamic accommodation bounding analyses were performed and worst-case envelopes were obtained for the aerodynamic torques and the differential ballistic coefficients between the leading and trailing GRACE spacecraft. These analyses

demonstrate how spacecraft aerodynamic design and analysis can benefit from a better understanding of spacecraft surface accommodation properties, and the implications for mission design constraints such as formation spacing control.
Author
Mission Planning; Perturbation Theory; Spacecraft Design; Design Analysis

20000033221 Kyushu Univ., Graduate School of Engineering, Fukuoka, Japan
The Orbital Change of Fragment Debris Due to the Sun
Nakajima, Rina; Hanada, Toshiya; Yasaka, Tetsuo; Technology Reports of Kyushu University; January 2000; ISSN 0023-2718; Volume 73, No. 1, pp. 41-46; In Japanese; Copyright; Avail: Issuing Activity

At present, the orbiting debris are increasing in number. The effects of these debris become serious problem. Therefore, it is important to investigate the behavior of debris under various perturbation. In this study, we discuss the effect of solar radiation pressure and the gravitational forces of the sun on the behavior of debris. Solar radiation pressure most eminently changes eccentricity, depending on area-mass ratio of debris. In the case of debris less than 1 mm, solar radiation pressure was more influential than the gravitational forces of the sun in changing orbit shape.
Author
Space Debris; Solar Radiation; Gravitational Effects; Perturbation; Radiation Pressure

20000033356 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The Use of USA Military Force in the Post Cold War Era. NASA: International Training and Integration Office Improving Interaction and Cooperation With the International Partners
Reed, Kim N.; Feb. 23, 2000; 118p; In English
Report No.(s): AD-A374198; AFIT-FY-00-95; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

As the trend towards globalization continues, international cooperation in space has become increasingly prevalent. Globalization has presented a new age of growth and shared prosperity through a more efficient allocation of resources making international cooperation more important now than ever before. As the capabilities of space-faring nations converge, the number of space capable nations increases, and space science projects become larger and more complex, international cooperation in space will be essential to the future of space exploration. According to Peter Smith with the National Aeronautics and Space Administration (NASA) International Relations Division, ”More than 1,200 agreements with over 130 countries and international organizations have been negotiated by NASA in the past 30 years. The benefits of such cooperation have been monetary (more than $12 billion contributed or pledged), strategic (access to foreign expertise and facilities) and, of course, political. The downsides, however, include management complexity, technical and programmatic risk and, of course, political risks”. International cooperation in space has significant advantages, but it can also present new problems and potential conflicts, many of which arise from cultural differences. NASA must be aware of these issues and have a means to limit or prevent these problems and conflicts from occurring so that it can be more successful in achieving its goals and objectives.
DTIC
Education; Armed Forces (USA); Space Flight; Space Exploration

13
ASTRODYNAMICS

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

20000033268 NASA Marshall Space Flight Center, Huntsville, AL USA
Test Results for the Automated Rendezvous and Capture System
Cruzen, Craig, NASA Marshall Space Flight Center, USA; Dabney, Richard, NASA Marshall Space Flight Center, USA; Lomas, James, NASA Marshall Space Flight Center, USA; November 1999; 17p; In English; Guidance and Control Conference, 2-6 Feb. 2000, Breckenridge, CO, USA; Sponsored by American Astronomical Society, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Automated Rendezvous and Capture (AR&C) system was designed and tested at NASA’s Marshall Space Flight Center (MSFC) to demonstrate technologies and mission strategies for automated rendezvous and docking of spacecraft in Earth orbit, The system incorporates some of the latest innovations in Global Positioning, System space navigation, laser sensor technologies and automated mission sequencing algorithms. The system’s initial design and integration was completed in 1998 and has undergone testing at MSFC. This paper describes the major components of the AR&C system and presents results from the official system tests performed in MSFC’s Flight Robotics Laboratory with digital simulations and hardware in the loop tests. The results

show that the AR&C system can safely and reliably perform automated rendezvous and docking missions in the absence of system failures with 100 percent success. When system failures are included, the system uses its automated collision avoidance maneuver logic to recover in a safe manner. The primary objective of the AR&C project is to prove that by designing a safe and robust automated system, mission operations cost can be reduced by decreasing the personnel required for mission design, preflight planning and training required for crewed rendezvous and docking missions.
Author
Space Rendezvous; Spacecraft Docking; Performance Tests; Digital Simulation; Systems Engineering; Automatic 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).

20000032302 Puerto Rico Univ., Electrical and Computer Engineering Dept., Mayaguez, Puerto Rico
Specifications for the Design of a Low Cost TDRSS-Compatible Portable Earth Terminal
Bonilla–Gonzalez, Eliud, Puerto Rico Univ., Puerto Rico; Fernandez–Sein, Rafael, Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 275-280; In English; See also 20000032189
Report No.(s): 98URC050; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Antarctica provides an incredibly rich variety of unspoiled settings for the installation and operation of scientific instruments to study both our planet as well as the cosmos. The lack of spectral pollution, as well as unique atmospheric and environmental conditions, provide a great setting for earth-based experiments. The international scientific community has recognized Antarctica's potential and is increasing its presence. One of these organizations, the Center for Astronomical Research in Antarctica (CARA), under the sponsorship of the National Science Foundation has established the Automated Astronomical Site-Testing Observatory (AASTO) at the South Pole. The AASTO is a self-contained observatory, currently located at the South Pole, and proposed to be moved to the high plateau of Antarctica. Its purpose is to collect atmospheric and environmental data for the determination of the optimum location for a permanent multinational astronomical observatory. The AASTO itself is derived from the successful US Automated Geophysical Observatory (AGO) program. The same conditions that make Antarctica attractive for an observatory pose a significant challenge in the establishing of communication links to allow command and control of the instruments, as well as the gathering of data in a timely fashion. Currently, personnel must use low data rate links with some satellites or travel to the South Pole to retrieve the data for later analysis at their home institutions. A high data rate two-way communication link between the scientists and the instrumentation would greatly enhance the productivity and efficiency of these projects. This issue is being addressed for other South Pole experimenters at Goddard Space Flight Center (GSFC) by the South Pole TDRSS Relay Project.
Derived from text
Earth Terminals; Low Cost; TDR Satellites; Specifications; Satellite Design; Astronomical Observatories

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.

20000032921 NASA Langley Research Center, Hampton, VA USA
An Entry Flight Controls Analysis for a Reusable Launch Vehicle
Calhoun, Philip, NASA Langley Research Center, USA; [2000]; 14p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1046; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA Langley Research Center has been performing studies to address the feasibility of various single-stage to orbit concepts for use by NASA and the commercial launch industry to provide a lower cost access to space. Some work on the conceptual design of a typical lifting body concept vehicle, designated VentureStar(sup TM) has been conducted in cooperation with the Lockheed Martin Skunk Works. This paper will address the results of a preliminary flight controls assessment of this

vehicle concept during the atmospheric entry phase of flight. The work includes control analysis from hypersonic flight at the atmospheric entry through supersonic speeds to final approach and landing at subsonic conditions. The requirements of the flight control effectors are determined over the full range of entry vehicle Mach number conditions. The analysis was performed for a typical maximum crossrange entry trajectory utilizing angle of attack to limit entry heating and providing for energy management, and bank angle to modulation of the lift vector to provide downrange and crossrange capability to fly the vehicle to a specified landing site. Sensitivity of the vehicle open and closed loop characteristics to CG location, control surface mixing strategy and wind gusts are included in the results. An alternative control surface mixing strategy utilizing a reverse aileron technique demonstrated a significant reduction in RCS torque and fuel required to perform bank maneuvers during entry. The results of the control analysis revealed challenges for an early vehicle configuration in the areas of hypersonic pitch trim and subsonic longitudinal controllability.
Author
Spacecraft Reentry; Lifting Reentry Vehicles; Recoverable Spacecraft; Feedback Control; Flight Control; Controllability

20000032922 NASA Langley Research Center, Hampton, VA USA
Reusable Launch Vehicle Tank/Intertank Sizing Trade Study
Dorsey, John T., NASA Langley Research Center, USA; Myers, David E., NASA Langley Research Center, USA; Martin, Carl J., NASA Langley Research Center, USA; [2000]; 16p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA
Report No.(s): AIAA Paper 2000-1043; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
A tank and intertank sizing tool that includes effects of major design drivers, and which allows parametric studies to be performed, has been developed and calibrated against independent representative results. Although additional design features, such as bulkheads and field joints, are not currently included in the process, the improved level of fidelity has allowed parametric studies to be performed which have resulted in understanding of key tank and intertank design drivers, design sensitivities, and definition of preferred design spaces. The sizing results demonstrated that there were many interactions between the configuration parameters of internal/external payload, vehicle fineness ratio (half body angle), fuel arrangement (LOX-forward/LOX-aft), number of tanks, and tank shape/arrangement (number of lobes).
Author
Reusable Launch Vehicles; Recoverable Launch Vehicles; X-33 Reusable Launch Vehicle; Venturestar Launch Vehicle; Aerospike Engines; Launch Vehicle Configurations

20000032978 NASA Marshall Space Flight Center, Huntsville, AL USA
An Innovative Structural Mode Selection Methodology: Application for the X-33 Launch Vehicle Finite Element Model
Hidalgo, Homero, Jr., American Inst. of Aeronautics and Astronautics, USA; [2000]; 9p; In English, 3-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1587; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
An innovative methodology for determining structural target mode selection and mode selection based on a specific criterion is presented. An effective approach to single out modes which interact with specific locations on a structure has been developed for the X-33 Launch Vehicle Finite Element Model (FEM). We presented Root-Sum-Square (RSS) displacement method computes resultant modal displacement for each mode at selected degrees of freedom (DOF) and sorts to locate modes with highest values. This method was used to determine modes, which most influenced specific locations/points on the X-33 flight vehicle such as avionics control components, aero-surface control actuators, propellant valve and engine points for use in flight control stability analysis and for flight POGO stability analysis. Additionally, the modal RSS method allows for primary or global target vehicle modes to also be identified in an accurate and efficient manner.
Author
Aerodynamic Stability; Finite Element Method; Mathematical Models; Stability Tests; X-33 Reusable Launch Vehicle

20000033618 NASA Marshall Space Flight Center, Huntsville, AL USA
X33 Transient Liftoff Analysis
Peck, Jeff, NASA Marshall Space Flight Center, USA; Brunty, Joseph, NASA Marshall Space Flight Center, USA; [2000]; 11p; In English; 41st; Structures, Structural Dynamics and Materials, 3-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 242-30-XI
Report No.(s): AIAA Paper 2000-1585; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The successful design of a launch vehicle requires the careful characterization of the various loads the structure will experience over its lifetime. Many of the most demanding load environments occur during the launch/ascent phase of a mission, typically defined as the point of engine start through engine cut off. One of the critical events during the launch phase is the liftoff event. This event imparts high loads on the vehicle due to transient events such as thrust build-up and vehicle release. This paper describes the theory and procedures used to calculate structural loads due to the liftoff event for the Lockheed-Martin X33 technology demonstrator vehicle. These procedures were developed at NASA's Marshall Space Flight Center and verified previously on other advanced launch system concepts and the Space Shuttle system.
Author
X-33 Reusable Launch Vehicle; Recoverable Launch Vehicles; Venturestar Launch Vehicle; Reusable Spacecraft

20000033619 NASA Marshall Space Flight Center, Huntsville, AL USA
We Must Take the Next Steps Towards Safe, Routine Space Travel
Lyles, G. M., NASA Marshall Space Flight Center, USA; [2000]; 30p; In English; 2000 National Space and Missile Materials Symposium, 28 Feb. 2000, San Diego, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents, in viewgraph form, six in a half generations of airplanes in a century. Some of the topics include: 1) Enterprise goals; 2) Generations of Reusable Launch Vehicles; 3) Space Transportation Across NASA; 4) Three Tiered Implementation Approach for Future Space Transportation Technology; 5) Develop a Comprehensive, Agency Level Space Transportation Plan That Will Enable NASA's Strategic Plan; 6) Timeline for Addressing NASA's Needs; 7) Significant 2nd Generation Technology Drivers; 8) Example Large Scale Ground Demonstrations; and 9) Example Pathfinder Demonstrations. The paper also includes various aircraft designs and propulsion system technology.
CASI
Space Transportation; Aircraft Design; Reusable Launch Vehicles; Technology Utilization

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.

20000031397 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-30 Launch Highlights and Continuous Record from T-9 Mins.
19890428; In English; Videotape: 36 min. 34 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000036565; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

The primary objective of the STS-30 mission was to deploy the Magellan/Venus radar mapper spacecraft and attached Inertial Upper Stage (IUS). The commander of the mission was David M. Walker. The crew was pilot, Ronald J. Grabe, and mission specialists, Norman E. Thagard, Mary L. Cleave, and Mark C. Lee. The mission was launched on May 4, 1989, after the April 28 launch attempt was scrubbed due to a problem with a liquid hydrogen recirculation pump on the number one main engine and a vapor leak in the four-inch liquid hydrogen recirculation line between the orbiter and the external tank. This videotape shows the crew breakfast on April 28, and the final preparations for launch. It also shows the crew boarding the shuttle. After the countdown is halted at T-31 seconds the crew leaves the orbiter.
CASI
Countdown; Launching; Space Transportation System; Spacecrews; Prelaunch Problems; Space Vehicle Checkout Program

20000032103 NASA, Washington, DC USA
]Space Shuttle Independent Assessment Team*, Oct. - Dec. 1999*
Mar. 07, 2000; 131p; In English; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Shuttle program is one of the most complex engineering activities undertaken anywhere in the world at the present time. The Space Shuttle Independent Assessment Team (SIAT) was chartered in September 1999 by NASA to provide an independent review of the Space Shuttle sub-systems and maintenance practices. During the period from October through December 1999, the team led by Dr. McDonald and comprised of NASA, contractor, and DOD experts reviewed NASA practices, Space Shuffle anomalies, as well as civilian and military aerospace experience. In performing the review, much of a very positive nature was observed by the SIAT, not the least of which was the skill and dedication of the workforce. It is in the unfortunate nature of this type of review that the very positive elements are either not mentioned or dwelt upon. This very complex program has undergone

a massive change in structure in the last few years with the transition to a slimmed down, contractor-run operation, the Shuttle Flight Operations Contract (SFOC). This has been accomplished with significant cost savings and without a major incident. This report has identified significant problems that must be addressed to maintain an effective program. These problems are described in each of the Issues, Findings or Observations summarized, and unless noted, appear to be systemic in nature and not confined to any one Shuttle sub-system or element. Specifics are given in the body of the report, along with recommendations to improve the present systems.
Author
Space Shuttles; Space Transportation System; Space Shuttle Orbiters; Aerospace Safety; Spacecraft Maintenance; Ground Crews; Operating Costs

20000032447 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-31: Hubble HST Science
Apr. 08, 1990; In English; Videotape: 42 min. 45 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-200039780; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

The primary objective of STS-31 was to deploy the Hubble Space Telescope(HST). This videotape presents a press briefing about the scientific goals of the HST program. The panel members were Dr. Weiler, HST program scientist; Dr. Boggess from NASA Goddard, the Center managing the HST Program; and Dr. Bahcall, President Elect of the American Astronomical Union. Dr. Weiler opened the panel discussion by introducing other HST scientists who were in the audience. Dr. Bahcall explained the four major areas that astronomers hope to better understand using the HST data: (1) The size and age of the universe; (2) quasars as flashlights to understanding other features of the universe; (3) planets around other stars; and (4) weather on the other planets of our Solar System. Other areas in which he hopes to have some understanding are galaxies under quasars, black holes, and missing matter. After his remarks, Dr. Bahcall presented a plaque to Charles Pellerin, who helped initiate the series of astrophysics telescopes. The HST is the first of these ”Great Observatories”. After the presentation, questions from the press were answered.
CASI
Universe; Hubble Space Telescope; Spaceborne Astronomy; Astrophysics

20000032462 NASA Johnson Space Center, Houston, TX USA
STS-101: Crew Interview / Jeffrey N. Williams
Mar. 21, 2000; In English; Videotape: 36 min. 36 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039942; JSC-1809D; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage of a preflight interview with Mission Specialist Jeffrey N. Williams is seen. The interview addresses many different questions including why Williams became an astronaut, and the events that led to his interest. Other interesting information that this one-on-one interview discusses is his reaction to and the reasons for the change of the mission objectives. Williams also mentions the scheduled space-walk that he will perform, docking with the International Space Station (ISS), the repairs of equipment, and the change of the batteries.
CASI
Crew Procedures (Preflight); Spacecrews; Astronauts; Space Transportation System; Space Transportation System Flights; Atlantis (Orbiter)

20000032463 NASA Johnson Space Center, Houston, TX USA
STS-101: Crew Interview / James S. Voss
Mar. 21, 2000; In English; Videotape: 31 min. 41 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039855; JSC-1809E; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage of a preflight interview with Mission Specialist James S. Voss is seen. The interview addresses many different questions including why Voss became an astronaut, the individuals who influenced him, and the events that led to his interest. Other interesting information that this one-on-one interview discusses is his reaction to and the reasons for the change of the mission objectives. Voss also mentions the scheduled space-walk that he will perform with Jeffrey N. Williams, docking with the International Space Station (ISS), the repairs of equipment, and the change of the batteries. Voss explains why himself, Susan J.

Helms, and Yuri Vladimirovich Usachev are the perfect choice for this mission because of their certification from Russia to work on the Zarya Control Module.
CASI
Space Transportation System; Space Transportation System Flights; Atlantis (Orbiter); Crew Procedures (Preflight); Spacecrews; Talking

20000032464 NASA Johnson Space Center, Houston, TX USA
STS-101: Crew Interview / Susan J. Helms
Mar. 21, 2000; In English; Videotape: 34 min. 15 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039853; JSC-1809F; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
Live footage of a preflight interview with Mission Specialist Susan J. Helms is seen. The interview addresses many different questions including why Helms became an astronaut, the individuals who influenced her, and the events that led to her interest. Other interesting information that this one-on-one interview discusses is his reaction to and the reasons for the change of the mission objectives. Susan also mentions the docking with the International Space Station (ISS), the repairs of equipment, the change of the batteries, and the transfer of equipment. Susan explains why she, James S. Voss, and Yuri Vladimirovich Usachev are the perfect choice for this mission because of their experience with the ISS modules. She also discusses what the ISS means to her as well as to the human efforts to explore space.
CASI
Space Transportation System; Space Transportation System Flights; Atlantis (Orbiter); Crew Procedures (Preflight); Spacecrews; Talking

20000032470 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-31: Hubble in VPF Lift to Work Platform
Oct. 10, 1989; In English; Videotape: 13 min. 45 sec. playing time, in color, no sound
Report No.(s): NONP-NASA-VT-2000039784; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
This videotape shows the Hubble Space Telescope being moved in the clean room Vertical Processing Facility (VPF) to the work platform. The Hubble Space Telescope was deployed on April 25, 1990 from the space shuttle Discovery during STS-31.
CASI
Clean Rooms; Hubble Space Telescope; Controlled Atmospheres; Assembling

20000032471 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-35: Astro-1 BBXRT Problem Area
Aug. 31, 1990; In English; Videotape: 5 min. playing time, in color, no sound
Report No.(s): NONP-NASA-VT-2000043342; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
The primary objective of STS-35 was to conduct observations in ultraviolet and X-ray astronomy with the ASTRO-1 observatory. ASTRO-1 consisted of four telescopes: Hopkins Ultraviolet Telescope (HUT); Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE); Ultraviolet Imaging Telescope (UIT); and Broad Band X-ray Telescope (BBXRT). This videotape shows work on the BBXRT in the clean room. Two days before a scheduled September 1 launch date, the avionics box on the BBXRT malfunctioned and had to be changed and retested.
CASI
Avionics; X Ray Telescopes; Clean Rooms

20000032479 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-34: Galileo Processing
Aug. 10, 1989; In English; Videotape: 13 min. 45 sec. playing time, in color, no sound
Report No.(s): NONP-NASA-VT-200043349; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
This videotape shows work being done on the Galileo spacecraft in the clean room, Vertical Processing Facility (VPF). It also shows the spacecraft being lifted to a work platform in the VPF. The deployment of Galileo on its trip to Jupiter was the primary objective of the STS-34 mission.
CASI
Clean Rooms; Galileo Spacecraft; Assembling

20000032488 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-35: Astronaut Departure
May 30, 1990; In English; Videotape: 10 min. 30 sec. playing time, in color, no sound
Report No.(s): NONP-NASA-VT-2000043341; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
The primary objective of the STS-35 mission was the round-the-clock observations of the celestial sphere in ultraviolet and X ray astronomy with ASTRO-1. The mission was commanded by Vance D. Brand. The crew consisted of the pilot Guy S. Gardner, the mission Specialists Jeffery Hoffman, John Lounge, and Robert Parker, and the payload specialists Samuel Durrance, and Ronald Parise. This videotape shows the astronauts leaving the Kennedy Space Center after one of the attempts to launch the mission was scrubbed due to hydrogen leaks aboard the shuttle Columbia.
CASI
Astronauts; Spacecrews; Preflight Operations

20000032538 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-31: Hubble Discovery Payload Doors Closing
Apr. 08, 1990; In English; Videotape: 2 min. 20 sec. playing time, in color, no sound
Report No.(s): NONP-NASA-VT-2000039774; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
The primary objective of mission STS-31 was to deploy the Hubble Space Telescope. The videotape shows the Hubble Space Telescope in Discovery's payload bay in the Vertical Assembly Building (VAB) clean room, while the payload bay's doors slowly close.
CASI
Hubble Space Telescope; Payloads; Discovery (Orbiter)

20000032539 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-32: LDEF Move from SAEF II to Hanger "C" CCAFS
May 14, 1990; In English; Videotape: 9 min. playing time, in color, no sound
Report No.(s): NONP-NASA-VT-2000039779; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
One of the primary objectives of STS-32 was to retrieve the Long Duration Exposure Facility (LDEF) from space. The LDEF was designed to provide long-term data on the space environment and its effects on space systems and operations. This videotape shows the LDEF being moved from the Spacecraft Assembly and Encapsulation Facility to Hanger C in the Cape Canaveral Air Force Station after it had been retrieved from space. There are many views of the environment around the Kennedy Space Facility.
CASI
Long Duration Exposure Facility; Cape Kennedy Launch Complex

20000032577 NASA Johnson Space Center, Houston, TX USA
STS-35: Post Launch News Conference
Dec. 02, 1990; In English; Videotape: 24 min. 38 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000043333; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS
Live footage shows the question and answer session of the Post Launch News Conference. The Panelists address questions from NASA Centers such as Goddard Space Flight Center and Kennedy Space Center (KSC), and from various audience participants. The status of the launch of STS-35 is discussed. Also discussed are the liquid oxygen malfunctions, helium leakage, and photographic optical tracking during the daytime.
CASI
Conferences; Postlaunch Reports; Space Transportation System; Space Transportation System Flights; Columbia (Orbiter)

20000032742 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-35: Helicopter Footage Orbiters on Both Pads A and B
Sep. 01, 1990; In English; Videotape: 3 min. 30 sec. playing time, in color, no sound
Report No.(s): NONP-NASA-VT-2000043334; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
This videotape shows several circuits around the launch pads at the Kennedy Space Center with Orbiters on both Pads A and B. Along with the Space Shuttle Columbia awaiting launch for STS-35 on Pad A, there are shots of Discovery awaiting launch for STS-41 on Pad B.
CASI
Cape Kennedy Launch Complex; Space Shuttles; Launchers; Launching Pads

20000032744 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-34: JPL RTG Safety Tests

Jul. 20, 1989; 7p; In English; Videotape: 11 min. 31 sec. playing time, in color, no sound

Report No.(s): NONP-NASA-VT-2000043346; No Copyright; Avail: CASI; A02, Hardcopy; B01, Videotape-Beta; V01, Videotape-VHS

The primary objective of STS-34 was to launch Galileo on its trip to Jupiter. The Galileo spacecraft contains two Radioisotope Thermoelectric Generators (RTG), which contains plutonium. This videotape shows and the accompanying material explains the tests that the RTG containment vessel has been subjected to, and the results of the tests. The videotape shows the trajectory of the Galileo spacecraft, a cutaway view of an RTG, the Plutonium-238 fuel capsule, and seven of the tests on the RTG.

CASI

Fuel Capsules; Galileo Spacecraft; Radioisotope Batteries; Thermoelectric Generators; Impact Tests; Performance Tests; Reliability

20000032749 NASA Johnson Space Center, Houston, TX USA

STS-99: Post Flight Presentation

Apr. 03, 2000; In English; Videotape: 15 min. 13 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000043499; JSC-1819; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Live footage shows the crewmembers of STS-99, Commander Kevin R. Kregel, Pilot Dominic L. Pudwill Gorie, and Mission Specialists Janet L. Kavandi, Janice E. Voss, Mamoru Mohri, and Gerhard P.J. Thiele, arriving at Kennedy Space Center (KSC) in the T-38 aircraft. Crewmembers are seen speaking to the welcoming crowd at KSC, suiting-up, walking out to the Astro-van, being strapped in the shuttle, and performing various activities while in orbit. Scenes include the astronaut training process, main engine ignition, liftoff, solid rocket booster separation, mast deployment and retraction, and the changing of the mapping tapes. Footage also includes the crewmembers sleeping, eating, exercising, dancing and having fun in zero gravity. The High Definition Television Camera (HDTV) picks up images from the Earth. These images includes Bolivia, Paraguay, Brazil, Bahamas, Mauritania, Saudi Arabia, Mount Fuji, Tokyo Bay, Southern Russia, the Black Sea, Equador, Northern Peru, the Mediterranean Sea, Malta, Sicily and Italy. The crewmembers of STS-99 each took a turn to narrate the scenes and events as they occur.

CASI

Space Transportation System; Space Transportation System Flights; Spacecrews; Talking; Radar Maps; Radar Imagery; Shuttle Imaging Radar; Topography; Earth Surface

20000032782 NASA Johnson Space Center, Houston, TX USA

STS-101: Crew Interview / Yuri Vladimirovich Usachev

Mar. 20, 2000; In English; Videotape: 23 min. 2 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000039856; JSC-1809G; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

Live footage of a preflight interview with Mission Specialist Yuri Vladimirovich Usachev is seen. The interview addresses many different questions including why Usachev became a cosmonaut, the individuals who influenced him, and the events that led to his interest. Other interesting information that this one-on-one interview discusses is his reaction and integration into the STS-101 crew. Usachev also mentions the scheduled space-walk of James S. Voss and Jeffrey N. Williams, his feeling once he steps into the International Space Station (ISS), the repairs of equipment, his handling of the hand held laser, and the change of the batteries.

CASI

Cosmonauts; Russian Space Program; Spacecrews; Talking; Crew Procedures (Preflight); Space Transportation System; Space Transportation System Flights; Atlantis (Orbiter)

20000032785 NASA Marshall Space Flight Center, Huntsville, AL USA

A Strategy for Integrating a Large Finite Element Model: X-33 Lessons Learned

McGhee, David S., NASA Marshall Space Flight Center, USA; [2000]; 7p; In English; Dynamics Specialists Conference, 3-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-1590; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The X-33 vehicle is an advanced technology demonstrator sponsored by NASA. For the past three years the Structural Dynamics & Loads Group of NASA's Marshall Space Flight Center has had the task of integrating the X-33 vehicle structural finite element model. In that time, five versions of the integrated vehicle model have been produced and a strategy has evolved

that would benefit anyone given the task of integrating structural finite element models that have been generated by various modelers and companies. The strategy that has been presented here consists of six decisions that need to be made. These six decisions are: purpose of model, units, common material list, model numbering, interface control, and archive format. This strategy has been proved and expanded from experience on the X-33 vehicle.
Author
Strategy; Finite Element Method; Models; X-33 Reusable Launch Vehicle

20000032963 NASA Kennedy Space Center, Cocoa Beach, FL USA
Debris/Ice/TPS Assessment and Integrated Photographic Analysis of Shuttle Mission STS-99
Katnik, Gregory N., NASA Kennedy Space Center, USA; March 2000; 107p; In English; Original contains color illustrations
Report No.(s): NASA/TM-2000-208565; NAS 1.15:208565; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
A debris/ice/thermal protection system assessment and integrated photographic analysis was conducted for Shuttle mission STS-99. Debris inspections of the flight elements and launch pad were performed before and after launch. Icing conditions on the External Tank were assessed by the use of computer programs and infrared scanned data during cryogenic loading of the vehicle, followed by on-pad visual inspection. High speed photography of the launch was analyzed to identify ice/debris sources and evaluate potential vehicle damage and/or in-flight anomalies. This report documents the debris/ice/thermal protection system conditions and integrated photographic analysis of Space Shuttle mission STS-99 and the resulting effect on the Space Shuttle Program.
Author
Debris; Ice; Space Transportation System; Thermal Protection; High Speed Photography; Space Missions

20000032977 NASA Marshall Space Flight Center, Huntsville, AL USA
Flutter Analysis of the X-33
Fowler, Samuel B., NASA Marshall Space Flight Center, USA; [2000]; 10p; In English; 41st; 41st SDM Conference, 3-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1589; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Flutter analysis performed in support of the X33 Advanced Technology Demonstrator is described. Analysis was conducted over a range of flow regimes using several different analysis codes. The finite element and aerodynamic models used in the analysis have undergone several years of development and refinement resulting in a high degree of model detail. The flutter analysis focuses on the area of three critical points within the vehicle's design trajectory at which full sets of external loads have previously been developed. A comparison between several different aerodynamic models is also made for the selected trajectory points.
Author
Flutter Analysis; X-33 Reusable Launch Vehicle; Design Analysis; Structural Design

20000033207 NASA Johnson Space Center, Houston, TX USA
STS-29: Pre-Launch Preparations/Launch and Landing
Mar. 15, 1989; In English; Viedotape: 57 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000036553; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
Live footage shows the crewmembers of STS-29, Commander Michael L. Coats, Pilot John E. Blaha, and Mission Specialists James P. Bagian, James F. Buchli, and Robert C. Springer, seated in the White Room with the traditional cake. The crew is seen performing various pre-launch activities including suit-up, and walk out to the Astro-van. This early morning launch shows countdown, main engine start, liftoff, booster separation, and various isolated footage of the launch from different cameras. Also presented are footage of the approach, gear touchdown, rollout at Edwards Air Force Base, and various isolated views of the landing.
CASI
Crew Procedures (Preflight); Spacecrews; Astronauts; Space Transportation System; Space Transportation System Flights; Discovery (Orbiter)

20000033208 NASA Johnson Space Center, Houston, TX USA
STS-29: TCDT
Feb. 08, 1989; In English; Videotape: 37 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000036551; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage shows the crewmembers of STS-29, Commander Michael L. Coats, Pilot John E. Blaha, and Mission Specialists James P. Bagian, James F. Buchli, and Robert C. Springer, participating in Terminal Countdown Demonstration Tests. The astronauts are seen on the launch pad, learning about the shuttle and its safety features. They are also shown putting on disposable masks and going into an emergency eye wash and emergency showers.
CASI
Astronaut Training; Crew Procedures (Preflight); Preflight Operations

20000033371 NASA Marshall Space Flight Center, Huntsville, AL USA
Ground Vibration Test Planning and Pre-Test Analysis for the X-33 Vehicle
Bedrossian, Herand, Lockheed Martin Corp., USA; Tinker, Michael L., NASA Marshall Space Flight Center, USA; Hidalgo, Homero, NASA Marshall Space Flight Center, USA; [2000]; 28p; In English; Dynamics Specialists Conference, 3-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 242-33-K1
Report No.(s): AIAA Paper 2000-1586; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper describes the results of the modal test planning and the pre-test analysis for the X-33 vehicle. The pre-test analysis included the selection of the target modes, selection of the sensor and shaker locations and the development of an accurate Test Analysis Model (TAM). For target mode selection, four techniques were considered, one based on the Modal Cost technique, one based on Balanced Singular Value technique, a technique known as the Root Sum Squared (RSS) method, and a Modal Kinetic Energy (MKE) approach. For selecting sensor locations, four techniques were also considered; one based on the Weighted Average Kinetic Energy (WAKE), one based on Guyan Reduction (GR), one emphasizing engineering judgment, and one based on an optimum sensor selection technique using Genetic Algorithm (GA) search technique combined with a criteria based on Hankel Singular Values (HSV's). For selecting shaker locations, four techniques were also considered; one based on the Weighted Average Driving Point Residue (WADPR), one based on engineering judgment and accessibility considerations, a frequency response method, and an optimum shaker location selection based on a GA search technique combined with a criteria based on HSV's. to evaluate the effectiveness of the proposed sensor and shaker locations for exciting the target modes, extensive numerical simulations were performed. Multivariate Mode Indicator Function (MMIF) was used to evaluate the effectiveness of each sensor & shaker set with respect to modal parameter identification. Several TAM reduction techniques were considered including, Guyan, IRS, Modal, and Hybrid. Based on a pre-test cross-orthogonality checks using various reduction techniques, a Hybrid TAM reduction technique was selected and was used for all three vehicle fuel level configurations.
Author
Ground Tests; X-33 Reusable Launch Vehicle; In-Flight Simulation; Vibration Tests; Free Flight

20000033439 NASA Dryden Flight Research Center, Edwards, CA USA
X-34 Captive Carry & Seunghee Lee Interview
Jun. 29, 1999; In English; Videotape: 5 min. 42 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000043975; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
Live footage shows the rollout of the aircraft carrying the X-34. Also shown are the taxing of the aircraft and takeoff. The NASA Dryden X-34 Project Manager is also shown during an interview.
CASI
X-34 Reusable Launch Vehicle; Air Launching; Pegasus Air-Launched Booster; Research Vehicles; Research and Development

20000033440 NASA Dryden Flight Research Center, Edwards, CA USA
X-38 Phase 3 Drops V-132 FF#3
Mar. 30, 2000; In English; Videotape: 43 min. playing time, in color, without sound
Report No.(s): NONP-NASA-VT-2000043892; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
Live footage shows the drop of the X-38 vehicle. Also shown are parachute deployments from various cameras.
CASI
X-38 Crew Return Vehicle; Research Vehicles; Research and Development

20000033616 NASA Marshall Space Flight Center, Huntsville, AL USA
Space Transportation in the New Millennium
McGill, Preston, NASA Marshall Space Flight Center, USA; [2000]; 48p; In English, 2 Feb. 2000, Marianna, FL, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents viewgraphs of Space Transportation in the New Millennium. Pictures are shown of the space shuttle lift Off, rocket motion, the space shuttle main engine, the space shuttle external tank, the space shuttle solid rocket booster, the X-33, X-34, X-37, X-38, magnetic levitation, the rbcc, nuclear thermal propulsion, anti-matter propulsion system, the NTP or anti-matter concept vehicles, and the Space Elevator.
CASI
Spacecraft Design; Space Shuttles; Space Transportation System; Spacecraft Propulsion; Rocket Engines

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.

20000032304 Puerto Rico Univ., Electrical and Computer Engineering Dept., Mayaguez, Puerto Rico
Automated TDRSS RF Relay System Through CTV
Diaz–Serrano, Javier, Puerto Rico Univ., Puerto Rico; Fernandez–Sein, Rafael, Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 281-285; In English; See also 20000032189
Report No.(s): 98URC051; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Checkout of spacecraft(S/C) telemetry and command capabilities was performed on a satellite prior to being launched into orbit. The Compatibility Test section has a Compatibility Test Van (CTV) that verifies Ground Network (GN) and Space Network (SN) compatibility. In this last mode of testing, the van relays the forward link command and ranging signals from Tracking and Data Relay Satellite System (TDRSS) to the Spacecraft under Test (SUT) and the return link telemetry and ranging signals from SUT to the TDRSS following a procedure outlined by Compatibility Test Section (CTS). This procedure is rather involved, so there is a requirement for computer-supported calculations and control. The scope of this project was to produce a user-friendly control environment with software (S/W) to support CTV TDRSS Relays. The man-machine interface (MMI) should improve methods for functions such as link calculations, antenna positioning, sun or TDRSS pointing angle calculation, and calibration procedures. This automated system was created using LabVIEW environment and programming language, which supports graphical user interface (GUI), input/output instrument access in addition to multitasking capabilities. This automated environment improved procedures in the following areas: 1) link calculations, 2) networking capability, 3) sun angle calculations, 4) TDRSS angle calculations, 5) calibration of instrumentation and testing path 6) antenna positioning control, 7) G/T figure of merit calculation. This automated system was based on a two-way design method, top-down design and bottom-up design.
Author
TDR Satellites; Radio Frequencies; Test Chambers; Automatic Control; Telemetry; Compatibility

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.

20000032438 DYNACS Engineering Co., Inc., BOeing ISS, Houston, TX USA
The Interplay Between Hardware and Control System Design in the Development of the Active Rack Isolation System
Fialho, Ian J., DYNACS Engineering Co., Inc., USA; Thampi, Sreekumar, Boeing North American, Inc., USA; [2000]; 4p; In English; 41st; Structures, Structural Dynamics, and Materials Conference, 3-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A primary mission of the International Space Station (ISS) is to provide a premier microgravity laboratory environment for conducting acceleration sensitive scientific research. In order to accomplish this goal, vibroacoustic disturbances caused by station activities that occur during the microgravity mode of operation, must be controlled. In addition to source isolation and other passive isolation methods, the ISS uses active isolation at the receiver, through the use of an Active Rack Isolation System (ARIS), as part of its overall vibration isolation strategy. A schematic diagram of a typical ARIS payload rack is shown. The ARIS isolation control system senses rack acceleration via three triaxial accelerometer heads and uses eight pushrod actuators to perform active

vibration attenuation. Position sensors housed in the actuator assembly are used to sense the relative position between the rack and the station. Electrical power, data and other essential resources are routed through a set of umbilicals that interface with a passthrough panel at the bottom of the rack. A representative umbilical set is shown.
Author
Hardware; Control Systems Design; Design Analysis; Vibration Isolators

20000032541 NASA Goddard Space Flight Center, Greenbelt, MD USA
Thermal Radiator Pointing for International Space Station
Green, Scott, NASA Goddard Space Flight Center, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

In order to provide thermal radiation environments that result in adequate beat rejection, the single-phase, liquid ammonia (NH3) heat rejection system on the International Space Station (ISS) requires that its two thermal radiator wings be dynamically rotated as the ISS travels through its orbit. This paper discusses the closed-loop, thermal radiator pointing system that is used on ISS to ensure adequate heat rejection by the radiators, while preventing freezing of the ammonia under low heat loads and cold-environmental conditions. Although initial designs used an open-loop approach for radiator pointing, concerns about performance robustness, algorithm complexity, memory requirements, and sustaining support drove the development of a more robust, simpler, closed-loop system. Hence, the challenge of the closed-loop system was to utilize existing sensors, actuators and computers to fit into the existing hardware and software architecture of the ISS. Using a proportional-integral (PI) control architecture with limited output and an anti-windup integrator, the temperature of the ammonia coming out of the radiator is measured and controlled by adjusting the radiator wing orientation. The radiator wing orientation for the local minimum environment is fed forward to the control system, and the closed-loop controller is used to generate a bias off of that local minimum environment in order to heat up the ammonia when necessary to avoid freezing. In the earth's shadow, the controller is suspended and the radiator wing is oriented to face the earth, the local maximum thermal environment which further prevents freezing of the ammonia. This control architecture is shown to provide adequate heat rejection and avoid freezing of the ammonia, even though the physical system consists of large transport delays and time-varying dynamics which change dramatically due to orbit motion and variable heat loads.
Author
Thermal Radiation; Thermal Environments; Liquid Ammonia; International Space Station

20000032752 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Tethered Formation Flying Concept for the SPECS Mission
Quinn, David A., NASA Goddard Space Flight Center, USA; Folta, David C., NASA Goddard Space Flight Center, USA; [2000]; 15p; In English; 23rd; Guidance and Control Conference, 2-6 Feb. 2000, Breckenridge, CO, USA; Sponsored by American Astronomical Society, USA
Report No.(s): AAS-00-015; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Sub-millimeter Probe of the Evolution of Cosmic Structure (SPECS) is a bold new mission concept designed to address fundamental questions about the Universe, including how the first stars formed from primordial material, and the first galaxies from pre-galactic structures, how the galaxies evolve over time, and what the cosmic history of energy release, heavy element synthesis, and dust formation is. Half of the luminosity and 98% of the post Big-Bang photons exit in the sub-millimeter range. The spectrum of our own Milky Way Galaxy shows this, and many galaxies have even more pronounced long-wavelength emissions. There can be no doubt that revolutionary science will be enabled when we have tools to study the sub-millimeter sky with Hubble- Space-Telescope-class resolution and sensitivity. Ideally, a very large telescope with an effective aperture approaching one kilometer in diameter would be needed to obtain such high quality angular resolution at these long wavelengths. However, a single aperture one kilometer in diameter would not only be very difficult to build and maintain at the cryogenic temperatures required for good seeing, but could actually turn out to be serious overkill. Because cosmic sub-millimeter photons are plentiful and the new detectors will be sensitive, the observations needed to address the questions posed above can be made with an interferometer using well established aperture synthesis techniques. Possibly as few as three 3-4 meter diameter mirrors flying in precision formation could be used to collect the light. to mitigate the need for a great deal of propellant, tethers may be needed as well. A spin-stabilized, tethered formation is a possible configuration requiring a more advanced form of formation flying controller, where dynamics are coupled due to the existence of the tethers between nodes in the formation network. The paper presents one such concept, a proposed configuration for a mission concept which combines the best features of structure, tethers and formation flying to meet the ambitious requirements necessary to make a future SPECS mission a success.
Author
Tethering; Mathematical Models; Cosmic Rays; Submillimeter Waves; Spacecraft Configurations; Galactic Structure

20000032976 Boeing Co., Space and Communications Group, Huntsville, AL USA

Space Station Reboost with Electrodynamic Tethers

Vas, Irwin E., Boeing Co., USA; Kelly, Thomas J., Boeing Co., USA; Scarl, Ethan A., Boeing Co., USA; Journal of Spacecraft and Rockets; November-December 1999; Volume 36, No. 6, pp. 1-10; In English

Contract(s)/Grant(s): NAS8-50000; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents the results of a study of an electrodynamic tether system to reboost the International Space Station (ISS). One recommendation is to use a partially bare tether for electron collection. Locations are suggested as to where the tether system is to be attached at the space station. The effects of the tether system on the microgravity environment may actually be beneficial, because the system can neutralize aerodrag during quiescent periods and, if deployed from a movable boom, can permit optimization of laboratory positioning with respect to acceleration contours. Alternative approaches to tether deployment and retrieval are discussed. It is shown that a relatively short tether system, 7 km long, operating at a power level of 5 kW could provide cumulative savings or over a billion dollars during a 10-year period ending in 2012. This savings is the direct result of a reduction in the number or nights that would otherwise be required to deliver propellant for reboost, with larger cost savings for higher tether usage. In addition to economic considerations, an electrodynamic tether promises a practical backup system that could ensure ISS survival in the event of an (otherwise) catastrophic delay in propellant delivery.

Author

International Space Station; Acceleration (Physics); Electrodynamics; Tethering; Tetherlines

20000033143 NASA Johnson Space Center, Houston, TX USA

International Space Station: Expedition 2000

Jan. 01, 2000; In English; Videotape: 55 min. 17 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000043347; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage of the International Space Station (ISS) presents an inside look at the groundwork and assembly of the ISS. Footage includes both animation and live shots of a Space Shuttle liftoff. Phil West, Engineer; Dr. Catherine Clark, Chief Scientist ISS; and Joe Edwards, Astronaut, narrate the video. The first topic of discussion is People and Communications. Good communication is a key component in our ISS endeavor. Dr. Catherine Clark uses two soup cans attached by a string to demonstrate communication. Bill Nye the Science Guy talks briefly about science aboard the ISS. Charlie Spencer, Manager of Space Station Simulators, talks about communication aboard the ISS. The second topic of discussion is Engineering. Bonnie Dunbar, Astronaut at Johnson Space Flight Center, gives a tour of the Japanese Experiment Module (JEM). She takes us inside Node 2 and the U.S. Lab Destiny. She also shows where protein crystal growth experiments are performed. Audio terminal units are used for communication in the JEM. A demonstration of solar arrays and how they are tested is shown. Alan Bell, Project Manager MRMDF (Mobile Remote Manipulator Development Facility), describes the robot arm that is used on the ISS and how it maneuvers the Space Station. The third topic of discussion is Science and Technology. Dr. Catherine Clark, using a balloon attached to a weight, drops the apparatus to the ground to demonstrate Microgravity. The bursting of the balloon is observed. Sherri Dunnette, Imaging Technologist, describes the various cameras that are used in space. The types of still cameras used are: 1) 35 mm, 2) medium format cameras, 3) large format cameras, 4) video cameras, and 5) the DV camera. Kumar Krishen, Chief Technologist ISS, explains inframetrics, infrared vision cameras and how they perform. The Short Arm Centrifuge is shown by Dr. Millard Reske, Senior Life Scientist, to subject astronauts to forces greater than 1-g. Reske is interested in the physiological effects of the eyes and the muscular system after their exposure to forces greater than 1-g.

CASI

International Space Station; Expeditions; Assembling; Astronauts

20000033203 NASA Johnson Space Center, Houston, TX USA

Phase 1 Program Joint Report

Nield, George C., Editor, NASA Johnson Space Center, USA; Vorobiev, Pavel Mikhailovich, Editor, Russian Space Agency, Russia; January 1999; 326p; In Russian

Report No.(s): NASA/SP-1999-6108; S-845; NAS 1.21:6108; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

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

Author

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

20000033273 NASA Marshall Space Flight Center, Huntsville, AL USA

Modal Survey Test of the SOTV 2X3 Meter Off-Axis Inflatable Concentrator

Engberg, Robert C., NASA Marshall Space Flight Center, USA; Lassiter, John O., NASA Marshall Space Flight Center, USA; McGee, Jennie K., SRS Technologies, USA; [2000]; 12p; In English; Structures, Structural Dynamics and Materials Conference, 3-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 00-1639; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA's Marshall Space Flight Center has had several projects involving inflatable space structures. Projects in solar thermal propulsion have had the most involvement, primarily inflatable concentrators. A flight project called Shooting Star Experiment initiated the first detailed design, analysis and testing effort involving an inflatable concentrator that supported a Fresnel lens. The lens was to concentrate the sun's rays to provide an extremely large heat transfer for an experimental solar propulsion engine. Since the conclusion of this experiment, research and development activities for solar propulsion at Marshall Space Flight Center have continued both in the solar propulsion engine technology as well as inflatable space structures. Experience gained in conducting modal survey tests of inflatable structures for the Shooting Star Experiment has been used by dynamic test engineers at Marshall Space Flight Center to conduct a modal survey test on a Solar Orbital Transfer Vehicle (SOTV) off-axis inflatable concentrator. This paper describes how both previously learned test methods and new test methods that address the unique test requirements for inflatable structures were used. Effects of the inherent nonlinear response of the inflatable concentrator on test methods and test results are noted as well. Nine analytical mode shapes were successfully correlated to test mode shapes. The paper concludes with several "lessons learned" applicable to future dynamics testing and shows how Marshall Space Flight Center has utilized traditional and new methods for modal survey testing of inflatable space structures.

Author

Concentrators; Design Analysis; Performance Tests; Dynamic Tests; Inflatable Space Structures; Research and Development

20000033274 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Recovery of TOMS-EP

Robertson, Brent, NASA Goddard Space Flight Center, USA; Sabelhaus, Phil, NASA Goddard Space Flight Center, USA; Mendenhall, Todd, TRW; Fesq, Lorraine, Massachusetts Inst. of Tech., USA; [1998]; 21p; In English

Report No.(s): AAS-00-076; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

On December 13th 1998, the Total Ozone Mapping Spectrometer - Earth Probe (TOMS-EP) spacecraft experienced a Single Event Upset which caused the system to reconfigure and enter a Safe Mode. This incident occurred two and a half years after the launch of the spacecraft which was designed for a two year life. A combination of factors, including changes in component behavior due to age and extended use, very unfortunate initial conditions and the safe mode processing logic prevented the spacecraft from entering its nominal long term storage mode. The spacecraft remained in a high fuel consumption mode designed for temporary use. by the time the onboard fuel was exhausted, the spacecraft was Sun pointing in a high rate flat spin. Although the uncontrolled spacecraft was initially in a power and thermal safe orientation, it would not stay in this state indefinitely due to a slow precession of its momentum vector. A recovery team was immediately assembled to determine if there was time to develop a method of despinning the vehicle and return it to normal science data collection. A three stage plan was developed that used the onboard magnetic torque rods as actuators. The first stage was designed to reduce the high spin rate to within the linear range of the gyros. The second stage transitioned the spacecraft from sun pointing to orbit reference pointing. The final stage returned the spacecraft to normal science operation. The entire recovery scenario was simulated with a wide range of initial conditions to establish the expected behavior. The recovery sequence was started on December 28th 1998 and completed by December 31st. TOMS-EP was successfully returned to science operations by the beginning of 1999. This paper describes the TOMS-EP Safe Mode design and the factors which led to the spacecraft anomaly and loss of fuel. The recovery and simulation efforts are described. Flight data are presented which show the performance of the spacecraft during its return to science. Finally, lessons learned are presented.

Author

Total Ozone Mapping Spectrometer; Anomalies; Computerized Simulation

20000033362 NASA Goddard Space Flight Center, Greenbelt, MD USA

Analysis and Ground Testing for Validation of the Inflatable Sunshield in Space (ISIS) Experiment

Lienard, Sebastien, Universities Space Research Association, USA; Johnston, John, NASA Goddard Space Flight Center, USA; Adams, Mike, NASA Goddard Space Flight Center, USA; Stanley, Diane, NASA Goddard Space Flight Center, USA; Alfano, Jean–Pierre, Universities Space Research Association, USA; Romanacci, Paolo, Universities Space Research Association, USA; [2000]; 12p; In English; 41st; 41st Structures, Structural Dynamics, and Materials Conference, 3-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-1638; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Next Generation Space Telescope (NGST) design requires a large sunshield to protect the large aperture mirror and instrument module from constant solar exposure at its L2 orbit. The structural dynamics of the sunshield must be modeled in order to predict disturbances to the observatory attitude control system and gauge effects on the line of site jitter. Models of large, non-linear membrane systems are not well understood and have not been successfully demonstrated. to answer questions about sunshield dynamic behavior and demonstrate controlled deployment, the NGST project is flying a Pathfinder experiment, the Inflatable Sunshield in Space (ISIS). This paper discusses in detail the modeling and ground-testing efforts performed at the Goddard Space Flight Center to: validate analytical tools for characterizing the dynamic behavior of the deployed sunshield, qualify the experiment for the Space Shuttle, and verify the functionality of the system. Included in the discussion will be test parameters, test setups, problems encountered, and test results.

Author

Dynamic Structural Analysis; Inflatable Structures; Spaceborne Experiments; Heat Shielding; Next Generation Space Telescope Project

20000033453 ISRO Satellite Centre, Peenya, Control Systems Group, Bangalore, India

Dynamics of Flexible Satellites Utilizing Vehicle Free-Free Modes

Maharana, Prashanta K., ISRO Satellite Centre, Peenya, India; Journal of Spacecraft Technology; Jan. 1998; Volume 8, No. 1, pp. 74-82; In English; Copyright; Avail: Issuing Activity

Vehicle free-free modes also known as unconstrained modes, are characterised for spacecraft with cantilevered flexible appendages. These modes are utilized to develop the dynamical modelling of satellites with flexible appendages. This model, like the constrained modes model, is completely described by a set of modal frequencies and coefficients. Modal identities involving the two sets of modal coefficients are derived. Truncation issues along with few merits and demerits of the model are brought out.

Author

Artificial Satellites; Dynamic Response; Flexible Spacecraft; Dynamic Structural Analysis; Spacecraft Structures

20000033455 ISRO Satellite Centre, Peenya, Bangalore, India

An Environment That Assists Spacecraft Configuration

Martin, Kamalini, ISRO Satellite Centre, Peenya, India; Ganeshan, A. S., ISRO Satellite Centre, Peenya, India; Journal of Spacecraft Technology; Jan. 1998; Volume 8, No. 1, pp. 50-60; In English; Copyright; Avail: Issuing Activity

Configuration design comprises both qualitative and quantitative activities. While the qualitative side of the design is characterised by the human inventiveness, creativity, and intuition, the quantitative side dwells on generating numerical answers to the questions that arise from the qualitative side. The design proceeds forward with a continual question and answer iteration between the two sides. The use of a cooperative approach to problem solving works especially well in situations that need creative human interpretation of solutions, i.e., where there is no single 'correct' solution. An environment, IDEAS (Integrated Design Approach for spacecraft), has been developed that supports spacecraft configuration by assisting engineering and managerial decisions. Configuration procedure is viewed as integration of multi-disciplinary knowledge sources, sequencing and a conceptually simple search process for design option combinations. The method of achieving dynamic and flexible design procedures while using a fixed control cycle is described here. A prototype of IDEAS has been successfully demonstrated for the configuration of a geosynchronous spacecraft.

Author

Spacecraft Configurations; Support Systems; Knowledge Based Systems; Synchronous Satellites; Spacecraft Design

20000033620 NASA Marshall Space Flight Center, Huntsville, AL USA

Comparison of Dynamic Characteristics for an Inflatable Solar Concentrator in Atmospheric and Thermal Vacuum Conditions

Slade, Kara N., Duke Univ., USA; Tinker, Michael L., NASA Marshall Space Flight Center, USA; Lassiter, John O., NASA Marshall Space Flight Center, USA; Engberg, Robert, NASA Marshall Space Flight Center, USA; [2000]; 27p; In English; 41st; Structures, Structural Dynamics and Materials, 3-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 242-81-10

Report No.(s): AIAA Paper 2000-1641; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Dynamic testing of an inflatable solar concentrator structure in a thermal vacuum chamber as well as in ambient laboratory conditions is described in detail. Unique aspects of modal testing for the extremely lightweight inflatable are identified, including the use of a noncontacting laser vibrometer measurement system. For the thermal vacuum environment, mode shapes and frequency

response functions are compared for three different test article inflation pressures at room temperature. Modes that persist through all the inflation pressure regimes are identified, as well as modes that are unique for each pressure. In atmospheric pressure and room temperature conditions, dynamic measurements were obtained for the expected operational inflation pressure of 0.5 psig. Experimental mode shapes and frequency response functions for ambient conditions are described and compared to the 0.5 psig results from the thermal vacuum tests. Only a few mode shapes were identified that occurred in both vacuum and atmospheric environments. This somewhat surprising result is discussed in detail, and attributed at least partly to 1.) large differences in modal damping, and 2.) significant differences in the mass of air contained by the structure, in the two environments. Results of this investigation point out the necessity of testing inflatable space structures in vacuum conditions before they can be launched. Ground testing in atmospheric pressure is not sufficient for predicting on-orbit dynamics of non-rigidized inflatable systems.
Author
Dynamic Characteristics; Dynamic Tests; Inflatable Space Structures; Inflatable Structures; Solar Collectors; Thermal Vacuum Tests; Vacuum Chambers

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.

20000032966 NASA Marshall Space Flight Center, Huntsville, AL USA
Chandra X-Ray Observatory Pointing Control System Performance During Transfer Orbit and Initial On-Orbit Operations
Quast, Peter, TRW Space and Electronics Group, USA; Tung, Frank, TRW Space and Electronics Group, USA; West, Mark, NASA Marshall Space Flight Center, USA; Wider, John, TRW Space and Electronics Group, USA; Feb. 02, 2000; 19p; In English; 23rd; 23rd Guidance and Control Conference, 2-6 Feb. 2000, Breckenridge, CO, USA; Sponsored by American Astronautical Society, USA
Report No.(s): AAS-00-074; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Chandra X-ray Observatory (CXO, formerly AXAF) is the third of the four NASA great observatories. It was launched from Kennedy Space Flight Center on 23 July 1999 aboard the Space Shuttle Columbia and was successfully inserted in a 330 x 72,000 km orbit by the Inertial Upper Stage (IUS). Through a series of five Integral Propulsion System burns, CXO was placed in a 10,000 x 139,000 km orbit. After initial on-orbit checkout, Chandra's first light images were unveiled to the public on 26 August, 1999. The CXO Pointing Control and Aspect Determination (PCAD) subsystem is designed to perform attitude control and determination functions in support of transfer orbit operations and on-orbit science mission. After a brief description of the PCAD subsystem, the paper highlights the PCAD activities during the transfer orbit and initial on-orbit operations. These activities include: CXO/IUS separation, attitude and gyro bias estimation with earth sensor and sun sensor, attitude control and disturbance torque estimation for delta-v burns, momentum build-up due to gravity gradient and solar pressure, momentum unloading with thrusters, attitude initialization with star measurements, gyro alignment calibration, maneuvering and transition to normal pointing, and PCAD pointing and stability performance.
Author
X Ray Astrophysics Facility; Spaceborne Astronomy; X Ray Astronomy

20000033219 GenCorp Aerojet, Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Engineering Test Report, AMSU-A2 METSAT Instrument (S/N 105) Vibration Tests Summary P/N 1331200-2
Heffner, R., GenCorp Aerojet, USA; March 1999; 35p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1999-209504; NAS 1.26:209504; Rept-11441; CDRL-207; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the Engineering Test Report, AMSU-A2 METSAT Instrument (S/N 105) Vibration Tests Summary, P/N 1331720-2, for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).
Author
Advanced Microwave Sounding Unit; Vibration Tests; Earth Observing System (EOS); Meteorological Satellites

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.

20000032185 Michigan Univ., Coll. of Engineering, Ann Arbor, MI USA
Final Report for Sounding Rocket ***Final Report, 11 Feb. 1997 - 31 Jan. 2000***
Clarke, John T., Michigan Univ., USA; [2000]; 3p; In English
Contract(s)/Grant(s): NAG5-5121; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
This paper presents a final report on sounding rocket flight activity. The period of performance is from 11 February 1997 to 31 January 2000.
CASI
Rocket Flight; Sounding Rockets; Rocket Launching

20000032212 Jackson State Univ., Dept. of Computer Science, Jackson, MS USA
An Object Model for a Rocket Engine Numerical Simulator
Mitra, D., Jackson State Univ., USA; Bhalla, P. N., Jackson State Univ., USA; Pratap, V., Jackson State Univ., USA; Reddy, P., Jackson State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 527-532; In English; See also 20000032189
Contract(s)/Grant(s): NCC3-437; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
Rocket Engine Numerical Simulator (RENS) is a packet of software which numerically simulates the behavior of a rocket engine. Different parameters of the components of an engine is the input to these programs. Depending on these given parameters the programs output the behaviors of those components. These behavioral values are then used to guide the design of or to diagnose a model of a rocket engine ”built” by a composition of these programs simulating different components of the engine system. In order to use this software package effectively one needs to have a flexible model of a rocket engine. These programs simulating different components then should be plugged into this modular representation. Our project is to develop an object based model of such an engine system. We are following an iterative and incremental approach in developing the model, as is the standard practice in the area of object oriented design and analysis of softwares. This process involves three stages: object modeling to represent the components and sub-components of a rocket engine, dynamic modeling to capture the temporal and behavioral aspects of the system, and functional modeling to represent the transformational aspects. This article reports on the first phase of our activity under a grant (RENS) from the NASA Lewis Research center. We have utilized Rambaugh’s object modeling technique and the tool UML for this purpose. The classes of a rocket engine propulsion system are developed and some of them are presented in this report. The next step, developing a dynamic model for RENS, is also touched upon here. In this paper we will also discuss the advantages of using object-based modeling for developing this type of an integrated simulator over other tools like an expert systems shell or a procedural language, e.g., FORTRAN. Attempts have been made in the past to use such techniques.
Author
Rocket Engines; Computerized Simulation; Applications Programs (Computers); Simulators; Engine Design; Design Analysis; Liquid Propellant Rocket Engines; Propulsion System Performance

20000032522 TRW Space Technology Labs., Redondo Beach, CA USA
High Pressure Earth Storable Rocket Technology Program-Hipes Options 1/2 Report ***Final Report***
Chazen, M. L., TRW Space Technology Labs., USA; Sicher, D., TRW Space Technology Labs., USA; Calvignac, J., TRW Space Technology Labs., USA; Ono, D., TRW Space Technology Labs., USA; June 1999; 57p; In English
Contract(s)/Grant(s): NAS3-27002; RTOP 632-1B-1B
Report No.(s): NASA/CR-1999-209168; NAS 1.26:209168; E-11765; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Under the High Pressure Earth Storable Rocket Technology (HIPES) Program, TRW successfully completed testing of two 100 lbf thrust class rhenium chambers using N204-MMH. The first chamber was successfully fired for 4789 seconds of operating time with a maximum duration of 700 seconds. This chamber had been previously fired for 5230 seconds with N2O4-N2H4. The second chamber was successfully fired for 8085 seconds with a maximum firing duration of 1200 seconds. The Isp (specific impulse) for both chambers ranged from 323 lbf-sec/lbm to 330 lbf-sec/lbm.
Author
High Pressure; Thrust Chambers; Rocket Engine Design; Engine Tests; Space Storage

20000032792 Department of the Navy, Washington, DC USA
Rocket Motor With Desensitizer Injector
Kunstmann, John F., Inventor; Jan. 04, 2000; 10p; In English
Patent Info.: Filed 4 Jan. 2000; US-Patent-Appl-SN-09/477,149
Report No.(s): AD-D019609; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
A rocket motor having a desensitizing mechanism for preventing explosion or energetic burning during slow cook-off is provided. The rocket motor includes a case contained rocket propellant with a desensitizing assembly attached forward of the propellant charge. The desensitizing assembly is formed with an enclosure containing a desensitizing fluid, connected to the interior of the rocket motor by a tube which is sealed by a heat activated plug. The heat activated plug melts at a temperature below the slow cook-off temperature of the rocket propellant. The melting of the plug allows the desensitizing fluid to be injected into the core of the propellant thereby desensitizing the propellant.
DTIC
Patent Applications; Rocket Engines; Injectors; Firing (Igniting); Desensitizing

20000032841 Martin Marietta Astronautics, Denver, CO USA
High-Performance, Flexible, Deployable Array Development for Space Applications
Gehling, Russell N., Martin Marietta Astronautics, USA; Armstrong, Joseph H., Martin Marietta Astronautics, USA; Misra, Mohan S., Martin Marietta Astronautics, USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 287-297; In English; See also 20000032812
Contract(s)/Grant(s): IR/D Proj. D-17R; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche
Flexible, deployable arrays are an attractive alternative to conventional solar arrays for near-term and future space power applications, particularly due to their potential for high specific power and low stowage volume. Combined with low-cost flexible thin-film photovoltaics, these arrays have the potential to become an enabling or an enhancing technology for many missions. In order to expedite the acceptance of thin-film photovoltaics for space applications, however, parallel development of flexible photovoltaics and the corresponding deployable structure is essential. Many innovative technologies must be incorporated in these arrays to ensure a significant performance increase over conventional technologies. For example, innovative mechanisms which employ shape memory alloys for stowage latches, deployment mechanisms, and array positioning gimbals can be incorporated into flexible array design with significant improvement in the areas of cost, weight, and reliability. This paper discusses recent activities at Martin Marietta regarding the development of flexible, deploy- able solar array technology. Particular emphasis is placed on the novel use of shape memory alloys for lightweight deployment elements to improve the overall specific power of the array. Array performance projections with flexible thin-film copper-indium-diselenide (CIS) are presented, and Government-sponsored solar array programs recently initiated at Martin Marietta through NASA and Air Force Phillips Laboratory are discussed.
Author
Deployment; Solar Arrays; Technology Utilization; Photovoltaic Conversion; Performance Prediction

20000032842 NASA Lewis Research Center, Cleveland, OH USA
Static Stability of a Three-Dimensional Space Truss
Shaker, John F., NASA Lewis Research Center, USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 299-312; In English; See also 20000032812; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche
Space Station requirements for power have resulted in a need for photovoltaic solar arrays possessing large blanket surface area. However, due to the limited Shuttle payload volume solar array designers have been driven to a deployable concept that by nature is extremely flexible. The principal support for this array system is the Folding Articulating Square Truss Mast (FASTMast). In order to accommodate service loads the FASTMast is expected to exhibit nonlinear behavior which could possibly result in structural instability. Presented herein are the results of the Lewis Research Center test and analysis efforts performed in an effort to characterize the FASTMast structural behavior in terms of stability. Results include those obtained from recent

nonlinear testing and analysis involving a 1/10 segment of the FASTMast flight article. Implications of these results as they relate to expected behavior of the flight unit will also be discussed.
Author
Static Stability; Photovoltaic Conversion; Solar Arrays; Nonlinear Systems

20000032845 NASA Lewis Research Center, Cleveland, OH USA
An Update on the Development of a Line-Focus Refractive Concentrator Array
Piszczor, Michael F., NASA Lewis Research Center, USA; ONeill, Mark J., ENTECH Corp., USA; Fraas, Lewis M., JX Crystals, Inc., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 313-322; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Concentrator arrays offer a number of generic benefits for space (i.e. high array efficiency, protection from space radiation effects, minimized plasma interactions, etc.). The line-focus refractive concentrator concept, however, also offers two very important advantages: (1) relaxation of precise array tracking requirements to only a single axis and (2) low-cost mass production of the lens material. The linear refractive concentrator can be designed to provide an essentially flat response over a wide range of longitudinal errors for satellites having only single-axis tracking capability. New panel designs emphasize light weight, high stiffness, stowability and ease of manufacturing and assembly. This paper will address the current status of the concentrator program with special emphasis on the design implications, and flexibility, of using a linear refractive concentrator lens as well as detail the recent fabrication of prototype hardware.
Author
Concentrators; Arrays; Prototypes; Manufacturing; Flexibility; Fabrication; Design Analysis

20000033276 National Defence Research Establishment, Avd. foer Vapen och Skydd, Tumba, Sweden
Travel Report from the Meeting of the Applied Vehicle Technology Panel (AVT) ***Reserapport fran 'the Meeting of the Applied Vehicle Technology Panel (AVT***
Sanden, R.; Ax, L.; May 1999; 24p; In Swedish, 19-23 Apr. 1999, Corfu, Greece; Sponsored by Applied Vehicle Technology Panel, Unknown
Report No.(s): PB2000-103073; FOA-R-99-01175-310-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This report contains information of special interest from the first symposium arranged for the new NATO organization, AVT. The meetings was directed towards technical questions and aging studies on small rocket motors and gas generators for tactical systems, which may come in the near future. New designs and applications of different rocket motors were presented. What was presented at the meeting gives a good overview of the current subject.
NTIS
Conferences; Rocket Engines; Aging (Materials); Gas Generators

20000033457 ISRO Satellite Centre, Peenya, Liquid Propulsion Systems Centre, Bangalore, India
Evolution and Growth of Spacecraft Propulsion Systems
Ramamurthi, K., ISRO Satellite Centre, Peenya, India; Nair, G. Madhavan, ISRO Satellite Centre, Peenya, India; Journal of Spacecraft Technology; Jan. 1998; Volume 8, No. 1, pp. 1-22; In English; Copyright; Avail: Issuing Activity

The different categories of spacecraft propulsion systems are reviewed with specific reference to their applications, principles of operation, performance and capabilities. The limitations of the widely-employed conventional chemical propulsion systems are discussed and the possibilities of improving them to give higher performance with reduced contamination of the spacecraft am highlighted. The feed systems and thrusters, which form the key elements of the propulsion system, are evaluated for their application in orbiting satellites. The different electrical and nuclear propulsion systems are studied..The review brings to focus the limitations and growth potential of the different spacecraft propulsion systems.
Author
Chemical Propulsion; Feed Systems; Nuclear Propulsion; Propulsion System Performance

20000033621 NASA Marshall Space Flight Center, Huntsville, AL USA
Probabilistic Structural Analysis of the Solid Rocket Booster Aft Skirt External Fitting Modification
Townsend, John S., NASA Marshall Space Flight Center, USA; Peck, Jeff, NASA Marshall Space Flight Center, USA; Ayala, Samuel, Sverdrup Technology, Inc., USA; [2000]; 39p; In English; 40th; Structures, Structural Dynamics and Materials, 12-15 Apr. 1999, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA has funded several major programs (the Probabilistic Structural Analysis Methods Project is an example) to develop probabilistic structural analysis methods and tools for engineers to apply in the design and assessment of aerospace hardware. A probabilistic finite element software code, known as Numerical Evaluation of Stochastic Structures Under Stress, is used to determine the reliability of a critical weld of the Space Shuttle solid rocket booster aft skirt. An external bracket modification to the aft skirt provides a comparison basis for examining the details of the probabilistic analysis and its contributions to the design process. Also, analysis findings are compared with measured Space Shuttle flight data.
Author
Probability Theory; Stochastic Processes; Structural Analysis; Stress Analysis; Nastran; NASA Programs; Design Analysis

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.

20000032201 Tuskegee Inst., Center for Food and Environmental Systems for Human Exploration of Space (CFESH), AL USA
Systems Characterization of Temperature, pH and Electrical Conductivity in Aerobic Biodegradation of Wheat Biomass at Differing Mixing Rates
Calhoun, M., Tuskegee Inst., USA; Trotman, A., Tuskegee Inst., USA; Aglan, H., Tuskegee Inst., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 501-506; In English; See also 20000032189; Sponsored in part from the USDA/CSREES
Contract(s)/Grant(s): NCC9-51; ALX-FS-2; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
The purpose of this preliminary study is to observe and relate the rate of mixing to pH and electrical conductivity in an aerobic, continuously stirred bioreactor. The objective is to use data collected from successive experiments as a means of a system characterization. Tests were conducted to obtain these data using a continuously stirred 20 L Cytostir glass reaction vessel as a bioreactor operated without built-in temperature or pH control. The tests were conducted on the lab bench at ambient temperatures. The substrate in the bioreactor was ground wheat biomass obtained from the Biomass Production Chamber at NASA Kennedy Space Center. In this study, the data reflect characteristics of the native (uninoculated) systems as well as inoculated systems. In the native systems, it was found that pi levels became stable after approximately 2 to 3 days. The electrical conductivity levels for the native systems tended to decrease over time. In contrast, ion activity was increased after the introduction of bacteria into the system. This could be correlated with the release of nutrients, due to the activity of the bacteria. Also, there were slight increases in pH in the inoculated system, a result which is expected for a system with no active pr controls. The data will be used to test a mathematical model in an automated system.
Author (revised)
Ph; Electrical Resistivity; Wheat; Mathematical Models; Bioreactors; Biodegradation; Active Control

20000032248 Atlanta Univ., Dept. of Chemistry, GA USA
Synthesis of New Heterocyclic Imidazoles for Nonlinear Optical Chromophores
Li, Haiying, Atlanta Univ., USA; Santos, Javier, Atlanta Univ., USA; VanDerveer, Donald, Georgia Inst. of Tech., USA; Mintz, Eric A., Atlanta Univ., USA; Bu, Xiu R., Atlanta Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 671-673; In English; See also 20000032189
Contract(s)/Grant(s): NAGw-2939; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM
A series of novel NLO (chromophores) imidazole chromophores containing tricyanovinyl acceptor coupled with thiophene have been developed.
Author
Synthesis (Chemistry); Heterocyclic Compounds; Nonlinearity; Optical Properties; Chromophores

20000033090 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Research on Low Temperature Formation of Silicon Thin Film Using Low Energy Ion Bombardment Process
Shindo, Wataru, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 88-91; In Japanese; Copyright; Avail: Issuing Activity

This dissertation presents low temperature silicon film deposition and highly effective yield management methodologies for deep submicron LSIs. The effects of ion energy, ion flux, and ion species on low temperature (300-350 C) silicon thin film deposition utilizing low energy ion bombardment process are investigated. In addition, methodologies for accurate yield prediction and efficient detection of process deterioration based on in-line wafer inspection are presented.
Author
Silicon Films; Ion Irradiation; Deposition

20000033270 Boeing Phantom Works, Seattle, WA USA
Development of the Spacecraft Materials Selector Expert System
Pippin, H. G., Boeing Phantom Works, USA; [2000]; 10p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS8-98213
Report No.(s): AIAA Paper 2000-0243; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
A specific knowledge base to evaluate the on-orbit performance of selected materials on spacecraft is being developed under contract to the NASA SEE program. An artificial intelligence software package, the Boeing Expert System Tool (BEST), contains an inference engine used to operate knowledge bases constructed to selectively recall and distribute information about materials performance in space applications. This same system is used to make estimates of the environmental exposures expected for a given space flight. The performance capabilities of the Spacecraft Materials Selector (SMS) knowledge base are described in this paper. A case history for a planned flight experiment on ISS is shown as an example of the use of the SMS, and capabilities and limitations of the knowledge base are discussed.
Author
Applications Programs (Computers); Artificial Intelligence; Expert Systems; Technology Utilization

24
COMPOSITE MATERIALS

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

20000032286 Clark-Atlanta Univ., High Performance Polymers and Ceramics (HiPPAC) Center, GA USA
Interlaminar Shear Properties of Low-Density, Low-Conductivity Pan Ablative Composites
Veazie, David R., Clark-Atlanta Univ., USA; Grover, Ronald O., Jr., Clark-Atlanta Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 223-228; In English; See also 20000032189
Report No.(s): 98URC041; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
In this study, the mechanical response of six low-density, low conductivity polyacrylonitrile (PAN) based carbon fiber reinforced phenolic resin composites was investigated. Six panels were fabricated at various autoclave cure pressures and ceramic microballoon filler content. of the six PAN composite panels, two panels each were fabricated with 20 deg/0, 15 deg/0 or 10% ceramic microballoon filler content. Composites with 20% microballoon content were cured at pressures of 1.65 MPa and 0.35 MPa, whereas panels with 15 deg/0 microballoon content were cured at 1.65 MPa and 0.69 MPa. Composites with 10% microballoon content were cured at 1.65 MPa and 0.35 MPa. The improvement in mechanical properties achieved by the influences of the microballoon content and the cure pressure was assessed by comparing the ultimate interlaminar shear strength of the composite at room temperature. Results included ultimate interlaminar shear strength of the PAN composites, and the description of the unique experimental techniques required by testing of brittle composites.
Author
Shear Properties; Ablation; Low Conductivity; Interlaminar Stress; Polyacrylonitrile; Composite Structures; Density (Mass/Volume)

20000032294 North Carolina Agricultural and Technical State Univ., Dept. of Mechanical Engineering, Greensboro,NC USA
A New Approach to Overcoming Spatial Aliasing in Structural Damage Detection
Schulz, Mark J., North Carolina Agricultural and Technical State Univ., USA; Naser, Ahmad S., North Carolina Agricultural and Technical State Univ., USA; Thyagarajan, Sunil K., North Carolina Agricultural and Technical State Univ., USA; Mickens, Travluss, North Carolina Agricultural and Technical State Univ., USA; Pai, Frank, Missouri Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 801-806; In English; See also 20000032189

Contract(s)/Grant(s): NCC1-255
Report No.(s): 98URC143; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Aircraft, reusable launch vehicles,unmanned aircraft, and other advanced structures are being built using lightweight composite materials/metals with design safety factors as low as 1.25. These advanced structures operate in uncertain and severe environments and are susceptible to damage such as delamination, fiber/matrix damage, hydrothermal strain in composite materials, and fatigue and cracking in metals. to ensure human safety and load-bearing integrity these structures must be inspected to detect and locate often invisible damage and faults before they become catastrophic. Conventional methods of non-destructive evaluation sometimes miss significant damage and are time consuming and expensive to perform. In contrast, vibrometry or vibration signature techniques are a global method of structural integrity monitoring that potentially can efficiently detect damage on large structures, including damage that is away from sensor locations, and in the interior of structures. However, a barrier problem in damage detection using vibration measurements is the need to measure the vibration response at a large number of points on the structure. Typically, model reduction or expansion procedures such as Guyan reduction or dynamic expansion are attempted to overcome the problem of insufficient measurements or spatial aliasing. These approaches depend on using information from the healthy model, and thus put error into the reduction used to represent the damaged structure. In this paper, a Frequency Response Function technique is used to detect damage to a fixed-free beam. The technique uses measured frequency response functions from the healthy structure as reference data, and then monitors vibration measurements during the life of the structure to detect damage. In an analytical simulation using a finite-element model of a beam, damage was located using only sparse measurements because the technique uses both rotation and translation measurements from the damaged structure.
Author

Structural Analysis; Damage Assessment; Spatial Dependencies; Mathematical Models; Computerized Simulation

20000032296 North Carolina Agricultural and Technical State Univ., Dept. of Mechanical Engineering, Greensboro,NC USA

Damage Detection and Impact Testing on Laminated and Sandwich Composite Panels

Hughes, Derke R., North Carolina Agricultural and Technical State Univ., USA; Craft, William J., North Carolina Agricultural and Technical State Univ., USA; Schulz, Mark J., North Carolina Agricultural and Technical State Univ., USA; Naser, Ahmad S., North Carolina Agricultural and Technical State Univ., USA; Martin, William N., North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 807-812; In English; See also 20000032189
Contract(s)/Grant(s): NCC1-255
Report No.(s): 98URC144; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

This research investigates health monitoring of sandwich shell composites to determine if the Transmittance Functions (TF) are effective in determining the present of damage. The health monitoring test was conducted on the sandwich plates before and after low velocity impacts using the health monitoring technique given in TFs are a NDE (Nondestructive Evaluation) technique that utilizes the ratios of cross-spectrums to auto-spectrums between two response points on the sandwich composites. The test for transmittance was conducted on the same density foam core throughout the experiment. The test specimens were 17.8 cm by 25.4 cm in dimension. The external sheets (face sheets) were created from graphite/epoxy laminate with dimension of 1.58 mm thick. The polymethacrylide (Rohacell) foam core was 12.7 mm thick. These samples experienced a transformation in the TF that was considered the low velocity impact damage. The low velocity damage was observed in the TFs for the sandwich composites.
Author

Impact Tests; Damage Assessment; Sandwich Structures; Laminates; Panels; Graphite-Epoxy Composites; Detection

20000032863 Pisa Univ., Dept. of Aerospace Engineering, Italy

Damage Tolerance Characteristics of Composite Sandwich Structures

Lazzeri, L., Pisa Univ., Italy; Mariani, U., Agusta S.p.A., Italy; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 4 - 1 - 4 - 6; In English; See also 20000032859; Copyright Waived; Avail: CASI; A02, Hardcopy

Current damage tolerance requirements impose strict constraints on the design of composite aircraft structures, since the various forms of defects taken into consideration must show ”no-growth” characteristics in the environmental and loading conditions expected in the operative life. A research activity was carried out by Agusta, in collaboration with the University of Pisa, with the purpose of assessing the damage tolerance characteristics of typical composite sandwich structures used by the helicopter industry. A particular effort was dedicated to the study of delamination growth under compression loading, a basic step for understanding the damage tolerance behaviour of composite structures. The results of the numerical analysis carried out show

that G, the Strain Energy Release Rate, is a suitable parameter for describing the behaviour of the delamination, but it is essential to consider its partition according to the fundamental modes.
Author
Helicopter Design; Aircraft Structures; Composite Structures; Damage; Delaminating; Helicopters; Sandwich Structures; Tolerances (Mechanics)

20000032864 Imperial Coll. of Science, Technology and Medicine, Dept. of Aeronautics, London, UK
Damage Tolerance to Low Velocity Impact of Laminated Composites
Davies, G. A. O., Imperial Coll. of Science, Technology and Medicine, UK; Hitchings, D., Imperial Coll. of Science, Technology and Medicine, UK; Zhang, X., Imperial Coll. of Science, Technology and Medicine, UK; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 6 - 1 - 6 - 13; In English; See also 20000032859; Sponsored in part by British Aerospace (Military and Aerostructure); Copyright Waived; Avail: CASI; A03, Hardcopy

A strategy is developed for predicting easily the threshold energy for delamination caused by impact, whatever the nature of the laminated structure. The actual delamination and fiber damage is also predicted and the consequent compression-after-impact strengths. The latter strategies may be approximate but current research is pointing the way to more accurate solutions based on finding energy-release-rates around the delamination front.
Author
Delaminating; Tolerances (Mechanics); Impact Damage; Aircraft Structures; Composite Structures; Impact Resistance

20000032867 Eurocopter Deutschland G.m.b.H., Munich, Germany
Fatigue Substantiation and Damage Tolerance Evaluation of Fiber Composite Helicopter Components
Bansemir, H., Eurocopter Deutschland G.m.b.H., Germany; Emmerling, S., Eurocopter Deutschland G.m.b.H., Germany; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 11 - 1 -11 - 11; In English; See also 20000032859
Report No.(s): ECD-0096-99-PUB; Copyright Waived; Avail: CASI; A03, Hardcopy

Helicopter rotor systems are dynamically loaded structures with many composite components such as main and tail rotor blades and rotor hubs. The new civil helicopter EC135 has a bearingless main rotor system certified according to the ”Special Condition for Primary Structures Designed with Composite Material” of the German airworthiness authority LBA containing increased safety demands. This special condition addresses subjects like: demonstration of ultimate load capacity including consideration of manufacturing and impact damages; fatigue evaluation for parts suitable or unsuitable for damage tolerance method and the related inspection procedures; investigation of growth rate of damages that may occur from fatigue, corrosion, intrinsic, and manufacturing defects or damages from discrete sources under repeated loads expected in service; residual strength requirements; consideration of the effects of material variability and environmental conditions like hot/wet strength degradation etc.; and substantiation of bonded joints. The fatigue tolerance evaluation and damage tolerance substantiation for composite structures are shown in this paper. The fulfillment of the ”Special Conditions” is demonstrated for the main rotor blade of the ECl35. T’he fatigue tolerance evaluation and damage tolerance sub- stantiation for composite structures are shown in this paper. The fulfillment of the ’Special Conditions’ is demonstrated for the main rotor blade of the EC 135.
Author
Aircraft Reliability; Composite Materials; Composite Structures; Damage; Degradation; Fiber Composites; Helicopters; Impact Damage; Rotary Wings; Tolerances (Mechanics); Fatigue (Materials); C-135 Aircraft

20000033016 Old Dominion Univ., Norfolk, VA USA
A Comparison of Quasi-Static Indentation and Drop-Weight Impact Testing on Carbon/Epoxy Laminates ***Final Report, 16 Dec. 1998 - 15 Dec. 1999***
Prabhakaran, R., Old Dominion Univ., USA; Douglas, Michael J., Old Dominion Univ., USA; [2000]; 71p; In English
Contract(s)/Grant(s): NAG1-2156; ODURF Proj. 191861; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This project was initiated to investigate the damage tolerance of polymer matrix composites (PMC). After a low velocity impact-such as the ones that can occur during manufacturing or service there is usually very little visual damage. There are two possible methods to simulate foreign object impact on PMC: static indentation and drop weight impact. A static method for modeling low velocity foreign object impact events for composites can prove to be very beneficial to researchers since much more data can be obtained from a static test than from an impact test. In order to examine if this is feasible, a series of static indentation and low velocity impact tests were performed and compared. Square specimens of different sizes and thicknesses were tested to cover a wide array of low velocity impact events. Laminates with a 45 degree stacking sequence were used since this is a common type of engineering laminate. Three distinct flexural rigidities under two different boundary conditions were tested in order to

obtain damage due to large deflections. Comparisons between static indentation and low velocity impact tests were based on the maximum applied transverse load. The dependent parameters examined were dent depth, back surface crack length, delamination area, and load-deflection behavior. Results showed that no distinct differences could be seen between the static indentation tests and the low velocity impact tests, indicating that static indentation tests can be used to simulate low velocity impact events.
Author
Epoxy Matrix Composites; Impact Tests; Laminates; Polymer Matrix Composites; Indentation; Drop Tests

20000033285 National Defence Research Establishment, Div. of Systems and Underwater Technology, Stockholm, Sweden
Frequency Selective Fibre Reinforced Thermoplastic Radome Structure ***Frekvensselelektiv Radomstruktur av Fiberarmerad Termoplast***
Larsson, F., National Defence Research Establishment, Sweden; Dec. 1998; 32p; In Swedish; Original contains color illustrations Report No.(s): PB2000-103140; FOA-R-98-00977-615-SE; No Copyright; Avail: National Technical Information Service (NTIS)

An investigation has been performed on the possibilities to obtain a frequency selective fiber reinforced thermoplastic radome structure with a high pass character. An introductory study gave the result that it is relatively easy to obtain such a structure by melting a grid of a twinned carbon fiber yarn into the thermoplastic resin. Structures with different grid arrangements have been designed, one with the grid in the middle and one with the grid on one of its surfaces have been manufactured and measured concerning reflection. A symmetric grid arrangement seems to give the greatest camouflage effect. However it is easiest to retro-fit a conventional radome with a grid on the outside surface. Calculated and measured reflection are in agreement in the pass band for the structure with the grid on one surface. On the other hand there are great differences for the structure with the grid in the middle, probably caused by lack of symmetry. The structures lose their transmission windows at high angles of incidence if thickness correction can not be applied.
NTIS
Composite Structures; Radomes; Reinforced Plastics; Radome Materials; Fiber Composites

20000033690 NASA Lewis Research Center, Cleveland, OH USA
Damage Progression in Bolted Composites
Minnetyan, Levon, Clarkson Univ., USA; Chamis, Christos C., NASA Lewis Research Center, USA; Gotsis, Pascal K., NASA Lewis Research Center, USA; Journal of Thermoplastic Composite Materials; May 1998; Volume 2, pp. 231-248; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Structural durability, damage tolerance, and progressive fracture characteristics of bolted graphite/epoxy composite laminates are evaluated via computational simulation. Constituent material properties and stress and strain limits are scaled up to the structure level to evaluate the overall damage and fracture propagation for bolted composites. Single and double bolted composite specimens with various widths and bolt spacings are evaluated. The effect of bolt spacing is investigated with regard to the structural durability of a bolted joint. Damage initiation, growth, accumulation, and propagation to fracture are included in the simulations. Results show the damage progression sequence and structural fracture resistance during different degradation stages. A procedure is outlined for the use of computational simulation data in the assessment of damage tolerance, determination of sensitive parameters affecting fracture, and interpretation of experimental results with insight for design decisions.
Author
Bolted Joints; Bolts; Composite Structures; Graphite-Epoxy Composites; Stress-Strain Relationships; Damage Assessment; Laminates; Fracturing; Structural Analysis

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.

20000032106 University of Southern California, Dept. of Aerospace and Mechanical Engineering, Los Angeles, CA USA
Studies of Premixed Laminar and Turbulent Flames at Microgravity
Abid, M., University of Southern California, USA; Aung, K., University of Southern California, USA; Ronney, P. D., University of Southern California, USA; Sharif, J. A., University of Southern California, USA; Wu, M.–S., University of Southern California, USA; [1999]; 8p; In English; 5th; Microgravity Combustion, 18-20 May 1999, Cleveland, OH, USA

Contract(s)/Grant(s): NAS3-2124; RTOP 101-32-0D; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Several topics relating to combustion limits in premixed flames at reduced gravity have been studied. These topics include: (1) flame balls; (2) numerical simulation of flame ball and planar flame structure and stability; (3) experimental simulation of buoyancy effects in premixed flames using aqueous autocatalytic reactions; and (4) premixed flame propagation in Hele-Shaw cells.
Author

Buoyancy; Combustion; Flame Propagation; Flame Stability; Microgravity; Premixed Flames; Direct Numerical Simulation; Turbulent Flames

20000032152 California Univ., Lawrence Berkeley Lab., Environmental Energy Technologies Div., Berkeley, CA USA

Effects of Buoyancy on Lean Premixed V-Flames Part I: Laminar and Turblent Flame Structure

Cheng, Robert K., California Univ., Lawrence Berkeley Lab., USA; Bedat, Benoit, California Univ., Lawrence Berkeley Lab., USA; Kostiuk, Larry W., Alberta Univ., Canada; Combustion and Flame; 1998; ISSN 0010-2180; Volume 116, pp. 360-375; In English

Contract(s)/Grant(s): NAS3-2000; DE-AC03-76F0-0098; Copyright; Avail: Issuing Activity

Laser schlieren and planar laser-induced fluorescence techniques have been used to investigate laminar and turbulent v-flames in +g, -g, and micro g under flow conditions that span the regimes of momentum domination (Ri is less than 0. 1) and buoyancy domination (Ri is greater than 0.1). Overall flame features shown by schlieren indicate that buoyancy dominates the entire flow field for conditions close to Ri = 1. With decreasing Ri, buoyancy effects are observed only in the far-field regions. Analyses of the mean flame angles demonstrate that laminar and turbulent flames do not have similar responses to buoyancy. Difference in the laminar +g and -g flame angles decrease with Ri (i.e., increasing Re) and converge to the microgravity flame angle at the momentum limit (Ri - 0). This is consistent with the notion that the effects of buoyancy diminish with increasing flow momentum. The +g and -g turbulent flame angles, however, do not converge at Ri = 0. As shown by OH-PLIF images, the inconsistency in +g and -g turbulent flame angles is associated with the differences in flame wrinkles. Turbulent flame wrinkles evolve more slowly in +g than in -g. The difference in flame wrinkle structures, however, cannot be explained in terms of buoyancy effects on flame instability mechanisms. It seems to be associated with the field effects of buoyancy that stretches the turbulent flame brushes in +g and compresses the flame brush in -g. Flame wrinkling offers a mechanism through which the flame responds to the field effects of buoyancy despite increasing flow momentum. These observations point to the need to include both upstream and downstream contributions in theoretical analysis of flame turbulence interactions.
Author

Flame Propagation; Premixed Flames; Turbulent Flames; Buoyancy; Microgravity

20000032154 Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

Soot Formation in Laminar Premixed Methane/Oxygen Flames at Atmospheric Pressure

Xu, F., Michigan Univ., USA; Lin, K.–C., Michigan Univ., USA; Faeth, G. M., Michigan Univ., USA; Combustion and Flame; 1998; ISSN 0010-2180; Volume 115, pp. 195-209; In English

Contract(s)/Grant(s): NAS3-1245; NAS3-1878; NAS3-2048; RTOP 101-12-0A; Copyright; Avail: Issuing Activity

Flame structure and soot formation were studied within soot-containing laminar premixed mc1hane/oxygen flames at atmospheric pressure. The following measurements were made: soot volume fractions by laser extinction, soot temperatures by multiline emission, gas temperatures (where soot was absent) by corrected fine-wire thermocouples, soot structure by thermophoretic sampling and transmission electron microscope (TEM), major gas species concentrations by sampling and gas chromatography, and gas velocities by laser velocimetry. Present measurements of gas species concentrations were in reasonably good agreement with earlier measurements due to Ramer et al. as well as predictions based on the detailed mechanisms of Frenklach and co-workers and Leung and Lindstedt: the predictions also suggest that H atom concentrations are in local thermodynamic equilibrium throughout the soot formation region. Using this information, it was found that measured soot surface growth rates could be correlated successfully by predictions based on the hydrogen-abstraction/carbon-addition (HACA) mechanisms of both Frenklach and co-workers and Colket and Hall, extending an earlier assessment of these mechanisms for premixed ethylene/air flames to conditions having larger H/C ratios and acetylene concentrations. Measured primary soot particle nucleation rates were somewhat lower than the earlier observations for laminar premixed ethylene/air flames and were significantly lower than corresponding rates in laminar diffusion flames. for reasons that still must be explained.
Author

Atmospheric Pressure; Gas Temperature; Methane; Oxygen; Premixed Flames; Soot; Combustion Products

20000032244 Fisk Univ., Dept. of Physics, Nashville, TN USA

Surface Passivation of CdZnTe Detector by Hydrogen Peroxide Solution Etching

Hayes, M., Fisk Univ., USA; Chen, H., Fisk Univ., USA; Chattopadhyay, K., Fisk Univ., USA; Burger, A., Fisk Univ., USA; James, R. B., Sandia National Labs., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 650-655; In English; See also 20000032189

Contract(s)/Grant(s): NCC8-133; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The spectral resolution of room temperature nuclear radiation detectors such as CdZnTe is usually limited by the presence of conducting surface species that increase the surface leakage current. Studies have shown that the leakage current can be reduced by proper surface preparation. In this study, we try to optimize the performance of CdZnTe detector by etching the detector with hydrogen peroxide solution as function of concentration and etching time. The passivation effect that hydrogen peroxide introduces have been investigated by current-voltage (I-V) measurement on both parallel strips and metal-semiconductor-metal configurations. The improvements on the spectral response of Fe-55 and 241Am due to hydrogen peroxide treatment are presented and discussed.

Author

Passivity; Cadmium Tellurides; Zinc Tellurides; Spectral Resolution; Room Temperature; Nuclear Radiation; Radiation Detectors

20000032284 Fisk Univ., Dept. of Physics, Nashville,TN USA

Raman and Infrared Spectroscopy of Yttrium Aluminum Borate Glasses and Glass-ceramics

Bradley, J., Fisk Univ., USA; Brooks, M., Fisk Univ., USA; Crenshaw, T., Fisk Univ., USA; Morris, A., Fisk Univ., USA; Chattopadhyay, K., Fisk Univ., USA; Morgan, S., Fisk Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 775-779; In English; See also 20000032189

Contract(s)/Grant(s): NCC8-133

Report No.(s): 98URC138; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Raman spectra of glasses and glass-ceramics in the Y2O3-Al2O3-B2O3 system are reported. Glasses with B2O3 contents ranging from 40 to 60 mole percent were prepared by melting 20 g of the appropriate oxide or carbonate powders in alumina crucibles at 1400 C for 45 minutes. Subsequent heat treatments of the glasses at temperatures ranging from 600 to 800 C were performed in order to induce nucleation and crystallization. It was found that Na2CO3 added to the melt served as a nucleating agent and resulted in uniform bulk crystallization. The Raman spectra of the glasses are interpreted primarily in terms of vibrations of boron - oxygen structural groups. Comparison of the Raman spectra of the glass-ceramic samples with spectra of aluminate and borate crystalline materials reveal that these glasses crystallize primarily as yttrium aluminum borate, YAl3(BO3)4.

Author

Aluminum Oxides; Borates; Ceramics; Glass; Raman Spectroscopy; Crystallization; Infrared Spectroscopy

20000032316 Puerto Rico Univ., San Juan, Puerto Rico

In Situ Infrared Spectroscopy of the Gaseous Species Present in a Diamond Chemical Vapor Deposition System

Morell, G., Puerto Rico Univ., Puerto Rico; Weiner, B. R., Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 866-871; In English; See also 20000032189

Contract(s)/Grant(s): NCCW-56; DE-FG02-94ER-75764; NAGW-4059; FIPI-8-80-032

Report No.(s): 98URC154; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

We interfaced a Hot-Filament Chemical Vapor Deposition (HFCVD) system to the emission port of an FT-IR spectrometer, in order to study the gas phase species present during the deposition of diamond thin films. The implementation of the infrared (IR) emission technique in situ allowed the study of various carbon-containing species believed to be crucial in diamond film growth. The two IR-active vibrational fundamentals of methane, v(3)(f2) and v(4)(f2), were observed at three different filament temperatures: 1000, 1500 and 2000 C. However, the net signal of v(3) was emission, while that of v(4) was absorption. These results indicate that the v(4) fundamental is excited beyond equilibrium, while the v(3) fundamental remains mostly in the ground state. This is due to the small concentration of methane, the low energy of v(4) compared to v(3) or to the Hz vibrational mode, and symmetry considerations that forbid interaction among the four fundamentals of methane. Thus, the excitation of v(3) is more likely than its decay under HFCVD conditions, producing a non-equilibrium population. At a filament temperature of 2000 C, the v(3) (sigma(+)(3)) fundamental of acetylene and a band at 1328 cm-l also ascribed to acetylene (v5 (pi(U)) + v4) appear in net absorption. This correlates well with the onset of molecular hydrogen breaking by the filament, which occurs at temperatures

around 2000 C and above. The hydrogen atoms produced in this heterogeneous reaction give rise to a chain of reactions that lead to acetylene, among other carbonaceous species.
Author
Infrared Spectroscopy; Diamond Films; Vapor Deposition; Emission; Infrared Absorption; Infrared Radiation; Molecular Gases; Vapor Phases

20000032324 Howard Univ., Dept. of Chemistry, Washington, DC USA
Mechanism of Nitric Acid Detection in a Polymer-Coated Quartz Crystal Microbalance
Habte, Kahsay, Howard Univ., USA; Pollack, S. K., Howard Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 895-899; In English; See also 20000032189
Report No.(s): 98URC159; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Coated piezoelectric quartz crystal microbalance (QCM) have been studied as potential selective and sensitive detectors for a wide range of toxic vapors. There is a current need to develop sensitive and chemically specific sensors for the detection of nitric acid for in-situ measurements in the atmosphere. The resonance frequency of the quartz crystal is determined by physical properties such as density, thickness, and shear modulus and is therefore intrinsically very stable. However, if any of its physical parameters change, the resonance frequency of the resonator will also change and a trace amount in picogram range can be detected. In order to detect trace amounts of nitric acid in the polymer-coated quartz crystal, we developed a home made QCM apparatus. The QCM apparatus, showed promising results in changing frequency when a certain mass was loaded on to 10MHz AT-Cut quartz crystal, but failed to maintain the stability and dramatic frequency jump was observed. to fulfill this requirement, a QCM apparatus (EQCN -402) with a Faraday Cage built in it was employed to avoid any noise or dramatic second or third harmonic oscillation. This apparatus is capable of measuring any picogram mass change on the Quartz Crystal and also can be used in liquid phase. Polymer coatings such as polystyrene, showed promising results in detecting nitric acid gas selectively. In order to prove the selectivity of polystyrene, we introduced gases such as hydrochloric acid and sulfur dioxide and to date no interference has been observed. Contact angle and ellipsometry are some of the methods currently used to detect any changes in surface chemistry of the films.
Author
Quartz Crystals; Piezoelectric Crystals; Nitric Acid; Gas Detectors; Microbalances; Toxic Hazards; Copolymers; Vapors; Coatings; Remote Sensing

20000032490 National Inst. of Standards and Technology, (BFRL), Gaithersburg, MD USA
Numerical Modeling of Counterflow Diffusion Flames Inhibited by Iron Pentacarbonyl
Rumminger, M. D.; Linteris, G. T.; Oct. 1999; 20p; In English
Report No.(s): PB99-102626; No Copyright; Avail: National Technical Information Service (NTIS)

This paper presents the first detailed numerical study of the extinction of methane-air counterflow diffusion flames by the super-effective agent iron pentacarbonyl. Calculations using a gas-phase chemical mechanism reproduce the magnitude of inhibition for small amounts of inhibitor in the air, but overpredict the inhibition effect for larger amounts of inhibitor. Reaction pathway and reaction flux analyses show that a catalytic cycle involving FeO, Fe(OH)2, and FeOH is primarily responsible for catalytic recombination of H atoms which produces the inhibition, and that a new cycle involving Fe(OH), FeOOH, and Fe(OH)2 has a minor role. Reaction flux calculations demonstrate that the fractional flux of H and O atoms through the iron reactions increases as inhibitor concentration increases, but eventually the fractional fluxes level off. Saturation of the catalytic cycles can partially explain the diminishing effect of the inhibitors at high inhibitor loading shown in both the calculated and experimental results. Flame structure calculations are used to determine the reasons for stronger inhibition for air-side addition of the inhibitor than for fuel-side. Simulations using an idealized inhibitor confirm the important role of transport in inhibition of counterflow diffusion flames.
NTIS
Counterflow; Diffusion Flames; Iron

20000032609 Saitama Inst. of Tech., Saitama, Japan
Extinction Characteristics of Tubular Flames Diluted with Nitrogen in a Rotating Stretched Flow Field
Sakai, Yukio, Saitama Inst. of Tech., Japan; Konishi, Katsuyuki, Saitama Inst. of Tech., Japan; Ishihara, Atsushi, Saitama Inst. of Tech., Japan; Ishizuka, Satoru, Saitama Inst. of Tech., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 15-21; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Extinction characteristics of tubular flames diluted with nitrogen in a rotating flow field have been experimentally investigated. The extinction limit was mapped as functions of the equivalence ratio phi and the added nitrogen ratio chi, and the flame diameter and temperature at extinction limits, the flame structure and the stable species concentration in the tubular flame near the extinction limits have been measured. Results show that, the flammable range and the concentrations of product and intermediate species in the inner core are shifted towards the fuel-lean side for methane and towards the fuel rich-side for propane flames. From these results, it seems that although the characteristics of tubular flame in the rotating flow field are influenced by the stratification through preferential diffusion and Lewis number through stretch as those of the other stretched flames, this effect is promoted by its curvature and the rotating motion of the mixture.
Author
Flow Distribution; Extinction; Nitrogen; Flammability; Turbulent Flames; Combustion; Rotating Fluids

20000032621 Saitama Inst. of Tech., Saitama, Japan
Pore Structure and Catalytic Activity of Solid Catalyst
Tominaga, Hiro–o, Saitama Inst. of Tech., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 64-68; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Pores inherent in any solid catalysts play vital roles to exhibit their activity and selectivity for catalysis. This was experimentally demonstrated, in this study, by use of several crystalline zeolitic materials with the pores of molecular dimension. First, shape selective oxidation of olefins and paraffins was observed with titanosilicate using hydrogen peroxide as oxidizing reagent, that is, only those linear olefins and paraffins which are easily accommodated in the pores were found to be susceptible to the reaction. Second, synthesis gas conversion into hydrocarbons was investigated over several hybrid catalysts comprising methanol synthesis catalyst and zeolites with different pore size. Selectivity either for aromatics or propane and butane are decisively influenced by the sizes of pore, crystal, and particle of the zeolite employed. Larger pore, as well as smaller crystal and particle, are in favor of the formation of propane and butane. The mechanism leading to the increased selectivity was discussed.
Author
Catalysts; Synthesis (Chemistry); Porosity; Catalytic Activity; Chemical Reactions; Zeolites

20000033010 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Si-Group Gas-Source MBE
Nakazawa, Hideki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 142-145; In Japanese; Copyright; Avail: Issuing Activity

Growth kinetics of Si-group Gas-Source MBE using hydride source gases has been studied by surface-hydrogen desorption measurements using Temperature Programmed Desorption(TPD). It was found that hydrogen desorption during Si Gas-Source MBE using silane(SiH4) and disilane(Si2H6) is a first-order reaction process and their activation energies were equaled to that of hydrogen desorption from Si (100) monohydride surface. From studies of adsorption process it was found that at low temperatures the source gases adsorb using 2 adsorption sites, while they use 4 adsorption sites at high temperatures. However, further investigations on the hydrogen desorption process from grown surfaces indicate a difference in the desorption processes between the two source gases. Furthermore, hydrogen desorption tends to show a higher-order process by thermal annealing. SiC on Si Gas-Source MBE using monomethylsilane(SiH3CH3) was found to have an optimum growth condition for surface morphology, crystallization, and stoichiometry. At low temperatures, it was clarified that the surface hydrogen termination degrades the quality of grown films.
Author
Adsorption; Desorption; Molecular Beam Epitaxy; Thin Films; Silicon Films; Reaction Kinetics

20000033154 Army Construction Engineering Research Lab., Champaign, IL USA
Reuse of Ammonium Nitrate - Wet Air Oxidation ***Final Report***
Maloney, Stephen W.; Sep. 1999; 96p; In English
Report No.(s): AD-A374134; CERL-TR-99/74; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Ammonium nitrate (AN) is a possible replacement for ammonium perchlorate as an oxidizer in solid rocket motors potentially generating large amounts of AN to be recycled or reused. AN requires phase stabilization before it can be used, so small amounts of potassium dinitrimide (KDN) are added to create phase stabilized ammonium nitrate (PSAN). Reuse alternatives would either require separating the KDN or destroying it. AN is commonly used as a fertilizer (80 percent of AN produced) and an oxidizer. Owing to the high demand and wide availability of AN for its most common use, the commercial cost is very low. This precludes reuse alternatives, which would require separation of the KDN. So, this report focused on destructive reuse as an oxidizer in wet air oxidation (WAO). The PSAN was tested to see if KDN was destroyed during WAO, and AN was tested as an oxidizer in WAO

treatment of an Army hazardous waste sludge. WAO will degrade KDN, and PSAN can be effectively used as an oxidizing agent. The hazardous waste sludge could be treated effectively. Sludge volume index was significantly reduced, meaning that the amount of sludge requiring disposal would be greatly reduced, offsetting the cost of WAO.
DTIC
Ammonium Nitrates; Rocket Oxidizers; Oxidation; Recycling

20000033222 Kyushu Univ., Graduate School of Engineering, Fukuoka, Japan
Basic Studies on Two-Dimensional Heat Transfer Characteristics of He II with Phase Changes
Noda, Takafumi; Rao, Yan F.; Fujimoto, Noboru; Morita, Koji; Fukuda, Kenji; Technology Reports of Kyushu University; January 2000; ISSN 0023-2718; Volume 73, No. 1, pp. 53-61; In Japanese; Copyright; Avail: Issuing Activity

Multi-dimensional analytical model to simulate the heat transfer characteristics of He II with phase changes is proposed. to simulate the heat transfer characteristics which are different according to the phases, parameters such as the thermo-mechanical force in the He II region, and others to deal with the boiling/condensation in the two-phase He I region are added to the Navier Stockes equation. In order to verify the validity of the model, a two-dimensional transient numerical simulation is performed. The results of transient temperature distributions from the simulation are compared with the experimental ones by Hamaguchi et al. It is found that the present model yields the results in qualitatively good agreement with the experiments and that the model is able to explain the mechanism of the unique temperature characteristics observed in the experiments.
Author
Helium Isotopes; Heat Transfer; Phase Transformations; Mathematical Models; Liquid Helium

20000033286 Geological Survey, Water Resources Div., Idaho Falls, ID USA
Use of Chemical and Physical Properties for Characterization of Strontium Distribution Coefficients at the Idaho National Engineering and Environmental Laboratory, Idaho
Rosentreter, J. J.; Nieves, R.; Kalivas, J.; Rousseau, J. P.; Bartholomay, R. C.; Jun. 1999; 36p; In English
Report No.(s): PB2000-103103; USGS/WRI-99-4123; No Copyright; Avail: National Technical Information Service (NTIS)

The U.S. Geological Survey and Idaho State University, in cooperation with the U.S. Department of Energy, conducted a study to determine strontium distribution coefficients K(sub d)S of surficial sediments at the Idaho National Engineering and Environmental Laboratory (INEEL). This report presents the results of a study to predict the variability of SR K(sub d)S of 20 surficial-sediment samples collected from selected sites at the INEEL in terms of selected chemical and physical properties of the solution and sediments. The surficial sediments were examined because pond wastewater containing SR-90 interacts with the sediment before infiltrating to the aquifer. Strontium Kds of the 20 surficial-sediment samples were determined using a synthesized aqueous solution and batch experimental techniques. Using these chemical and physical properties, variable selection, based on multivariate regression techniques, was used to identify those properties that best predict the experimentally determined K(sub d)S. Additionally, variable selection was used to eliminate variables that would be difficult to obtain, either from field measurements or from standard archived information.
NTIS
Strontium 90; Chemical Properties; Physical Properties; Transport Properties; Environmental Laboratories

20000033432 National Taiwan Univ., Dept. of Chemical Engineering, Taipei, Taiwan, Province of China
The adsorption of EDTA-Chelated Copper Ion in Aqueous Solution by an Activated Carbon Adsorption Column
Chang, Chung, National Taiwan Univ., Taiwan, Province of China; Ku, Young, National Taiwan Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Nov. 1997; ISSN 0253-3839; Volume 20, No. 6, pp. 651-659; In English; Copyright; Avail: Issuing Activity

A series of column adsorption experiments on the adsorption of EDTA-chelated copper by activated carbon were conducted to obtain more applicable design data. The efficiency of utilization of activated carbon bed improves with increasing empty bed contact time (EBCT). But the absorption capacity of activated carbon usually increases with decreasing EBCT value. Two different adsorption models, the Bed-Depth-Service-Time (BDST) model and Homogeneous Surface Diffusion Model (HSDM), are used to simulate the experimental data. The adsorption behavior of Cu-EDTA in an activated column can be described by the BDST model, but the fitted rate constant of adsorption(k) decreases with increasing EBCT, thus, it is necessary to modify the BDST model to further estimate the exhaust time of activated carbon under various conditions. The fitted results of the HSDM model indicate higher deviations to the experimental results, possibly because the adsorption rate is mainly determined by the surface reaction step.
Author
Activated Carbon; Adsorption; Surface Reactions; Copper; Metal Ions; Ethylenediaminetetraacetic Acids; Chelates

20000033511 Queen Mary and Westfield Coll., Dept. of Chemistry, London, UK

The Ultrafast Dynamics of [Mn(Br)(CO)3((i)Pr-DAB)]: The First Stages of fac yields mer Isomerisation

Farrell, I. R., Queen Mary and Westfield Coll., UK; Vlcek, A., Jr., Queen Mary and Westfield Coll., UK; Matousek, P., Rutherford Appleton Lab., UK; Towrie, Mike, Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 103; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

The organometallic complex fac-[Mn(Br)(CO)3((i)Pr-DAB)] has a low lying halide-to-ligand charge transfer transition from where it undergoes a fac yields mer isomerisation. The first stage of this isomerisation process is believed to be the concerted loss of an equatorial carbonyl ligand and migration of the axial halide into the equatorial plane, the isomerisation process being completed by the recombination of the dicarbonyl fragment with free CO. This study examines the events that lead to this isomerisation process on the ultrafast timescale and hope to unravel the kinetics and mechanism of the process.

Author

Organometallic Compounds; Isomerization; Charge Transfer; Magnesium; Bromine; Praseodymium

20000033516 Nottingham Univ., School of Chemistry, UK

Nanosecond Time-Resolved Resonance Raman Studies (TR(sup 3)) on Solvent Effects on Organometallic Charge Transfer Excited States at Both Room and Cryogenic Temperatures

Sun, X. Z., Nottingham Univ., UK; Nikiforov, S. M., Nottingham Univ., UK; George, M. W., Nottingham Univ., UK; Clark, I. P., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 113-114; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Electron transfer is a fundamental process important for a wide range of biological and chemical processes. Time-resolved infrared spectroscopy (TRIR), a combination of UV flash photolysis with fast infrared detection, is particularly useful in studying excited states of transition metals containing metals such as CO or CN. These groups have very high IR extinction coefficients and act as probes of the c1cctron distribution in the excited states. The lowest electronic excited state of the tricarbonyl, ClRe(CO)3(bpy), is an MLCT state, involving charge-transfer from the central Re atom to the bpy ligand. We have used TRIR to show how IR can probe the charge-transfer transition, since it reduces the Re-CO backbonding and hence shifts the nu(CO) to higher frequency. On lowering the temperature of solutions of coordination compounds in glassforming materials through the glass transition temperature, there is a sharp variation in some photophysical properties, explained by the change in viscosity. In particular, the emission for long lived charge-transfer states shifts to the blue (luminescence rigidochromism). We have studied the C-O vibrations of the MLCT excited state of ClRe(CO)3(bpy) in both solution and rigid glass phase. A temperature dependence of the position of the excited state nu(CO) was observed; this new phenomenon was referred to as infrared rigidochromism. In fluid solution the average shift in nu(CO), (Delta)nu(CO), upon MLCT excitation for ClRc(CO)3(bpy) is 58/cm, while in a rigid glass (Delta)nu(CO) is only 38/cm. This observation can be explained by the inability of the rigid solvent to assist in the charge-transfer process. In a fluid environment, the solvent molecules are free to rotate and can reorientate themselves to accommodate the charge separation created upon MLCT excitation.

Derived from text

Time Functions; Cryogenic Temperature; Electron Transfer; Chemical Analysis; Infrared Spectroscopy; Organometallic Compounds; Bioassay

20000033517 Nottingham Univ., School of Chemistry, UK

Nanosecond Step-Scan FTIR Spectroscopy in Conventional and Supercritical Fluids

Sun, X. Z., Nottingham Univ., UK; Nikiforov, S. M., Nottingham Univ., UK; George, M. W., Nottingham Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 115-117; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Time-resolved IR spectroscopy (TRIR) is a technique for probing the rate and mechanism of photochemical reactions. It involves the use of a pulsed UV/visible laser to initiate the reaction, and fast IR detection to monitor the generation of short-lived intermediates. The technique is becoming widespread and has already made a major impact on the Study of organic and organometallic reactions both in the gas phase and in Solution. Traditionally the TRIR apparatus at Nottingham has consisted of an IR diode laser which is tuned to a particular IR frequency and is used to monitor changes in IR absorption of a reaction solution following a UV laser Pulse. The IR laser is then re-tuned to another frequency and the process is repeated. Thus IR spectra are built Lip point-by-point by plotting change in absorbance versus wavenumber. The relatively narrow line- widths of absorptions make it possible to monitor several key species in solution at the same time; destruction of reactants and formation of excited states, intermediates and products can all be Followed. Our current point-by-point laser-based approach to TRIR limits the IR range that

can be studied due to the long acquisition time required for a complete spectrum (indeed, recording a 300/ cm spectrum is a whole day's work). However, many problems can only be solved by obtaining data over a much wider IR range.
Derived from text
Time Functions; Infrared Spectroscopy; Photochemical Reactions; Organometallic Compounds; Supercritical Fluids; Infrared Spectra

20000033518 Salford Univ., Dept. of Biological Sciences, UK
Ultrafast Studies of the Photochemistry of Phenols
Bisby, R. H., Salford Univ., UK; Matousek, P., Rutherford Appleton Lab., UK; Towrie, M., Rutherford Appleton Lab., UK; Parker, A. W., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 118-119; In English; See also 20000033474; Copyright; Avail: Issuing Activity

alpha-Tocopherol (vitamin E) protects lipidic systems (membranes and lipoproteins) against oxidative damage by acting as a chain-breaking antioxidant. The kinetics of oxidation of alpha-tocopherol and the reduction of the tocopheroxyl radical have been studied in the micro- and millisecond time regions by nanosecond laser flash photolysis. These studies showed that the tocopheroxyl radical (T-O(sup .)) was formed by photoionisation. Time-resolved resonance Raman spectroscopy indicated that the tocopheroxyl radical cation (T-OH(+)), with a pK(SUB a) of -1.4, was the predominant species in strongly acidic solutions. Furthermore, the radical cation is expected to be an intermediate not only in the photoionisation reaction, but may also participate in biological oxidations of vitamin E. T-OH + H(NU) yields T-O(sup .)H(+). However, the pK(sub a) value of the radical cation indicated that the lifetime would be of the order of picoseconds in neutral solution and so femtosecond laser studies should provide an ideal approach to kinetic studies of radical cation formation and decay.
Author
Reaction Kinetics; Time Dependence; Research; Photochemical Reactions; Phenols; Lipoproteins

20000033519 Oxford Univ., Physical and Theoretical Chemistry Lab., Oxford, UK
Discharge-Flow Studies of the Kinetics of the Reactions of Br, Cl, BrO and ClO with CH3O using LIF Detection
Canosa–Mas, C. E., Oxford Univ., UK; Hendy, N. J., Oxford Univ., UK; Shah, D., Oxford Univ., UK; Vipond, A., Oxford Univ., UK; Wayne, R. P., Oxford Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 120-123; In English; See also 20000033474
Contract(s)/Grant(s): NERC-GT-04/97/273/MAS; Copyright; Avail: Issuing Activity

It is now well established that the rapid spring-time depletion of stratospheric ozone over the Antarctic is due to catalytic cycles involving XO radicals, where X = Cl or Br, The reactions of CH3O2 with XO are of potential importance in the stratosphere. Under low ozone conditions, the reaction of Cl atoms with CH4 is favoured, leading to the formation of CH3O2, which in turn may react with XO. It has been proposed that the reactions with ClO and BrO could both possess channels that promote the chain decomposition of ozone.
Derived from text
Reaction Kinetics; Bromine; Chlorine; Chlorine Oxides; Methane; Ozone

20000033525 Northumbria Univ., Dept. of Chemical Life Sciences, Newcastle-upon-Tyne, UK
State to State Chemiluminescence in Mn + Cl2 Yields MnCl* + Cl
Hughes, T. J., Northumbria Univ., UK; Levy, M. R., Northumbria Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 136-137; In English; See also 20000033474; Copyright; Avail: Issuing Activity

The partly-Filled d-shells of the transition metals render the electronic spectroscopy of" both the atoms and the diatomic oxides and halides extremely complex. Hence, in simple gas phase atomic reactions, many potential surfaces may be accessible and interact. This complexity represents both a challenge and an opportunity for reaction dynamicists. to determine whether or not ground state atoms are responsible, a much 'colder' beam source is required. This is achieved in the present work, by the use of an MnO2 target instead of Mn. Laser-induced fluorescence has been used to determine the time-profile of the Mn pulse. For reasons of space, only the MnCl(sup *)(c(sup 5)Sigma(sup +)) results are presented.
Derived from text
Chemiluminescence; Manganese Oxides; Microscopy; Chlorine; Atomic Recombination; Nuclear Reactions; Diatomic Molecules; Electron Counters

20000033531 Dundee Univ., Dept. of APEME, UK
X-Ray Lithography Using Novel Mask Making Technique
Cairns, J. A., Dundee Univ., UK; Fitzgerald, A. G., Dundee Univ., UK; Berry, G. J., Dundee Univ., UK; Davidson, M. R., Dundee

Univ., UK; Thomson, J., Dundee Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 149-150; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

High density silicon chips are manufactured by projecting an image of their circuitry through a mask onto the silicon wafer. The masks consist of a quartz Substrate coated with a chromium layer which is selectively etched to produce the desired pattern. One difficult), is to produce linewidths Much narrower- than I pin. Although the chip maker can project the image through a stepper system and thereby reduce it by a factor of 5, this imposes an ultimate limit in the linewidth of approx. 0.2 microns achievable on the chip. to produce next-generation integrated circuits the industry Must Undergo a complete paradigm shift. No less than five possible replacements have been proposed to succeed optical lithography which include: extreme ultraviolet, SCALPEL. projection ion beam lithography, X-ray lithography and electron beam direct write. The main problem preventing the implementation of these techniques is that of mask fabrication, which involves a series of complex processing steps, often onto fragile membrane-type substrates. At the University of Dundee we have investigated a new method for the production of X-ray masks. This involves the use of a newly synthesised range of organometallic compounds which decompose under the influence of electron beam irradiation, leaving behind a metallic residue. Since electron beams can be focused down to less than 0.1 micron, this opens up an entirely new method of producing masks. The main aim of the experiments performed at the Lasers for Science Facility was to investigate the potential of organometallic compounds to produce X-ray masks. This report describes experiments performed using the soft X-ray source at the Rutherford Appleton Laboratory with X-ray masks produced from organometallic compounds.

Author

X Ray Sources; Lithography; Masks; Chips; Coatings; Fabrication; Integrated Circuits; Organometallic Compounds; Substrates; Wafers

20000033547 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK

Efficient Rejection of Fluorescence from Raman Spectra

Matousek, P., Rutherford Appleton Lab., UK; Towrie, M., Rutherford Appleton Lab., UK; Stanley, A., Rutherford Appleton Lab., UK; Parker, A. W., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 192-193; In English; See also 20000033474

Contract(s)/Grant(s): EPSRC-GR/L/83943; Copyright; Avail: Issuing Activity

Resonance Raman spectroscopy provides a powerful and sensitive analytical tool but is restricted to investigating samples with low levels of fluorescence in the region of the Raman spectra. These problems are exacerbated when performing time-resolved resonance Raman (TR(sup 3)) investigations because the pump pulse electronically excites the sample to potentially emissive states. Further problems associated with fluorescence can also come from sample impurities. to apply the technique of ps-TR(sup 3) more widely a method for removing fluorescence has been a major quest and whilst a number of techniques have been proposed and used, no generally applicable solution has been found. One of the most promising methods seeks to temporally reject the longer lived fluorescence. Ideally, such a system should achieve the highest possible rejection ratio while having high throughput and have the time resolution, or gating time, of approx. 1 - 2 ps to match the duration of the Raman flux in typical ps-TR(sup 3) systems. Existing gated CCD cameras and photomultipliers typically operate on nanosecond timescales with the fastest reaching several tens of picoseconds. Streak cameras perform better offering gating times 10 ps, limited by trigger jitter, but these have dynamic range limitations.

Derived from text

Efficiency; Fluorescence; Rejection; Raman Spectroscopy; CCD Cameras

20000033553 Queen Mary and Westfield Coll., Dept. of Chemistry, London, UK

Ultrafast Time-Resolved UV-Visible Absorption Study of Photochemical Radical Formation from [Re(R)(CO)3(dmb)] R = Me or Et

Farrell, I. R., Queen Mary and Westfield Coll., UK; Vlcek, A., Jr., Queen Mary and Westfield Coll., UK; Matousek, P., Rutherford Appleton Lab., UK; Towrie, M., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 101; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

Metal complexes of the general formula [Re(R)(CO)3(dmb)]; R = Me, Et, (i)Pr, Bz; (alpha-diimine = R-DAB, bpy, dmb, etc. often react via a Re-R homolysis to give the radical photoproducts [Re(S)(CO)3(alpha-diimine)] and R(*). Re-R homolysis quantum yields for the Et, (i)Pr and Bz complexes all approach unity whereas the methyl complex reacts with a quantum yield of only 0.4, which is found to be heavily dependent on temperature. The objects of this study are the two complexes [Re(R)(CO)3(dmb)]; R = Me or Et; dmb = 4,4'-dimethyl-2,2'bipyridine. It is hoped that time-resolved spectroscopy on the

ultrafast timescale will unravel further the mechanism behind the homolysis reaction and reveal the factors which limit the homolysis quantum yield for the methyl complex.
Derived from text
Photochemical Reactions; Methyl Compounds; Complex Compounds; Spectroscopy; Absorption Spectra

20000033555 Oxford Univ., Clarendon Lab., Oxford, UK
Time-Resolved Fluorescence of Cyano-Terphenyl in Solution
Toner, W. T., Oxford Univ., UK; Kwok, W. M., Imperial Coll. of Science, Technology and Medicine, UK; Ma, C., Imperial Coll. of Science, Technology and Medicine, UK; Phillips, D., Imperial Coll. of Science, Technology and Medicine, UK; Matousek, P., Rutherford Appleton Lab., UK; Towrie, M., Rutherford Appleton Lab., UK; Parker, A. W., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 109; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

Time resolved fluorescence spectra of cyano-terphenyl (CTP) have been obtained as part of a programme to identify and quantify the effects of relaxation on fast reactions initiated by photo-excitation, and complement our earlier work on this subject. The Kerr gate system was modified to reduce dispersion, enhance time-resolution and extend the spectral range to the UV. The first collection lens was replaced by a mirror, and benzene was used instead of CS2 as the Kerr medium, in a 1 mm rather than a 2 mm cell. The gate was formed by an UV sheet polarizer, the Kerr cell, and a crossed Glan Taylor polarizer. ”Magic angle” conditions were used. The instrument response time was approx. 3 ps (rise from 10% to 90%). A 1 mm cell with copper sulphate solution in water was used in front of the spectrometer to block the residual gating pulse. Data for CTP in cyclohexane, I-octanol and acetonitrile, uncorrected for substantial wavelength dependence of sensitivity. were shown.Preliminary inspection indicates that there are no large time-dependent spectral distortions.
Derived from text
Time Dependence; Time Functions; Fluorescence; Cyano Compounds; Cyclohexane; Kerr Cells; Sensitivity; Spectrometers; Terphenyls; Excitation

20000033688 Cleveland State Univ., Dept. of Chemical Engineering, Cleveland, OH USA
Oxidation of Chemically-Vapor-Deposited Silicon Carbide in Carbon Dioxide
Opila, Elizabeth J., Cleveland State Univ., USA; Nguyen, QuynhGiao N., Ohio Aerospace Inst., USA; Journal of American Ceramics Society; 1998; Volume 81, No. 7, pp. 1949-1952; In English; 98th, 17 Apr. 1996, Indianapolis, IN, USA; Sponsored by American Ceramic Society, USA
Report No.(s): AMS Paper-C-30-96; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Chemically-vapor-deposited silicon carbide (CVD SiC) was oxidized in carbon dioxide (CO2) at temperatures of 1200-1400 C for times between 96 and 500 h at several gas flow rates. Oxidation weight gains were monitored by thermogravimetric analysis (TGA) and were found to be very small and independent of temperature. Possible rate limiting kinetic mechanisms are discussed. Passive oxidation of SiC by CO2 is negligible compared to the rates measured for other oxidants that are also found in combustion environments, oxygen and water vapor.
Author
Carbon Dioxide; Chemical Reactions; Silicon Carbides; Vapor Deposition; Gas Flow; Oxidation

26
METALS AND METALLIC MATERIALS

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

20000032110 Iowa State Univ. of Science and Technology, Inst. for Physical Research and Technology, Ames, IA USA
Crystal Preparation of Ni-Mn-Ga Alloys ***Final Report, 1 Aug. 1999 - 31 Dec. 2000***
Lograsso, Thomas A.; Dec. 31, 1999; 16p; In English
Contract(s)/Grant(s): N00014-99-1-0997; Proj-99PRO7890-00
Report No.(s): AD-A373527; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Partial evaluation of the liquidus diagram of Ni-Mn-Ga by thermal analysis and microstructural evaluation has determined that the primary solidification surface for the Heusler alloy phase exists over a wide range of compositions. The primary solidification surface falls modestly in temperature with either increasing Mn or Ga concentrations. The composition, Ni50Mn25Ga25, melts incongruently over a temperature range of approximately 18 deg C. The small temperature range of solidification allows for the conditions suitable for crystal growth to be easily established and maintained throughout the crystal

growth process for a wide variety of compositions. In general, the Mn composition increases as the solid grows with an associated decrease in Ni composition. Analysis of the composition profiles indicated that the compositional changes, and hence, the solidification process, is dominated by convective mixing in the liquid during growth and evaporative losses of Mn. Finally, preliminary experiments were conducted that demonstrated the feasibility of using the Czochralski technique for the preparation of Ni-Mn-Ga alloys. Additional process optimization is required to gain confidence in applying the Czochralski method to the routine preparation of Ni50Mn25Ga25 and its alloys.
DTIC
Crystal Growth; Gallium Alloys; Nickel Alloys; Magnesium Alloys

20000032117 Boeing Commercial Airplane Co., Seattle, WA USA
Validated Feasibility Study of Integrally Stiffened Metallic Fuselage Panels for Reducing Manufacturing Costs: Cost Assessment of Manufacturing/Design Concepts ***Final Report***
Metschan, S., Boeing Commercial Airplane Co., USA; February 2000; 26p; In English
Contract(s)/Grant(s): NAS1-20014; NAS1-20267; RTOP 522-12-51-01
Report No.(s): NASA/CR-2000-209343; NAS 1.26:209343; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The objective of the Integral Airframe Structures (IAS) program was to demonstrate, for an integrally stiffened structural concept, performance and weight equal to ”built-up” structure with lower manufacturing cost. This report presents results of the cost assessment for several design configuration/manufacturing method combinations. The attributes of various cost analysis models were evaluated and COSTRAN selected for this study. A process/design cost evaluation matrix was developed based on material, forming, machining, and assembly of structural sub-elements and assembled structure. A hybrid design, made from high-speed machined extruded frames that are mechanically fastened to high-speed machined plate skin/stringer panels, was identified as the most cost-effective manufacturing solution. Recurring labor and material costs of the hybrid design are up to 61 percent less than the current built-up technology baseline. This would correspond to a total cost reduction of $1.7 million per ship set for a 777-sized airplane. However, there are important outstanding issues with regard to the cost of capacity of high technology machinery, and the ability to cost-effectively provide surface finish acceptable to the commercial aircraft industry. The projected high raw material cost of large extrusions also played an important role in the trade-off between plate and extruded concepts.
Author
Airframes; Cost Analysis; Fuselages; Manufacturing; Feasibility Analysis; Rigid Structures

20000032158 National Inst. of Standards and Technology, Materials Science and Engineering Lab., Gaithersburg, MD USA
Materials Science and Engineering Laboratory, Metallurgy: 1999 Programs and Accomplishments
Handwerker, C. A.; Schaefer, R. J.; Jan. 2000; 140p; In English
Report No.(s): PB2000-101374; NISTIR-6436; No Copyright; Avail: National Technical Information Service (NTIS)
The report describes areas of scientific expertise, major technical activities and accomplishments of the Metallurgy Division of the NIST Materials Science and Engineering Laboratory (MSEL) in 1999. The mission of the NIST Metallurgy Division is to provide leadership in developing measurement methods, standards, and fundamental understanding of materials behavior needed by the U.S. materials metrology infrastructure for the more effective production and use of both traditional and emerging materials. As a fundamental part of this mission we are responsible not only for developing new measurement methods with broad applicability across materials classes and industries, but also for working with individual industry groups to develop and integrate measurements, standards, and evaluated data for specific, technologically important applications.
NTIS
Metallurgy; Materials Science

20000032793 Gesellschaft fuer Bergbau, Metallurgie, Rohstoff- und Umwelttechnik, Clausthal-Zellerfeld, Germany
Non-metals in metals 1998
Hirschfeld, D.; Dec. 31, 1998; 207p; In German; In English; 22nd; Non-metals in metals 1998, Germany
Report No.(s): DE99-776049; ETDE-DE-804; ISBN 3-9805924-3-X; No Copyright; Avail: Department of Energy Information Bridge
The major topics discussed at the symposium are: (1) Thermodynamics and kinetics, (2) chemical, physical and physico-chemical examination methodology, (3) materials properties. 13 of the 25 papers presented at the symposium have been analysed and indexed for separate retrieval from the database.
NTIS
Metals; Thermodynamics; Physical Chemistry

20000032939 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Electromigration Mechanisms of VLSI Multilevel Interconnects

Kawasaki, Hisao, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 61-64; In Japanese; Copyright; Avail: Issuing Activity

In this study, it has been shown that electromigration failures are significantly influenced by the test structures and stress conditions. For better estimation of the lifetime of VLSI interconnects at operating conditions, it has been demonstrated that data must be taken using test structures designed to minimize structural effects, namely effects of reservoir, stress-induced Al backflow and Joule heating. In modern multilevel metallization schemes, it has been shown that Al-Cu interconnects fail through mainly two stages, incubation stage and Al depletion stage. This incubation time, before which no electromigration induced Al depletion starts, was found to be time period during which Cu atoms in Al-Cu alloys diffuse from the cathode end of interconnects beyond critical length (Blech length). Based on the experimental findings, an electromigration failure model which considers the incubation time and Al drift time separately has been established. by Utilizing the new electromigration test structures and innovative data analysis methods, the model has been experimentally verified. The model predicts that lifetimes of Al-Cu interconnects at W plug contacts/ vias under operating conditions are dominated by Cu diffusion (incubation times) in Al-Cu. It has been attempted to apply the established model to the Al filled vias and Cu vias. It has been shown that frequently observed larger standard deviations of electromigration failure distributions from Al filled vias are due to the variation in the electromigration-induced void location. For Cu-doped Al filled vias, the electromigration failure mechanism is thought to be the same as for Al-Cu interconnects at W plug contacts/ vias, which is Cu diffusion dominated. Therefore, it can be concluded that inferiority of the Al filled vias in electromigration reliability is an apparent one and the Al filled via integration scheme is a very attractive candidate for future high-performance, highly reliable multi-level metallization modules. Realistic assessment for the reliability of the Cu interconnects requires understanding of Cu depletion process and the statistical distribution of electromigration fail times. Finally, research on addition of impurities to Cu for a better electromigration performance of Cu metallization was suggested.

Author

Electromigration; Very Large Scale Integration; Structural Failure

20000033153 Naval Postgraduate School, Dept. of Mechanical Engineering, Monterey, CA USA

Factors Affecting the Strength and Toughness of Ultra-Low Carbon Steel Weld Metal

Van Slyke, Jonathan J.; Dec. 1999; 95p; In English

Report No.(s): AD-A374133; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The factors that affect strength and toughness often ultra-low carbon steel weld samples (HSLA-80 and HSLA-100), welded using the gas metal arc welding (GMAW) process and new ultra-low carbon consumable electrodes, were studied. The analysis was confined only to the weld metal, and the base metal was not considered. Analysis methods included optical microscopy, scanning electron microscopy, and transmission electron microscopy. Energy dispersive x-ray analysis was performed in the transmission electron microscope to analyze the chemical composition of non-metallic inclusions. The microstructure was found to be primarily granular ferrite with some primary ferrite, bainite, and martensite. Very little acicular ferrite was found (is less than 18 %). Because of this, to get the best mechanical properties in the weld, the size and volume fraction of non-metallic inclusions needs to be minimized. This can be accomplished by minimizing the amount of oxygen while increasing the amount of titanium and aluminum in the weld metal. EDX analysis revealed that the non-metallic inclusions were multi-phase particles with two predominant phases: a TiO-MnO phase and a MnO-SiO2-Al2O3, phase. Copper-sulfide caps were also found on the surface of some inclusions. This inclusion chemistry is typical of what is found in welding HSLA steel.

DTIC

Carbon Steels; Welded Structures; Toughness; Microstructure

20000033434 Szehai Inst. of Tech. and Commerce, Dept. of Mechanical Engineering, Taipei, Taiwan, Province of China

Influence of Zr Addition on the Corrosion Behavior of the Ni3Al Intermetallic Compounds

Chang, Tien–Tsai, Szehai Inst. of Tech. and Commerce, Taiwan, Province of China; Chuang, Tung–Han, National Taiwan Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Nov. 1997; ISSN 0253-3839; Volume 20, No. 6, pp. 623-628; In English; Copyright; Avail: Issuing Activity

The effect of Zr addition on the corrosion behavior of the Ni3Al alloy in an aerated 3.5% NaCl solution has been studied by means of electrochemical methods. The results showed that the corrosion potential of Ni3Al first tended to be noble and then became active with an increase in Zr content. The corrosion current density first decreased and then increased as the Zr content increased. Also, the addition of Zr increased pitting resistance and the stability of passive film. Thus, the resistance in corrosion

behavior of the alloys first increased and then decreased with an increase in Zr content. However, the addition of Zr did not alter the morphology of intergranual corrosion in the pits.
Author
Corrosion; Intermetallics; Nickel Alloys; Aluminum Alloys; Zirconium; Additives; Electrochemistry

20000033456 ISRO Satellite Centre, Peenya, Battery Div., Bangalore, India
Metal Hydride Alloys for Nickel-Metal Hydride Batteries
Venugopalan, S., ISRO Satellite Centre, Peenya, India; Journal of Spacecraft Technology; Jan. 1998; Volume 8, No. 1, pp. 23-49; In English; Copyright; Avail: Issuing Activity

This presentation reviews the current status of the technological development of Nickel-Metal hydride batteries. This includes a brief history of the development of intermetallic alloy hydrides, desirable characteristics of MH alloy for electrochemical energy storage applications, chemistry of metal hydride, functions of constituent elements of alloys, comparison of AB2 & AB5 MH alloys that are of interest to battery application, methods of preparation of alloys,activation of MH alloy powder & metal hydride electrodes, methods of evaluation of alloys, preparation of electrodes, performance of cell and the failure modes of NIMH cells.
Author
Electric Batteries; Metal Hydrides; Intermetallics; Nickel Compounds

20000033510 Queen Mary and Westfield Coll., Dept. of Chemistry, London, UK
A Femtosecond Spectroscopic Study of MLCT Excited States Dynamics of [Cr(CO)4(bpy)]: Excitation Energy Dependent Branching Between CO Dissociation and Relaxation
Farrell, I. R., Queen Mary and Westfield Coll., UK; Vlcek, A., Jr., Queen Mary and Westfield Coll., UK; Matousek, P., Rutherford Appleton Lab., UK; Towrie, M., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 102; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

The metal complex [Cr(CO)4(bpy)] has an intense metal-to-ligand charge transfer (MLCT) absorption band at ca. 500 nm. Population of this MLCT state leads to the dissociation of an axial CO ligand with a temperature and excitation wavelength (lambda(sub ex)) dependent quantum yield of 0.1 - 0.2. The present study investigates the mechanism for this, in particular the rate of CO loss and factors that limit and affect quantum yield.
Author
Time Functions; Spectroscopy; Excitation; Charge Transfer; Ligands; Chromium Compounds; Carbon Compounds

20000033538 Exeter Univ., School of Physics, UK
Observation of Ultrafast Demagnetization in a Nickel Foil
Wu, J., Exeter Univ., UK; Wilks, R., Exeter Univ., UK; Hicken, R. J., Exeter Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 169-171; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Recent observations of optically induced ultrafast demagnetization in magnetic metals have caused great excitement in the Magnetism community. The principles that govern spin dynamics on femto and picosecond time scales are not yet fully understood and there is the promise of technological applications in which magnetic components are switched on and off by direct optical excitation. Nickel was considered to be an ideal candidate for such studies because its Curie temperature is the lowest of the ferromagnetic 3d transition metals. In previous pump-probe studies of Nickel, optical excitation was performed with micro-joule pulses at repetition rates of less than 100 kHz. In this report we describe the experimental procedures that must be used when working with nano-joule pulses at a repetition rate of 92 MHz. We demonstrate that ultra-fast demagnetization may be observed in a Nickel foil under such conditions.
Author
Demagnetization; Magnetic Materials; Switching; Magnetic Properties

20000033680 NASA Lewis Research Center, Cleveland, OH USA
Design for Oxidation Resistance
Smialek, James L., NASA Lewis Research Center, USA; Schaeffer, Jon C., General Electric Co., USA; Barrett, Charles A., NASA Lewis Research Center, USA; ASM Handbook: Materials Selection and Design; 1997; Volume 20, pp. 589-602; In English; ISBN-0-87170-386-6; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Alloys intended for use in high-temperature environment rely on the formation of a continuous, compact, slow-growing oxide layer for oxidation and hot corrosion resistance. to be protective, this oxide layer must be chemically, thermodynamically stable. Successful alloy design for oxidative environment is best achieved by developing alloys that are capable of forming adherent

scales of either alumina (Al2O3), chromia (Cr2O3), or silica (SiO2). In this article, emphasis has been placed on the issue related to high-temperature oxidation of superalloys used in gas turbine engine application. Despite the complexity of these alloys, optimal performance has been associated with protective alumina scale formation. As will be described below, both compositional makeup and protective coatings play key role in providing oxidation protection. Other high-temperature materials described include nickel and titanium aluminide intermetallics, refractory metal, and ceramics.
Author
Refractory Metals; Protective Coatings; Oxidation Resistance; Corrosion Resistance; Aluminum Oxides; Ceramics; Chromium Oxides; Heat Resistant Alloys; Hot Corrosion

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.

20000032164 NASA Marshall Space Flight Center, Huntsville, AL USA
Observation of Individual Fluorine Atoms from Highly Oriented Poly(Tetrafluoroethylene) Films by Atomic Force Microscopy
Lee, J. A., NASA Marshall Space Flight Center, USA; February 2000; 18p; In English
Report No.(s): NASA/TM-2000-209962; NAS 1.15:209962; M-966; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Direct observation of the film thickness, molecular structure, and individual fluorine atoms from highly oriented poly(tetrafluoroethylene) (PTFE) films were achieved using atomic force microscopy (AFM). A thin PTFE film is mechanically deposited onto a smooth glass substrate at specific temperatures by a friction-transfer technique. Atomic resolution images of these films show that the chain-like helical structures of the PTFE macromolecules are aligned parallel to each other with an intermolecular spacing of 5.72 A, and individual fluorine atoms are clearly observed along these twisted molecular chains with an interatomic spacing of 2.75 A. Furthermore, the first direct AFM measurements for the radius of the fluorine-helix, and of the carbon-helix in sub-angstrom scale are reported as 1.7 and 0.54 A respectively.
Author
Fluorine; Atoms; Film Thickness; Molecular Structure; Polytetrafluoroethylene; Observation

20000032171 National Inst. of Standards and Technology, (BFRL), Gaithersburg, MD USA
Effect of Lubricant Concentration, Miscibility, and Viscosity on R134a Pool Boiling
Kedzierski, M. A.; Jan. 2000; 68p; In English
Report No.(s): PB2000-103297; NISTIR-6450; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This paper presents pool boiling heat transfer data for twelve different R134a/lubricant mixtures and pure R134a on a Turbo-BII(trademark)-HP surface. The mixtures were designed to examine the effects of lubricant mass fraction, viscosity, and miscibility on the heat transfer performance of R134a. The magnitude of the effect of each parameter on the heat transfer was quantified with a regression analysis. The mechanistic cause of each effect was given based on a new theoretical interpretation and/or one from the literature. The model illustrates that large improvements over pure 134a heat transfer can be obtained for R134a/lubricant mixtures with small lubricant mass fraction, high lubricant viscosity, and a large critical solution temperature (CST). The ratio of the heat flux of the R134a/lubricant mixtures to that of the pure R134a for fixed wall superheat was given as a function of pure R134a heat flux for all twelve mixtures.
NTIS
Refrigerants; Viscosity; Solubility; Heat Transfer; Thermodynamic Properties; Mathematical Models; Boiling

20000032199 Tuskegee Inst., Center for Food and Environmental Systems for Human Exploration of Space, AL USA
Development of Paper Products from Dried Sweetpotato Stems and Peanut Shells
McConnell, R., Tuskegee Inst., USA; Smith, R., Tuskegee Inst., USA; Jones, G., Tuskegee Inst., USA; Lu, J. Y., Tuskegee Inst., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 495-499; In English; See also 20000032189; Sponsored in part from USDA/CSREES/Evans-Allen
Contract(s)/Grant(s): NCC9-51; ALX-FS-2; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

One of the goals of NASA's Advanced Life Support Program (ALS) for sustaining human life in space is to achieve a closed system in plant production and usage. That all inedible plant parts should be recycled or used in some way. A Tuskegee University team researching sweetpotato and peanut for ALS has developed paper products from dried sweet-potato stems and peanut shells. In this study, the sweet-potato stems and peanut shells were soaked separately in water for 48 hours. After 48 hours, researchers manually separated the pulp and the unusable parts. to form the paper, 160 g of pulp and water mixture was poured through a 15.1 cm (diameter) filtration funnel and the pulp was trapped on 15 cm (diameter) falter paper. The falter paper and pulp were dried in an air oven, and the filter paper was removed, An examination under a scanning electron microscope showed that the sweet-potato paper was composed of "fibers", whereas the peanut shell paper was composed of "blocks". Results of physical testing showed that the sweet-potato stem paper was stronger than the peanut shell paper. It is anticipated that there may be other uses of these products such as writing paper, bags and packaging material. Because of its biodegradability, it can be incorporated into the resource recycling system at the end of its use.
Author
Technology Assessment; Potatoes; Recycling; Product Development; Paper (Material); Life Support Systems

20000032219 Clark-Atlanta Univ., Dept. of Engineering, GA USA
Characterization of the Sol-Gel Transition for Zirconia-Toughened Alumina Precursors
Moeti, I., Clark-Atlanta Univ., USA; Karikari, E., Clark-Atlanta Univ., USA; Chen, J., Clark-Atlanta Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 551-556; In English; See also 20000032189
Contract(s)/Grant(s): DAAL03-92-G-0380; NAG4-11; NAGW-2939; EPA-CR-818689; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
High purity ZTA ceramic powders with and without yttria were produced using metal alkoxide precursors. ZTA ceramic powders with varying volume percents of zirconia were prepared (7, 15, and 22%). Aluminum tri-sec butoxide, zirconium propoxide, and yttrium isopropoxide were the reagents used. Synthesis conditions were varied to control the hydrolysis and the aging conditions for the sol to gel transition. FTIR analysis and theological characterization were used to follow the structural evolution during the sol to gel transition. The greater extent of hydrolysis and the build-up of structure measured from viscoelastic properties were consistent. Heat treatment was conducted to produce submicron grain fully crystalline ZTA ceramic powders. In all experimental cases a-alumina and tetragonal zirconia phases were confirmed even in the absence of yttria.
Author
Zirconium; Aluminum Oxides; Sol-Gel Processes; Characterization; Yttrium; Ceramics; Alkoxides; Fabrication; Toughness; Wear Resistance

20000032222 NASA Marshall Space Flight Center, Huntsville, AL USA
Synthesis of Polymers Containing Covalently Bonded NLO Chromophores
Denga, Xiao–Hua, New Mexico Highlands Univ., USA; Sanghadasa, Mohan, Alabama Univ., USA; Walton, Connie, Grambling State Univ., USA; Penn, Benjamin B., NASA Marshall Space Flight Center, USA; Amai, Robert L. S., New Mexico Highlands Univ., USA; Clark, Ronald D., New Mexico Highlands Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 563-568; In English; See also 20000032189
Contract(s)/Grant(s): NAG5-121; NAG8-1288; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
Polymers containing covalently bonded nonlinear optical (NLO) chromophores are expected to possess special properties such as greater stability, better mechanical processing, and easier film formation than their non-polymeric equivalent. For the present work, polymethylmethacrylate (PMMA) was selected as the basic polymer unit on which to incorporate different NLO chromophores. The NLO components were variations of DIVA {[2-methoxyphenyl methylidene]-propanedinitrile} which we prepared from vanillin derivatives and malononitrile. These were esterified with methacrylic acid and polymerized either directly or with methyl methacrylate to form homopolymers or copolymers respectively. Characterization of the polymers and NLO property studies are underway.
Author
Copolymers; Synthesis (Chemistry); Copolymerization; Polymethyl Methacrylate; Chromophores; Covalent Bonds; Nonlinear Optics

20000032239 Prairie View Agricultural and Mechanical Coll., TX USA
Preparation and Surface Analysis of a Fluorinated Amorphous Silicon for Photo-voltaic Device Application
McWhinney, Hylton G., Prairie View Agricultural and Mechanical Coll., USA; Burton, Dawn, Prairie View Agricultural and

Mechanical Coll., USA; Fogarty, Thomas N., Prairie View Agricultural and Mechanical Coll., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 629-633; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Amorphous silicon films (a-Si:H) have been routinely deposited on a variety of substrates. Surface and interfacial studies were carried out with a PHI 5600 X-ray photo electron spectrometer. Co-deposition with fluorine yielded films having oxygen present as bulk oxide. The higher the fluorine content, the greater the amount of bulk oxygen observed. The presence of oxygen may be a contributing factor to inconsistent film properties of fluorine doped silicon materials, reported else where. A definite chemical interface between a layer containing fluorine and a layer made from pure silane has been delineated.

Author

Photovoltaic Cells; Amorphous Silicon; Silicon Films; Thin Films; Substrates

20000032241 Puerto Rico Univ., Dept. of Physics, Mayaguez, Puerto Rico

Luminescence of Eu(3+) doped SiO2 Thin Films and Glass Prepared by Sol-gel Technology

Castro, Lymari, Puerto Rico Univ., Puerto Rico; Jia, Weiyi, Puerto Rico Univ., Puerto Rico; Wang, Yanyun, Puerto Rico Univ., Puerto Rico; Santiago, Miguel, Puerto Rico Univ., Puerto Rico; Liu, Huimin, Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 634-638; In English; See also 20000032189

Contract(s)/Grant(s): DE-FG02-94ER-75764; DAAH04-96-10416; NCCW-88; NSF EHR-91-08775; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Trivalent europium ions are an important luminophore for lighting and display. The emission of (5)D0 to (7)F2 transition exhibits a red color at about 610 nm, which is very attractive and fulfills the requirement for most red-emitting phosphors including lamp and cathode ray phosphorescence materials. Various EU(3+) doped phosphors have been developed, and luminescence properties have been extensively studied. On the other hand, sol-gel technology has been well developed by chemists. In recent years, applications of this technology to optical materials have drawn a great attention. Sol-gel technology provides a unique way to obtain homogeneous composition distribution and uniform doping, and the processing temperature can be very low. In this work, EU(3+) doped SiO2 thin films and glasses were prepared by sol-gel technology and their spectroscopic properties were investigated.

Author

Trivalent Ions; Europium; Silicon Dioxide; Doped Crystals; Thin Films

20000032242 Puerto Rico Univ., Dept. of Physics, Mayaguez, Puerto Rico

Fluorescence of Pentavalent Chromium in SiO2 Sol-Gel Glasses

Jia, Weiyi, Puerto Rico Univ., Puerto Rico; Castro, Lymari, Puerto Rico Univ., Puerto Rico; Wang, Yanyun, Puerto Rico Univ., Puerto Rico; Liu, Huimin, Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 639-643; In English; See also 20000032189

Contract(s)/Grant(s): NCCW-88; DAAH04-96-10416; DE-FR02-94ER-757640; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Chromium ions are very attractive to optical spectroscopy and laser physics. It is well known that the first laser in the history is a ruby laser activated with Cr(3+). It was found in early nineties that Cr(4+) was also an interesting lasing ion in the near infrared, and various Cr(4+) lasers have been developed. Very recently, it was reported that Cr(2+) doped in CdSe crystals showed lasing action in the infrared. The above achievement have stimulated an interest in searching for Cr(5+) and investigating its optical properties. Cr(5+) is isoelectronic with Ti(3+) and V(4+), having electron configuration 3d1. Ti(3+) is the active center of commercial cw and femtosecond sapphire lasers, tunable in the range 680-1100 nm. V(4+) doped in YAlO3 and Al2O3 showed broad band emission near 635 nm. Although EPR results of Cr(5+) were reported, the optical properties were less studied. Herren et al. reported an observation of luminescence from Cr doped in SiO2 sol-gel glass. The luminescence spectrum was assigned to pentavalent ions in their first paper, and later it was identified to be the emission from the charge transfer transition of Cr(6+). The first observation of photoluminescence from octahedrally coordinated Cr(5+) in BaCaMg aluminate glasses was reported very recently. In this work, we report luminescence results of Cr doped SiO2 sol-gel glasses. The fluorescence spectra are very different from Herrens' results, and we believe it originates from pentavalent Cr.

Derived from text

Fluorescence; Chromium; Metal Ions; Silicon Dioxide; Crystals; Doped Crystals

20000032249 Puerto Rico Univ., Dept. of Physics, Mayaguez, Puerto Rico

Nitride semiconductor thin films grown by N-radical-assisted pulsed laser deposition

Fernandez, Felix E., Puerto Rico Univ., Puerto Rico; Pumarol, Manuel, Puerto Rico Univ., Puerto Rico; Martinez, Antonio, Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 119-124; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Wide bandgap semiconductor materials, particularly the Group III - Nitrides (AlN, InN, GaN), have extraordinary potential for a wide range of technological applications. In the last few years, development of thin films of these materials has attracted rapidly increasing numbers researchers. One of the key issues of concern is that of the required growth temperature for films of sufficient quality in terms of stoichiometry, crystallinity, crystal orientation, and defect concentration. The most successful growth techniques, of those so far utilized, require high substrate temperatures. Deposition techniques providing higher kinetic energies of incident species offer an alternative route which might allow growth of good quality films at lower temperatures. Pulsed Laser Deposition (PLD) can provide higher kinetic energies than most thin film growth methods. However, III-nitride thin films grown by PLD are often nitrogen deficient. We have been able to obtain good stoichiometry for aluminum nitride films even at room temperature by providing atomic nitrogen at low (thermal) energies during growth. Very good orientation was obtained on sapphire substrates at moderate temperatures (approximately 500 C). We also report on preliminary work by the same method with GaN film growth from a liquid Ga target.

Author

Nitrides; Semiconductors (Materials); Thin Films; Energy Gaps (Solid State); Crystal Growth; Radicals; Pulsed Laser Deposition

20000032251 Clark-Atlanta Univ., Dept. of Chemistry, GA USA

Development of Polyimides-Based NLO Materials for Electrooptical Applications

Rutherford, Jacqueline, Clark-Atlanta Univ., USA; Li, Xiang, Clark-Atlanta Univ., USA; Mintz, Eric A., Clark-Atlanta Univ., USA; Bu, Xiu R., Clark-Atlanta Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 675-678; In English; See also 20000032189

Contract(s)/Grant(s): NAGW-2939; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Development of thermally stable optical materials for nonlinear optics have recently focused on the covalent incorporation of NLO chromophores into high performance polymers, especially thermally stable and processable polyamides. One key aspect for the incorporation of robust NLO chromophores into high Tg polymers is to sustain poling induced order. Other advantages include high loading level of chromophores, and elimination of possible phase separation as well as chromophore sublimation at processing or working temperature. We have prepared several polyimide based polymers which are covalently linked with thermally stable chromophores that we have developed, since polyamides generally exhibit high Tg and good film transparency. Here, we report the development and subsequent incorporation of indoline based chromophores into polyamides, leading to thermally stable NLO polymers.

Derived from text

Polyimides; Polyamide Resins; Chromophores; Nonlinear Optics; Electro-Optics

20000032287 Fisk Univ., Dept. of Physics, Nashville,TN USA

"Un-annealed and Annealed Pd Ultra-Thin Film on SiC Characterized by Scanning Probe Microscopy and X-ray Photoelectron Spectroscopy"

Lu, W. J., Fisk Univ., USA; Shi, D. T., Fisk Univ., USA; Elshot, K., Fisk Univ., USA; Bryant, E., Fisk Univ., USA; Lafate, K., Fisk Univ., USA; Chen, H., Fisk Univ., USA; Burger, A., Fisk Univ., USA; Collins, W. E., Fisk Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 229-234; In English; See also 20000032189

Contract(s)/Grant(s): NAGW-2925; NAG3-2012; NAG3-1430

Report No.(s): 98URC042; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Pd/SiC has been used as a hydrogen and a hydrocarbon gas sensor operated at high temperature. UHV (Ultra High Vacuum)-Scanning Tunneling Microscopy (STM), Atomic Force Microscopy (AFM) and X-ray Photoelectron Spectroscopy (XPS) techniques were applied to study the relationship between the morphology and chemical compositions for Pd ultra-thin films on SiC (less than 30 angstroms) at different annealing temperatures. Pd ultra-thin film on 6H-SiC was prepared by the RF sputtering method. The morphology from UHV-STM and AFM shows that the Pd thin film was well deposited on SiC substrate, and the Pd was partially aggregated to round shaped participates at an annealing temperature of 300 C. At 400 C, the amount of

surface participates decreases, and some strap shape participates appear. From XPS, Pd2Si was formed on the surface after annealing at 300 C, and all Pd reacted with SiC to form Pd2Si after annealing at 400 C. The intensity of the XPS Pd peak decreases enormously at 400 C. The Pd film diffused into SiC, and the Schottky barrier height has almost no changes. The work shows the Pd sicilides/SiC have the same electronic properties with Pd/SiC, and explains why the Pd/SiC sensor still responds to hydrogen at high operating temperatures.
Author
Annealing; Silicon Carbides; Palladium; Thin Films; Scanning Tunneling Microscopy; Photoelectron Spectroscopy; X Ray Spectroscopy; Atomic Force Microscopy

20000032449 Yamagata Univ., Faculty of Engineering, Japan
The Interfacial Activity of the Toluene Extract from a Styrene/Cellulose Graft Product
Taga, Tooru, Yamagata Univ., Japan; Bulletin of Yamagata University (Engineering); February 2000; ISSN 0085-834X; Volume 26, No. 1, pp. 19-23; In Japanese; Copyright; Avail: Issuing Activity

Styrene was grafted onto the cellulose gel made from a phosphoric acid solution of cellulose. Toluene extraction was carried out on the graft product at room temperature after removing homo polystyrene by means of tetrahydrofuran extraction. The toluene solutions of the extracts constituted of polystyrene and cellulose were dispersed in 85% phosphoric acid, forming emulsion systems. The interfacial tension between two macroscopic phases, i.e. a clear toluene phase and a transparent phosphoric acid phase, recovered from the emulsion system after standing for 24 hours, was determined by pulling up a tensiometer ring. The tension of phosphoric acid against 0.02 g/dl toluene solution was 1.4 dyne/cm while the value against pure toluene was 14.0. In control experiments, the tensions against pellucid toluene solutions containing both homo polystyrene and alcogel cellulose prepared from the hydrogel cellulose were a little lower than that against pure toluene. These results indicate that, although the polystyrene/cellulose mixture was surface inactive, the toluene extract was surface active. Since this activity is closely correlated to the amphiphilicity of molecule, it can be concluded that the extract is composed of styrene/cellulose graft copolymer.
Author
Interfacial Tension; Toluene; Styrenes; Cellulose; Grafting; Solvent Extraction

20000032494 Max-Planck-Inst. fuer Metallforschung, Stuttgart, Germany
Colloidal processing and rapid prototyping of Si3N4, V. 75
Liwu Wang,; Dec. 31, 1998; 115p; In English
Report No.(s): DE99-763415; ETDE-DE-795; No Copyright; Avail: Department of Energy Information Bridge

Some progresses have been made in the wet shaping of Si3N4 based on a better understanding of the colloidal behavior of suspensions and by improved pressure casting with porous polystyrene (PS) molds. This work illustrated that the combination of proper colloidal processing and rapid prototyping is an effective way to fabricate high-performance ceramics with complex shapes. In colloidal processing the packing density and microstructure of green bodies can be controlled if the interaction between ceramic particles in suspensions and the conditions under which the suspensions are consolidated are understood. Therefore, detailed studies on the surface chemistry of the Si3N4 powder, the dispersing behavior of Si3N4 suspensions, the influence of dispersants and the mechanism during powder consolidation into complex-shaped green bodies are performed.
NTIS
Colloids; Packing Density; Microstructure; Silicon Nitrides

20000032537 NASA Johnson Space Center, Houston, TX USA
Oxidation of Reinforced Carbon-Carbon Subjected to Hypervelocity Impact
Curry, Donald M., NASA Johnson Space Center, USA; Pham, Vuong T., NASA Johnson Space Center, USA; Norman, Ignacio, Boeing North American, Inc., USA; Chao, Dennis C., Boeing North American, Inc., USA; March 2000; 66p; In English
Report No.(s): NASA/TP-2000-209760; S-852; NAS 1.60:209760; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This paper presents results from arc jet tests conducted at the NASA Johnson Space Center on reinforced carbon-carbon (RCC) samples subjected to hypervelocity impact. The RCC test specimens are representative of RCC components used on the Space Shuttle Orbiter. The arc jet testing established the oxidation characteristics of RCC when hypervelocity projectiles, simulating meteoroid/orbital debris, impact the RCC material. In addition to developing correlations for use in trajectory simulations, we discuss analytical modeling of the increased material oxidation in the impacted area using measured hole growth

data. Entry flight simulations are useful in assessing the increased Space Shuttle RCC component degradation as a result of impact damage and the hot gas flow through an enlarging hole into the wing leading-edge cavity.
Author
Carbon-Carbon Composites; Hypervelocity Impact; Oxidation; Arc Jet Engines; Hypervelocity Projectiles; Impact Tests

20000032572 Institut Francais du Petrole, Rueil-Malmaison, France
Synthesis and characterization of associating polymers which contain siloxanes chains
Meyer, V.; Jan. 11, 1999; 218p; In French; In English
Report No.(s): DE99-765553; IFP-45-237; No Copyright; Avail: Department of Energy Information Bridge

Polymers that associate via physical interactions in solutions have received much attention as viscosifiers. Such associating polymers are now used in variety of applications due to their unique theological properties coating, food thickeners, paints, enhanced oil recovery, water treatment. They contain a hydrophilic main chain with hydrophobic side chain that is generally constituted of hydrocarbon or fluorocarbon groups. Novel copolymers with sites of association in aqueous solution were prepared by co-polymerizing acrylamide with an hydrophobic monomer containing siloxane parts. Rheological properties were studied as a function of polymer concentration, microstructure, shear rate and frequency in order to show intra intermolecular associations between the hydrophobic parts. The polymer solution viscosity increases as a function of the hydrophobic group content. Tests of adsorption show a high affinity of these copolymers with clay and the amount absorbed increase with the quantity of hydrophobic entities containing in the chain. These properties are enhanced compared to copolymers containing hydrocarbon chains.
NTIS
Copolymerization; Siloxanes; Molecular Chains; Microstructure; Oil Recovery; Paints; Water Treatment

20000032616 Saitama Inst. of Tech., Saitama, Japan
On the Polymer/Salt Hybrid of Polyelectrolyte Complex (PAA/PVPy)/Salt (NaCl)
Hirai, Yoshiyuki, Saitama Inst. of Tech., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 72-75; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Polyelectrolyte complexes of poly (acrylic acid)/poly (4-vinylpyridine) have been adopted as the polymer matrix for polymer/salt hybrid. The incorporation of NaCl solution into the complexes has been investigated, and the mechanism of incorporation has been discussed. The following have been proved. The Na(+) ions interact with pyridine rings not with carboxyl groups. The carboxyl groups form hydrogen bonds with water molecules of solvent. The complex containing excess poly (4-vinylpyridine) is interesting as the polymer matrix for solid polymer electrolyte.
Author
Molten Salt Electrolytes; Electrochemistry; Solid Electrolytes; Polymers; Sodium Chlorides

20000032625 Saitama Inst. of Tech., Saitama, Japan
Dehydrochlorination of Poly (Vinyl Chloride) and Poly (Vinylidene Chloride) Films
Tanaka, Jun, Saitama Inst. of Tech., Japan; Kumazawa, Takashi, Saitama Inst. of Tech., Japan; Shimizu, Harumichi, Saitama Inst. of Tech., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 42-45; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The dehydrochlorination reactions of poly (vinyl chloride) (PVC) and poly (vinylidene chloride) (PVDC) with alkaline isoamylalcohol solutions in the presence of organic peroxide were studied. PVC and PVDC films were treated with potassium hydroxide in isoamylalcohol containing a small amount of organic peroxide such as di-t-butylperoxide (DTBP) to form the dehydrochlorinated polyene structure. It was found that the dehydrochlorination depended largely on the reaction temperature and DTBP concentrations. On doping with electron acceptor such as iodine, the conductivity of these films increased markedly up to 10(exp -5)-10(exp -6)S/Cm and it depended on the dehydrochlorinated ratio. The electrodes of polymer batteries consisted of dehydrochlorinated PVC and PVDC films. The electromotive forces of these polymer batteries were approx. 1.2-2.5V.
Author
Acceptor Materials; Electric Batteries; Organic Peroxides; Vinylidene; Dehydrogenation; Chlorine Compounds

20000032626 Saitama Inst. of Tech., Saitama, Japan
Copolymerization of N-Phenylmaleimide and Methyloxirane Initiated with Organozinc Compounds
Hagiwara, Tokio, Saitama Inst. of Tech., Japan; Hamana, Hiroshi, Saitama Inst. of Tech., Japan; Narita, Tadashi, Saitama Inst. of Tech., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 38-41; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Copolymerization of N-phenylmaleimide (PMI) and methyloxirane (MO) was carried out with organozinc initiators (diethylzinc and diethylzinc/methanol systems) and several anionic initiators such as sodium naphthalenide and potassium tert-butoxide. Among them only [Zn(OMe3)2(EtZnOMe3)6] gave rise to the copolymerization and afforded the methanol insoluble copolymer in 19% yield with unimodal molecular weight distribution (Mn = 5.0 x 10(exp 3) (for polystyrene standard calibration) and Mw/Mn = 1.5). H-1-NMR and TLC analyses confirmed that the copolymerization of the carbon-carbon double bond and of the three-membered cyclic ether takes place. The other organozinc compounds (diethylzinc, (EtZnOM3)4 and (Zn(OMe3)2)(n)) and the anionic initiators only produced homopolymers of PMI or MO.
Author
Copolymerization; Methyl Compounds; Phenyls; Polystyrene; Organic Compounds; Monomers; Initiation; Catalysts; Vinyl Copolymers

20000032933 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Room-Temperature Direct Plasma Oxidation of Tantalum by High-Density Ion Bombardment and Highly-Reliable Metal-Insulator-Metal Structure Employing Tantalum Nitride Interfacial Layers
Nakao, Shin–ichi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 319-320; In Japanese; Copyright; Avail: Issuing Activity
Electrical properties and qualities of tantalum oxide films and highly-reliable structure of tantalum oxide capacitors were investigated in this study. Tantalum oxide films were formed by plasma direct oxidation of tantalum films at room temperature. High density and low electron temperature plasma supplied by microwave-excitation plasma process equipment featuring radial line slot antenna (RLSA) was adopted for this oxidation process. Weakly-oxidized interfacial layer was obtained between tantalum layer and tantalum oxide layer by spectroscopic ellipsometry. to realize formation of strongly-oxidized tantalum oxide layers and to avoid oxygen diffusion from tantalum oxide layer, inserting tantalum nitride layers into interface between tantalum oxide layer and electrode layer as diffusion barrier for oxygen atoms is necessary.
Author
Metal Films; MIM (Semiconductors); Oxidation; Oxide Films; Tantalum

20000032934 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Structure and Saturation Magnetization of alpha”-Fe16N2 Thin Films Fabricated by Means of an Ultra-Clean Sputtering Process
Kato, Masafumi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 317-318; In Japanese; Copyright; Avail: Issuing Activity
alpha”-Fe16N2 films were fabricated by means of an ultra-clean sputtering process (UC process). The impurity oxygen content of Fe-N films fabricated by this process was 0.3 at%, one-third of that of films fabricated by the normal process. The mean diameter of the grain size of UC processed alpha”-Fe16N2 was 1.5 times larger than that of films fabricated by the normal process. The degree of the preferred grain orientation of UC-processed alpha”-Fe16N2 films was superior to that of films fabricated by the normal process. The saturation magnetization of alpha”-Fe16N2 films fabricated by the UC process was at most 240 emu/g, the same as that of films fabricated by the normal process.
Author
Magnetization; Sputtering; Thin Films; Microstructure; Cleanliness

20000032935 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Intial Growth of Metal Films Fabricated by Sputtering and Evaporation
Ashino, Masakazu, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 315-316; In Japanese; Copyright; Avail: Issuing Activity
Microstructural changes in the initial growth stage of Cu films fabricated by sputtering and evaporation are discussed. During and after deposition, the amplitude V of surface acoustic waves (SAWs) propagated on the piezoelectric substrate through die films deposited on it, and the electrical sheet resistivity of the films, R(sub sq), were measured. The surface morphology of the films was examined by using an atomic force microscope. As a result it was found that (1) the critical thicknesses d(sub p), at which the islands of a film begin to percolate, and d(sub c) at which the film becomes two-dimensionally continuous, are smaller in sputter-deposited films than in evaporated ones; (2) the surface roughness of sputter-deposited films is smaller than that of evaporated films; and (3) microstructural change that increases the average inter-island spacing is harder to achieve in sputter-deposited films than in evaporated ones.
Author
Evaporation; Metal Films; Microstructure; Sputtering; Surface Acoustic Wave Devices

20000032973 NASA Marshall Space Flight Center, Huntsville, AL USA

Polymeric Coatings for Electrodynamic Tethers

Vaughn, Jason A., NASA Marshall Space Flight Center, USA; Kamenetzky, Rachel R., NASA Marshall Space Flight Center, USA; Finckenor, Miria M., NASA Marshall Space Flight Center, USA; Schuler, Peter, Triton Systems, Inc., USA; [2000]; 2p; In English; Joint Propulsion, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 242-81-40; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Two polymeric coatings have been developed for the Propulsive Small Expendable Deployer System (ProSEDS) mission. ProSEDS is designed to provide an on-orbit demonstration of the electrodynamic propulsion capabilities of tethers in space. The ProSEDS experiment will be a secondary payload on a Delta II unmanned expendable booster scheduled for launch in August 2000. A 5-km conductive tether is attached to the Delta 11 second stage and collects current from the low Earth orbit (LEO) plasma to facilitate de-orbit of the spent stage. The conductive tether is attached to a 10-km non-conductive tether, the other end of which is attached to an endmass containing several scientific instruments. A bare metal tether would have the best conductivity but thermal concerns preclude this design. A conductive polymer developed by Triton Systems has been optimized for conductivity and thermo-optical properties. The current design for the ProSEDS conductive tether is seven strands of 28 AWG aluminum wire individually coated with 8.7 micrometers (0.35 mil) of an atomic oxygen-resistant conductive polymer composed of a mixture of 87% Clear Oxygen-Resistant polymer (COR) and 13% polyanaline (PANi), wrapped around a braided Kevlar (TM) 49 core. Extensive testing has been performed at the Marshall Space Flight Center (MSFC) to qualify this material for flight on ProSEDS. Atomic oxygen exposure was performed, with solar absorptance and infrared emittance measured before and after exposure. Conductivity was measured before and after atomic oxygen exposure. High voltage tests, up to 1500 V, of the current collecting ability of the COR/PANi have been completed. Approximately 160 meters of the conductive tether closest to the Delta 11 second stage is insulated to prevent any electron reconnection to the tether from the plasma contactor. The insulation is composed of polyimide overcoated with TOR-BP, another polymeric coating developed by Triton for this mission. TOR-BP acts as both insulator and a protective coating against atomic oxygen erosion. The insulation has been tested to withstand 5000 V.

Author

Polymeric Films; Tetherlines; Electrodynamics; Small Satellite Technology; Protective Coatings

20000033032 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of Ultra-Thin Insulator Film Formation using High-Density Plasma

Saito, Yuji, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 329-330; In Japanese; Copyright; Avail: Issuing Activity

High-integrity silicon nitride films can be obtained at a temperature of 400 deg C using a high-density (>10(exp 12) cm 3) plasma characterized by low ion bombardment energies of below 7eV. It was found for the first time that stoichiometric silicon nitride can be grown at 400 C by precise control of nitrogen mixing ratio to generate N(+2) in plasma. The growth rate and the electrical properties of this silicon nitride are similar to those of thermally grown nitride. Moreover, hysteresis of the C-V curve attributed to charge traps in the silicon nitride film disappeared with the addition of hydrogen to Ar/N2 plasma, and nitride films with low leakage current was obtained using Ar/N2/H2 plasma. In addition, the growth rate increases using Ar/NH3 plasma and electrical properties of the nitride films are similar to those formed by Ar/N2/H2 plasma. These technologies are very promising for fabricating feature metal substrate silicon-on-insulator (SOI) devices and silicon nitride gate metal-insulator-semiconductor field effect transistors (MISFET's).

Author

Thin Films; Insulators; Silicon Films; Silicon Nitrides

20000033034 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Microstructure and Magnetic Properties of M-Co(M=Au,Ag,Cu) Granular Thin Films Fabricated by Means of an Extremely Clean Sputtering Process

Tashashi, Daisuke, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 321-322; In Japanese; Copyright; Avail: Issuing Activity

The influence of impurities in the sputtering atmosphere on the microstructure and magnetic properties of M-Co(M = Au,Ag,Cu) granular thin films was investigated. M-Co films were prepared under different purities of the sputtering atmosphere by changing the base pressure, with 10(exp -11) Torr for an extremely clean process (XC-process) and 10(exp -7) Torr for a

lower-grade process (LG-process). It was found that M-Co solid solution formed from competition phenomenon between matrix metal and oxygen combines with Co atom.
Author
Thin Films; Sputtering; Magnetic Properties; Microstructure; Purity

20000033072 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Infinite-Ranged Spin-S Ising Spin Glass Models by using the Replica Method
Katayama, Katsuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 379-380; In Japanese; Copyright; Avail: Issuing Activity

We investigate effects of the spin value for three types of infinite-ranged Ising spin glass models, namely the SK model, the GS model and the CNY model with spin-S Ising spin, including S = infinity, by using the replica method; the replica symmetry (RS) solutions, the AT stability and the replica symmetry breaking (RSB) solutions. We clarify that some thermodynamic quantities show different behaviors for a finite S and for S = infinity in these models. We find that there exists a first order phase transition for an integer S but not for a half-integer S is greater than 1/2, including S = infinity, in the GS model. We find that there exists a two-sublattice structure of order parameters for an integer S but not for a half-integer S is greater than 1/2 in the CNY model.
Author
Spin Glass; Ising Model; Particle Spin; Broken Symmetry

20000033092 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Dispersed-Precipitates Microstructure and Giant Magneto-optical Properties for MnSbPt Films
Saito, Shin, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 69-72; In Japanese; Copyright; Avail: Issuing Activity

The mechanism of the enhancement of the MO Kerr rotation in the short wavelength region for Mn50Sb44Pt6 films was investigated from the viewpoints of the dispersed-precipitates microstructure and of their components of the dielectric tensor. As results, it was found that (1) the PtMnSb phase with fcc structure coherently precipitated at grain boundaries of the host solid solution of the hex. MnSb(Pt) phase at the annealing temperatures less than 300 C, (2) the PtMnSb phase recrystallized to be the size of about 1000 A, with changing the crystal orientation from (110) to a high atomic density plane of (111) at the annealing temperatures more than 300 C, (3) the PtSb2 phases nucleated and grew to be dendrite as a result of the diffusion of Pt atoms from the PtMnSb phase after annealing over 400 C, (4) for the Mn50Sb44Pt6 film, the maximum of theta(sub k), where epsilon(sub xx)' was relatively small, was originated from epsilon(sub xy)', (5) the appearance and the shift of the theta(sub k) maximum were caused by the epsilon(sub xy)' maximum, and (6) in the sharing layers between the MnSb phase and the PtMnSb phase under the coherent precipitation process, only the magneto-optical transition (epsilon(sub xy)' maximum) of the MnSb phase at 2.50 eV was observed.
Author
Precipitates; Microstructure; Magneto-Optics; Kerr Magnetooptical Effect; Precipitation Hardening

20000033179 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Measurements of Acoustic Properties of Glasses by the Ultrasonic Waves in the VHF Range
Wei, Ting–Cun, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 24-27; In Japanese; Copyright; Avail: Issuing Activity

In this paper, the properties analysis of glasses and optical fiber preforms, and the characterizations of their fabrication processes have been carried out using ultrasonic waves in the VHF range. It has been shown that the ultrasonic waves in the VHF range are very useful in the characterizations of glass materials for their significant frequency dependences of attenuation and velocity. It has also been shown that the impurities such as OH, Cl etc. with ppm order which are incorporated into glasses in their fabrication process, and the inhomogeneous distributions of dopants can be detected obviously with ultrasonic method.
Author
Acoustic Properties; Glass; Ultrasonic Radiation

20000033277 National Inst. of Standards and Technology, Gaithersburg, MD USA
New Approaches to the Development of Fire-Safe Aircraft Materials
Morgan, A. B.; Gilman, J. W.; Nyden, M.; Jackson, C. L.; Feb. 2000; 28p; In English
Report No.(s): PB2000-101949; NISTIR-6465; No Copyright; Avail: National Technical Information Service (NTIS)

Thermoplastic polyetherimide-clay nanocomposites were synthesized from 1,3-phenylenediamine and bisphenol A dianhydride using an in situ approach. The two organically treated clays were montmorillonite clays treated with the ammonium salts of n-dodecylamine or 12-amino-1-dodecanoic acid. The dispersion of the clay in the polyetherimide were analyzed by wide-angle X-ray scattering and tramission electron microscopy. The results showed that the clay treated with the ammonium salt of 12-amino-1-dodecanoic acid gave a well-dispersed intercalated nanocomposite while the clay treated with the ammonium salt of n-dodecylamine gave a well-dispersed immiscible blend. These nanocomposites were then analyzed by thermal gravimetric analysis for their thermal stability. Computational and experimental approaches were developed to explore the nature and consequences of thermally induced changes that occur in the condensed phase of burning polymers. A computational strategy for evaluating molecular weight distributions from molecular dynamics simulations was developed based on a simple differential equation for the time dependence of the number average degree of polymerization, x. The experimental effort was successful in obtaining real-time measurements of the mid-infrared spectra of burning polymers. The condensed phase spectra of nylon 6 and a nylon 6/clay nanocomposite were measured using a fiber optic reflectance probe while they were burning on the cone calorimeter.
NTIS
Aircraft Construction Materials; Flame Retardants; Thermoplasticity; Polymerization; Thermal Analysis; Flammability

20000033514 Edinburgh Univ., Dept. of Chemistry, UK
Photoluminescence of 5-Cyanoindole Electropolymer Films
Jennings, P., Edinburgh Univ., UK; Jones, A. C., Edinburgh Univ., UK; Mount, A. R., Edinburgh Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 110-111; In English; See also 20000033474; Original contains color illustrations
Contract(s)/Grant(s): EPSRC-GR/K/12625; Copyright; Avail: Issuing Activity
Electropolymerized 5-substituted indoles are new examples of photoluminescent conjugated polymer systems. The occurrence of efficient luminescence in conjugated polymers has become o technological interest since the discovery that electroluminescence could be produced from poly(phenylene vinylene) in thin-film light-emitting diode structures Electroluminescent polymer films have potential applications in the development of large-area light-emitting displays. The aim of this research project was to carry out a detailed investigation of the photophysical properties of electropolymerized 5-substituted indoles, with particular emphasis on the factors influencing their photoluminescence efficiency. The electropolymerisation of 5-substituted indoles proceeds via a trimeric intermediate and the polymer consists of linked trimer units. Previously, we have reported on the fluorescence properties of the polymers and their constituent trimers in solution phase and of intact polymer films). In this report we focus on the photoluminescence properties of electropolymerized 5-cyanoindole films. As discussed previously, the photoluminescence efficiency of 5-cyanoindole polymer films shows a dramatic dependence on redox state. The films are highly fluorescent in the reduced (neutral) state but non-fluorescent in the oxidised (cationic) state. The fluorescence of the non-emitting oxidised film is restored when the Film is dissolved, indicating that it is the morphology of the film, not the redox state of the polymer chains, that is responsible for the quenching of fluorescence.
Author
Electroluminescence; Polymerization; Photoluminescence; Research; Oxidation-Reduction Reactions

20000033515 Durham Univ., Dept. of Chemistry, UK
Study of Amphiphillic Polymers at Oil/Water Interfaces Using Vibrational Sum-Frequency Spectroscopy
Bowers, J., Durham Univ., UK; Zarbakhsh, A., Durham Univ., UK; Webster, J. R. P., Rutherford Appleton Lab., UK; Towrie, M., Rutherford Appleton Lab., UK; Clark, I. P., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 112; In English; See also 20000033474; Copyright; Avail: Issuing Activity
Sum frequency spectroscopy (SFS) is a non-linear, surfacespecific technique that measures the vibrational spectrum of molecules assembled at a surface or interface. In the experiment, two pulsed laser beams (one visible, the other infrared) are overlapped on the surface and the intensity of the generated sum-frequency output is measured as a function of the incident infrared frequency. by polarisation selection of the three beams, molecular orientation and bonding processes at the interface can be inferred. SFS has been applied at solid/liquid air/liquid, and liquid/liquid interfaces. Since surfactants and polymers appear in a wide range of domestic and industrial applications we sought to make a comparative study of the adsorption of polymers with different molecular architecture at an oil/water interface using SFS. The method exploited thus far to study liquid/liquid interfaces limits the choice of oil. In order to develop a new method of studying liquid/liquid interfaces utilising thin, stable oil films (based on a method we have established for complementary neutron reflectivity studies), we have used the LSF's lasers.
Author
Vibrational Spectra; Frequencies; Infrared Radiation; Liquid-Liquid Interfaces; Nonlinearity; Surfactants

20000033528 Nottingham Trent Univ., Nottingham, UK

KrF Laser Annealing of ZnS:Mn Thin Film Phosphors

Mastin, E., Nottingham Trent Univ., UK; Cranton, W., Nottingham Trent Univ., UK; Thomas, C. B., Nottingham Trent Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 141-142; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Inorganic thin Films of ZnS:Mn are of importance in the Field of flat screen display technology as the active light emitting layer in thin Film electroluminescent displays (TFELs). Recently, the Displays Research Group at Nottingham Trent University have demonstrated the use of TFEL technology within a novel high resolution, miniature display device that utilizes laterally transmitted light to produce high intensity emission at reflecting microstructures. Miniature flat screen displays based on this technology have Sufficient luminance (greater than 3000 fL) to be suitable for portable head mounted display systems, where the projected display image is bright enough to permit viewing over ambient background illumination. Critical to the fabrication of the LETFEL, or any TFEL device is an annealing process to activate the dopant in the thin film phosphor. However, as demonstrated by the authors, thermal annealing of the device also results in a modification of the phosphor/dielectric interface region, which is detrimental to the electron transport properties within the device, limiting the performance. Hence, since 1997, the Displays Group has been working with the CLF, under EPSRC Grant No. GR/K90074, to examine the feasibility of using pulsed laser annealing (PLA) of the thin film phosphor, in order to achieve the dopant activation with minimal effect on the interface region. Following an initial period of investigation to determine the optimum experimental arrangement PLA irradiations of ZnS:Mn thin films have been demonstrated to provide enhancements in luminescence , and recently we have commenced PLA of LETFEL display devices, which are currently being fabricated into full), working demonstrators. The present report covers the experimental period 98/99, when much of the work was concerned with a materials investigation into the effect of PLA on ZnS:Mn thin film crystallinity.

Author

Krypton Fluoride Lasers; Zinc Sulfides; Manganese; Thin Films; Phosphors; Laser Annealing; Fabrication

20000033533 South Bank Univ., School of Electrical, Electronic and Information Engineering, London, UK

Growth, Excimer Laser Annealing and Characterisation of ECR-PECVD Si Thin Films for Seed Layer Production of Crystalline Si on Amorphous Substrates

Summers, S., South Bank Univ., UK; Reehal, H. S., South Bank Univ., UK; Hirst, G. J., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 154-155; In English; See also 20000033474; Sponsored in part by BP Solar; Copyright; Avail: Issuing Activity

Current silicon solar cell manufacturing costs are kept high due to the use of expensive crystalline silicon substrates. The substrates account for around 50% of the cost of production and inhibit the development of photovoltaic product lines. Therefore low cost alternatives need to be used. An obvious choice is glass and this has been the choice of many research groups in this field. However glass constrains the processing temperatures in thin film crystalline silicon growth limiting traditional high temperature (greater than 600 C) approaches and so other techniques are required to attain the required crystallinity of material on an amorphous substrate. Excimer laser crystallisation (ELC) has been used to produce crystalline silicon from amorphous silicon films as thin film transistors for use in active matrix LCD displays. This approach could, in principle, be extended to large area crystallisation for solar cells and is the motivation for this work.

Author

Technology Assessment; Amorphous Materials; Amorphous Silicon; Crystallinity; Glass; Low Cost; Solar Cells; Silicon Films; Manufacturing

20000033576 NASA Langley Research Center, Hampton, VA USA

Stretch-Oriented Polyimide Films

Hinkley, Jeffrey A., NASA Langley Research Center, USA; Klinedinst, D., Norfolk State Univ., USA; Feuz, L., Eidgenoessische Technische Hochschule, Switzerland; April 2000; 18p; In English

Contract(s)/Grant(s): RTOP 274-00-99-07

Report No.(s): NASA/TM-2000-210094; NAS 1.15:210094; L-17953; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two thermoplastic polyimides - one amorphous, the other crystallizable -- were subjected to isothermal stretching just above their glass transition temperatures. Room-temperature strengths in the stretch direction were greatly improved and, moduli increased up to 3.6-fold. Optimum stretching conditions were determined.

Author

Polyimides; Polymeric Films; Thermoplasticity; Stretching; Tensile Properties

20000033689 NASA Lewis Research Center, Cleveland, OH USA

Creep Life of Ceramic Components Using a Finite-Element-Based Integrated Design Program (CARES/CREEP)

Gyekenyesi, J. P., NASA Lewis Research Center, USA; Powers, L. M., Cleveland State Univ., USA; Jadaan, O. M., Wisconsin Univ., USA; Transactions of the ASME; Jan. 1998; Volume 120, pp. 162-171; In English; 41st; International Gas Turbine and Aeroengine Congress and Exhibition, 10-13 Jun. 1996, Birmingham, UK; Sponsored by American Society of Mechanical Engineers, USA

Report No.(s): ASME-Paper-96-GT-369; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The desirable properties of ceramics at high temperatures have generated interest in their use for structural applications such as in advanced turbine systems. Design lives for such systems can exceed 10,000 hours. The long life requirement necessitates subjecting the components to relatively low stresses. The combination of high temperatures and low stresses typically places failure for monolithic ceramics in the creep regime. The objective of this paper is to present a design methodology for predicting the lifetimes of structural components subjected to creep rupture conditions. This methodology utilized commercially available finite element packages and takes into account the time-varying creep strain distributions (stress relaxation). The creep life of a component is discretized into short time steps, during which the stress and strain distributions are assumed constant. The damage is calculated for each time step based on a modified Monkman-Grant creep rupture criterion. Failure is assumed to occur when the normalized accumulated damage at any point in the component is greater than or equal to unity. The corresponding time will be the creep rupture life for that component. Examples are chosen to demonstrate the CARES/CREEP (Ceramics Analysis and Reliability Evaluation of Structures/CREEP) integrated design programs, which is written for the ANSYS finite element package. Depending on the component size and loading conditions, it was found that in real structures one of two competing failure modes (creep or slow crack growth) will dominate. Applications to benechmark problems and engine components are included.

Author

Creep Analysis; Finite Element Method; Ceramics; Engine Parts; Service Life; Creep Properties; Failure Modes

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.

20000033615 NASA Marshall Space Flight Center, Huntsville, AL USA

Peroxide Propulsion at the Turn of the Century

Anderson, William E., NASA Marshall Space Flight Center, USA; Butler, Kathy, Boeing Co., USA; Crocket, Dave, Orbital Sciences Corp., USA; Lewis, Tim, Orbital Sciences Corp., USA; McNeal, Curtis, NASA Marshall Space Flight Center, USA; Mar. 13, 2000; 59p; In English; 4th; 4th International Symposium on Liquid Space Propulsion, 13 Mar. 2000, Heilbronn, Germany; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A resurgence of interest in peroxide propulsion has occurred in the last years of the 21st Century. This interest is driven by the need for lower cost propulsion systems and the need for storable reusable propulsion systems to meet future space transportation system architectures. NASA and the Air Force are jointly developing two propulsion systems for flight demonstration early in the 21st Century. One system will be a development of Boeing's AR2-3 engine, which was successfully fielded in the 1960s. The other is a new pressure-fed design by Orbital Sciences Corporation for expendable mission requirements. Concurrently NASA and industry are pursuing the key peroxide technologies needed to design, fabricate, and test advanced peroxide engines to meet the mission needs beyond 2005. This paper will present a description of the AR2-3, report the status of its current test program, and describe its intended flight demonstration. This paper will then describe the Orbital 10K engine, the status of its test program, and describe its planned flight demonstration. Finally the paper will present a plan, or technology roadmap, for the development of an advanced peroxide engine for the 21st Century.

Author

Propulsion System Performance; Reusable Rocket Engines; Space Transportation System; Hydrogen Peroxide; Liquid Rocket Propellants

29
SPACE PROCESSING

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

20000032211 Morehouse School of Medicine, Space Medicine and Life Sciences Research Center, Atlanta,GA USA
Simulated Microgravity Induced Cytoskeletal Rearrangements are Modulated by Protooncogenes
Melhado, C. D., Morehouse School of Medicine, USA; Sanford, G. L., Morehouse School of Medicine, USA; Bosah, F., Morehouse School of Medicine, USA; Harris–Hooker, S., Morehouse School of Medicine, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 45-50; In English; See also 20000032189
Contract(s)/Grant(s): NCCW-85; NAG9-852; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Microgravity is the environment living systems encounter during space flight and gravitational unloading is the effect of this environment on living systems. The cell, being a multiphasic chemical system, is a useful starting point to study the potential impact of gravity unloading on physiological function. In the absence of gravity, sedimentation of organelles including chromosomes, mitochondria, nuclei, the Golgi apparatus, vacuoles, and the endoplasmic reticulum may be affected. Most of these organelles, however, are somewhat held in place by cytoskeleton. Hansen and Igber suggest that intermediate filaments act to stabilize the nuleus against rotational movement, and integrate cell and nuclear structure. The tensegrity theory supports the idea that mechanical or physical forces alters the cytoskeletal structures of a cell resulting in the changes in cell: matrix interactions and receptor-signaling coupling. This type of stress to the cytoskeleton may be largely responsible regulating cell shape, growth, movement and metabolism. Mouse MC3T3 El cells under microgravity exhibited significant cytoskeletal changes and alterations in cell growth. The alterations in cytoskeleton architecture may be due to changes in the expression of actin related proteins or integrins. Philopott and coworkers reported on changes in the distribution of microtubule and cytoskeleton elements in the cells of heart tissue from space flight rats and those centrifuged at 1.7g. Other researchers have showed that microgravity reduced EGF-induced c-fos and c-jun expression compared to 1 g controls. Since c-fos and c-jun are known regulators of cell growth, it is likely that altered signal transduction involving protooncogenes may play a crucial role in the reduced growth and alterations in cytoskeletal arrangements found during space flight. It is clear that a microgravity environment induces a number of changes in cell shape, cell surface molecules, gene expression, and cytoskeletal reorganization. However the underlying mechanism for these cellular changes have not been clearly defined. We examined alterations in endothelial migration, and cytoskeleton architecture (microfilamentous f-actin and vimentin-rich- intermediate filaments) following wounding under simulated microgravity. We also examined the possibility that altered signal transduction pathways, involving protooncogenes, may play a crucial role in microgravity-induced retardation of cell migration and alterations in cytoskeletal organization. We hypothesize that, based on the tensegrity theory, cytoskeletal organization respond to gravitational unloading and through this response, cell behavior, function and gene expression are modified.

Derived from text

Cells (Biology); Microgravity; Gravitational Effects; Physiological Effects; Biological Effects; Musculoskeletal System; Cytology

20000032542 Boeing Co., Huntington Beach, CA USA
Microgravity Vibration Output Testing of Space Station Rotary Joints
Boucher, Robert L., Boeing Co., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The mission of the International Space Station is to provide a working laboratory in orbit for research in engineering, life sciences, and microgravity. Ensuring that the mechanical equipment on Space Station does not unduly disturb the microgravity environment is of paramount importance in meeting the Station's mission. The large inertia being moved by the Space Station's solar array and thermal radiator rotary joints make them one of the largest potential disturbance sources. The present paper describes the mechanical and control system design of these joints, their disturbance producing characteristics, and analytical predictions of some key performance indicators. The component and system functional tests performed to measure the actual vibration output of the joints are detailed and the test results discussed. Results of the rotary joint test program presented here show that the joints do meet the Space Station microgravity requirements, ensuring that this unique laboratory for microgravity research will be unaffected by the operation of the largest moving machinery on board.

Author

Life Sciences; Microgravity; Vibration; Vibration Measurement; International Space Station; Joints (Junctions)

20000032745 NASA Glenn Research Center, Cleveland, OH USA

Effects of G-Jitter on Interfacial Dynamics of Two Miscible Liquids: Application of MIM

Duval, Walter M. B., NASA Glenn Research Center, USA; Tryggvason, Bjarni V., Canadian Space Agency, Canada; March 2000; 44p; In English; 37th; 37th Aerospace Sciences Meeting and Exhibit, 11-19 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 101-53-00

Report No.(s): NASA/TM-2000-209789; NAS 1.15:209789; E-12073; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We designed an experiment to examine the effects of g-jitter on mixing of two miscible liquids using the Microgravity Vibration Isolation Mount (MIM). The global bifurcation of the interface was observed with the MIM operating alternatively to either transmit the g-jitter, isolate from the g-jitter or to provide controlled vibration levels with well defined amplitude and frequency content. With the MIM in isolation mode, the interface remains stationary indicating buoyancy induced convection is negligibly small such that mixing occurs via intrinsic mass diffusion without the masking effect of vibration driven convection. Analytical and computational results are in agreement with the experimental findings. Operation of the MIM in forced mode with conditions typical of g-jitter shows that vibration induced convective flows can excite instability mechanisms such as Kelvin-Helmholtz to generate large amplitude quasi-stationary waves oriented vertically for various cases with Stokes-Reynolds number in the range of 0.003 to 0.5. The two and four mode quasi-stationary waves are also predicted with a mathematical model. Though unplanned, the effect of a primary thruster filing was captured and shown to cause a catastrophic bifurcation, enhancing local mass transport. In light of the findings, experiments planned for the International Space Station should consider the potential effects of g-jitter.

Author

Vibration; Vibration Effects; Vibration Isolators; Transport Theory; Liquids; Microgravity; Phase Shift; Liquid Flow; Liquid-Liquid Interfaces

20000033451 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands

Mathematical Methods for Quasi-Static Components of Natural Perturbative Accelerations in Micro Gravity Environment Analysis

Spallicci, Allesendro D. A. M., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Journal of Spacecraft Technology; Jan. 1998; Volume 8, No. 1, pp. 88-93; In English; Copyright; Avail: Issuing Activity

Calculation of the natural (gravity gradient and air drag) quasi-static components of perturbative accelerations for analysis of the microgravity environment has been carried out for EURECA. Considering the simulation of spacecraft torques, the predictions are compared to in-orbit measurements performed with accelerometers on-board the EURECA spacecraft. The comparison shows that reliable upper limits on gravity gradient, drag, and spacecraft torques acceleration can be established with a confidence of low percentage.

Author

Accelerometers; Microgravity; Simulation; Perturbation; Acceleration (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.

20000032467 GenCorp Aerojet, Azusa, CA USA

Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Engineering Test Report: AMSU-A2 S/N 108 Weight and Center of Gravity, Measurements *Final Report*

Bahng, R., GenCorp Aerojet, USA; Mar. 07, 2000; 36p; In English

Contract(s)/Grant(s): NAS5-32314

Report No.(s): AEROJET-11652; CDRL-207; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the Engineering Test Report, AMSU-A2 S/N 108 Weight and Center of Gravity Measurements, for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).

Author

Advanced Microwave Sounding Unit; Center of Gravity; Performance Tests

20000032499 Japan Atomic Energy Research Inst., Tokyo, Japan

ITER cryostat main chamber and vacuum vessel pressure suppression system design

Ito, A.; Nakahira, M.; Takahashi, H.; Tada, E.; Nakashima, Y.; Mar. 31, 1999; 168p; In English

Report No.(s): DE99-758369; JAERI-TECH-99-026; No Copyright; Avail: Department of Energy Information Bridge

Design of Cryostat Main Chamber and Vacuum Vessel Pressure Suppression System (VVPS) of International Thermonuclear Experimental Reactor (ITER) has been conducted. The cryostat is a cylindrical vessel that includes in-vessel component such as vacuum vessel, superconducting toroidal coils and poloidal coils. This cryostat provides the adiabatic vacuum about 10(sup -4) Pa for the superconducting coils operating at 4 K and forms the second confinement barrier to tritium. The adiabatic vacuum is to reduce thermal loads applied to the superconducting coils and their supports so as to keep their temperature 4 K. The VVPS consists of a suppression tank located under the lower bio-shield and 4 relief pipes to connect the vacuum vessel and the suppression tank. The VVPS is to keep the maximum pressure rise of the vacuum vessel below the design value of 0.5 MPa in case of the in-vessel LOCA (water spillage from in-vessel component). The spilled water and steam are lead to the suppression tank through the relief pipes when the internal pressure of vacuum vessel is over 0.2 MPa, and then the internal pressure is kept below 0.5 MPa. This report summarizes the structural design of the cryostat main chamber and pressure suppression system, together with their fabrication and installation.

NTIS

Fusion Reactors; Thermonuclear Reactions; Vacuum Systems; Systems Engineering; Structural Design

20000032554 State Univ. of New York, Dept. of Mechanical and Aerospace Engineering, Buffalo, NY USA

The Other Side of Multidisciplinary Design Optimization: Accommodating a Multiobjective, Uncertain and Non-Deterministic World

Lewis, Kemper, State Univ. of New York, USA; Mistree, Farrokh, Georgia Inst. of Tech., USA; Engineering Optimization; 1998; Volume 31, No. 2, pp. 161-189; In English

Contract(s)/Grant(s): NGT-51102; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The evolution of multidisciplinary design optimization (MDO) over the past several years has been one of rapid expansion and development. In this paper, the evolution of MDO as a field is investigated as well as the evolution of its individual linguistic components: multidisciplinary, design, and optimization. The theory and application of each component have indeed evolved on their own, but the true net gain for MDO is how these piecewise evolutions coalesce to form the basis for MDO, present and future. Originating in structural applications, MDO technology has also branched out into diverse fields and application arenas. The evolution and diversification of MDO as a discipline is explored but details are left to the references cited.

Author

Multidisciplinary Design Optimization; Design Analysis; Structural Design; Computer Aided Design

20000032959 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Logic Design Pathology and Space Flight Electronics

Katz, R., Spacecraft Digital Electronics, USA; Barto, R., Spacecraft Digital Electronics, USA; Erickson, K., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 18p; In English; European Space Components Conference (ESCCON 2000), 20-24 Mar. 2000, Noordwijk, Netherlands; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The ESCCON will be held at the beginning of the year 2000 in a time when small satellites, constellations and new applications have created unprecedented demands on cost, availability and assurance of electronic components. New management concepts and standardi-sation and procurement methods have responded to the changes in the world market. In particular, various space component initiatives have drastically improved the situation in Europe. The Conference will accordingly reflect recent achievements, discuss the problems and challenges of the present and review future prospects and risks. The state of the art and trends in component technologies and physics, new testing and measurement techniques, development of packaging and assembly methods, and tolerance to the space environment will form an important part of the conference. The conference will highlight all major activities relating to selection, procurement, control, and utilization of electronic, electrical and electromechanical components for space application and relate, discuss and question the developments of the latest concepts and methods. Invited papers will address key issues and Panel/Round Table discussions will further emphasise major topics. Continuing the success of previous conferences, a strong intercontinental relationship will be maintained and ample opportunities will be provided for the exchange of ideas and information between managers, engineers and specialists from various countries and projects.

Derived from text

Electromechanics; Logic Design; Space Flight; Spacecraft Components; Microelectronics

20000033151 Hong Kong Univ. of Science and Technology, Kowloon, Hong Kong

Proceedings of Symposium on Energy Engineering in the 21st Century (SEE 2000), Volume 3

Jan. 13, 2000; 461p; In English, 9-13 Jan. 2000, Hong Kong

Contract(s)/Grant(s): F62562-99-M-9146

Report No.(s): AD-A373941; AOARD-CSP-991002-Vol-3; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

Volume 1, Page 1-406 Includes: Keynote Papers, Forced Convection, Natural Convection, and Boiling and Condensation Volume 2, Page 407 - 903 Includes: Two-Phase Flow, Porous Media, Heat Pipes and Thermosyphons, Conduction and Radiation, Microscale Heat Transfer, Heat Transfer Enhancement, Solar Energy & Nuclear Energy, Thermal Storage, Melting & Solidification Volume 3, Page 904 - 1,345 Includes: Drying & Food Processing, Heat Exchangers, Air-Conditioning and Refrigeration, Cryogenic Engineering, Energy and Environment, Combustion and Fire Volume 4, Page 1,346 - 1,734 Includes: Cycle Analysis, Engine Combustion, Waste Treatment by Thermal Methods, Fuel Cells, Clean Combustion Technology, Coal Combustion

DTIC

Conferences; Energy Storage

20000033172 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of Wet Cleaning Process for ULSI Manufacturing

Tsuga, Toshihito, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 92-94; In Japanese; Copyright; Avail: Issuing Activity

The wet cleaning system which can satisfy both high performance and high productivity was developed and the effects for future ULSI Manufacturing could be verified. The requirements for silicon wafer cleaning levels and for cleaning technology in and after sub-quarter micron devices were expressed clearly and the needs could be satisfied by newly developed single wafer wet cleaning system, that the cleaning process conditions were optimized. This paper shows the cleaning technology to offer ultra-clean silicon surface with high productivity.

Author

Wafers; Chemical Cleaning; Silicon; Very Large Scale Integration

20000033242 Clemson Univ., Dept. of Mechanical Engineering, SC USA

Using Design Capability Indices to Satisfy Ranged Sets of Design Requirements

Chen, Wei, Clemson Univ., USA; Allen, Janet K., Georgia Inst. of Tech., USA; Simpson, Timothy W., Georgia Inst. of Tech., USA; Mistree, Farrokh, Georgia Inst. of Tech., USA; 1996; 13p; In English; Design Engineering Technical, 18-22 Aug. 1996, Irvine, CA, Irvine, CA, USA, USA; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): NAG1-1564; NSF DDM-93-96503

Report No.(s): DETC96/DAC-1090; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

For robust design it is desirable to allow the design requirements to vary within a certain range rather than setting point targets. This is particularly important during the early stages of design when little is known about the system and its requirements. Toward this end, design capability indices are developed in this paper to assess the capability of a family of designs, represented by a range of top-level design specifications, to satisfy a ranged set of design requirements. Design capability indices are based on process capability indices from statistical process control and provide a single objective, alternate approach to the use of Taguchi's signal-to- noise ratio which is often used for robust design. Successful implementation of design capability indices ensures that a family of designs conforms to a given ranged set of design requirements. to demonstrate an application and the usefulness of design capability indices, the design of a solar powered irrigation system is presented. Our focus in this paper is on the development and implementation of design capability indices as an alternate approach to the use of the signal-to-noise ratio and not on the results of the example problem, per se.

Author

Computer Aided Design; Design Analysis; Robustness (Mathematics)

20000033284 State Univ. of New York, Multidisciplinary Center for Earthquake Engineering Research, Buffalo, NY USA

Proceedings of the US-Japan Workshop on Earthquake Resistant Design of Lifeline Facilities and Countermeasures against Soil Liquefaction

O'Rourke, T. D.; Bardet, J. P.; Hamada, M.; Nov. 19, 1999; 678p; In English; 7th, 15-17 Aug. 1999, Seattle, WA, USA

Contract(s)/Grant(s): NSF CMS-97-01471

Report No.(s): PB2000-103354; MCEER-99-0019; No Copyright; Avail: CASI; A06, Microfiche; A99, Hardcopy

The 43 papers in this volume present information about the seismic design of lifeline facilities and methods to prevent liquefaction. The papers are grouped into the following categories: (1) Liquefaction and ground deformation; (2) Lifelines and earthquake effects; and (3) Waterfront structures, pile foundations, and buildings. The appendices contain: (1) reports created in working group sessions; (2) the workshop agenda; and (3) a list of workshop participants.
NTIS
Conferences; Earthquake Resistant Structures; Liquefaction; Countermeasures

20000033300 Georgia Inst. of Tech., Systems Realization Lab., Atlanta, GA USA
On the Use of Statistics in Design and the Implications for Deterministic Computer Experiments
Simpson, Timothy W., Georgia Inst. of Tech., USA; Peplinski, Jesse, Georgia Inst. of Tech., USA; Koch, Patrick N., Georgia Inst. of Tech., USA; Allen, Janet K., Georgia Inst. of Tech., USA; 1997; 12p; In English; Design Engineering Technical, 14-17 Sep. 1997, Sacramento, CA, USA; Sponsored by American Society of Mechanical Engineers, USA; Sponsored in part by Gwaltney
Contract(s)/Grant(s): NGT-51102; NSF DMI-96-12365; NSF DMI-96-12327
Report No.(s): DETC97/DTM-3881; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Perhaps the most prevalent use of statistics in engineering design is through Taguchi's parameter and robust design -- using orthogonal arrays to compute signal-to-noise ratios in a process of design improvement. In our view, however, there is an equally exciting use of statistics in design that could become just as prevalent: it is the concept of metamodeling whereby statistical models are built to approximate detailed computer analysis codes. Although computers continue to get faster, analysis codes always seem to keep pace so that their computational time remains non-trivial. Through metamodeling, approximations of these codes are built that are orders of magnitude cheaper to run. These metamodels can then be linked to optimization routines for fast analysis, or they can serve as a bridge for integrating analysis codes across different domains. In this paper we first review metamodeling techniques that encompass design of experiments, response surface methodology, Taguchi methods, neural networks, inductive learning, and kriging. We discuss their existing applications in engineering design and then address the dangers of applying traditional statistical techniques to approximate deterministic computer analysis codes. We conclude with recommendations for the appropriate use of metamodeling techniques in given situations and how common pitfalls can be avoided.
Author
Statistical Analysis; Mathematical Models; Neural Nets; Experiment Design; Approximation; Computer Aided Design

20000033301 State Univ. of New York, Dept. of Mechanical and Aerospace Engineering, Buffalo, NY USA
Collaborative, Sequential and Isolated Decisions in Design
Lewis, Kemper, State Univ. of New York, USA; Mistree, Farrokh, Georgia Inst. of Tech., USA; 1997; 13p; In English; Design Engineering Technical, 14-17 Sep. 1997, Sacramento, CA, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): NGT-51102; NSF DMI-94-20405
Report No.(s): DETC97/DTM-3883; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Massachusetts Institute of Technology (MIT) Commission on Industrial Productivity, in their report Made in America, found that six recurring weaknesses were hampering American manufacturing industries. The two weaknesses most relevant to product development were 1) technological weakness in development and production, and 2) failures in cooperation. The remedies to these weaknesses are considered the essential twin pillars of CE: 1) improved development process, and 2) closer cooperation. In the MIT report, it is recognized that total cooperation among teams in a CE environment is rare in American industry, while the majority of the design research in mathematically modeling CE has assumed total cooperation. In this paper, we present mathematical constructs, based on game theoretic principles, to model degrees of collaboration characterized by approximate cooperation, sequential decision making and isolation. The design of a pressure vessel and a passenger aircraft are included as illustrative examples.
Author
Concurrent Engineering; Decision Making; Industries; Computer Aided Manufacturing; Computer Aided Design; Game Theory; Optimization

20000033302 Georgia Inst. of Tech., Systems Realization Lab., Atlanta, GA USA
The Problem of Size in Robust Design
Koch, Patrick N., Georgia Inst. of Tech., USA; Allen, Janet K., Georgia Inst. of Tech., USA; Mistree, Farrokh, Georgia Inst. of Tech., USA; Mavris, Dimitri, Georgia Inst. of Tech., USA; 1997; 12p; In English; Design Engineering Technical, 14-17 Sep. 1997, Sacramento, CA, USA; Sponsored by American Society of Mechanical Engineers, USA; Sponsored in part by Gwaltney
Contract(s)/Grant(s): NGT-51102; NSF DMI-96-12365
Report No.(s): DETC97/DAC-3983; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

To facilitate the effective solution of multidisciplinary, multiobjective complex design problems, a departure from the traditional parametric design analysis and single objective optimization approaches is necessary in the preliminary stages of design. A necessary tradeoff becomes one of efficiency vs. accuracy as approximate models are sought to allow fast analysis and effective exploration of a preliminary design space. In this paper we apply a general robust design approach for efficient and comprehensive preliminary design to a large complex system: a high speed civil transport (HSCT) aircraft. Specifically, we investigate the HSCT wing configuration design, incorporating life cycle economic uncertainties to identify economically robust solutions. The approach is built on the foundation of statistical experimentation and modeling techniques and robust design principles, and is specialized through incorporation of the compromise Decision Support Problem for multiobjective design. For large problems however, as in the HSCT example, this robust design approach developed for efficient and comprehensive design breaks down with the problem of size - combinatorial explosion in experimentation and model building with number of variables -and both efficiency and accuracy are sacrificed. Our focus in this paper is on identifying and discussing the implications and open issues associated with the problem of size for the preliminary design of large complex systems.
Author
Experiment Design; Supersonic Transports; Complex Systems; Robustness (Mathematics); Mathematical Models; Aircraft Design; Computer Aided Design; Decision Support Systems

20000033436 National Chung Hsing Univ., Dept. of Civil Engineering, Taichung, Taiwan, Province of China
Design of Scaffold Shores for Concrete Buildings During Construction
Yen, Tsong, National Chung Hsing Univ., Taiwan, Province of China; Chen, How–Ji, National Chung Hsing Univ., Taiwan, Province of China; Huang, Yue–Lin, National Chung Hsing Univ., Taiwan, Province of China; Chen, Wei–Fah, Purdue Univ., USA; Chi, Ren–Chau, National Chung Hsing Univ., Taiwan, Province of China; Lin, Yung–Chih, National Chung Hsing Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Nov. 1997; ISSN 0253-3839; Volume 20, No. 6, pp. 603-614; In English; Copyright; Avail: Issuing Activity

The aim of this paper is to offer some practical information for consideration in designing scaffold systems commonly used in concrete building construction. to this end, the content of this work is divided into two parts; the load part and the resistance part. In the load part, the loads during the process of concrete placing are discussed. Some field data have been collected. The intensities and distributions of the gravity loads are based on the investigations and calculations of 20 working sites. An amplification factor (A.F.) is also suggested to cover the effects caused by some seriously unsymmetrical concrete-placing paths. In the resistance part, the load-carrying capacities and the variations of the scaffolds are discussed. Some laboratory and field tests along with analytical work have been made. The unit structure which serves as a basic unit to develop the entire scaffold system is also suggested. Based on the load and resistance information, a step-by-step design procedure for scaffold shore systems is proposed.
Author
Buildings; Loads (Forces); Construction; Concrete Structures; Structural Reliability

20000033633 Hong Kong Univ. of Science and Technology, Kowloon, Hong Kong
Proceedings of Symposium on Energy Engineering in the 21st Century (SEE 2000), Volume 4
Cheng, Ping, Editor, Hong Kong Univ. of Science and Technology, Hong Kong; Jan. 13, 2000; 406p; In English, 9-13 Jan. 2000, Hong Kong
Contract(s)/Grant(s): F62562-99-M-9146
Report No.(s): AD-A373942; AOARD-CSP-991002-Vol-4; ISBN 1-56700-132-7; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

Topics discussed in this symposium includes: Forced Convection, Natural Convection, and Boiling and Condensation, Two-Phase Flow, Porous Media, Heat Pipes and Thermosyphons, Conduction and Radiation, Microscale Heat Transfer, Heat Transfer Enhancement, Solar Energy & Nuclear Energy, Thermal Storage, Melting & Solidification, Drying & Food Processing, Heat Exchangers, Air-Conditioning and Refrigeration, Cryogenic Engineering, Energy and Environment, Combustion and Fire, Cycle Analysis, Engine Combustion, Waste Treatment by Thermal Methods, Fuel Cells, Clean Combustion Technology, and Coal Combustion
DTIC
Conferences; Heat Storage; Fuel Cells; Thermal Energy

20000033634 Hong Kong Univ. of Science and Technology, Kowloon, Hong Kong

Proceedings of Symposium on Energy Engineering in the 21st Century (SEE 2000), Volume 2

Cheng, Ping, Editor, Hong Kong Univ. of Science and Technology, Hong Kong; Jan. 13, 2000; 517p; In English, 9-13 Jan. 2000, Hong Kong

Contract(s)/Grant(s): F62562-99-M-9146

Report No.(s): AD-A373943; AOARD-CSP-991002-Vol-2; ISBN 1-56700-132-7; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche

Topics in this symposium includes: Forced Convection, Natural Convection, and Boiling and Condensation, Two-Phase Flow, Porous Media, Heat Pipes and Thermosyphons, Conduction and Radiation, Microscale Heat Transfer, Heat Transfer Enhancement, Solar Energy & Nuclear Energy, Thermal Storage, Melting & Solidification, Drying & Food Processing, Heat Exchangers, Air-Conditioning and Refrigeration, Cryogenic Engineering, Energy and Environment, Combustion and Fire, Cycle Analysis, Engine Combustion, Waste Treatment by Thermal Methods, Fuel Cells, Clean Combustion Technology, and Coal Combustion.

DTIC

Conferences; Fuel Cells; Thermal Energy

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.

20000032104 NASA Langley Research Center, Hampton, VA USA

Improved Speech Coding Based on Open-Loop Parameter Estimation

Juang, Jer–Nan, NASA Langley Research Center, USA; Chen, Ya–Chin, Institute for Computer Applications in Science and Engineering, USA; Longman, Richard W., Institute for Computer Applications in Science and Engineering, USA; February 2000; 22p; In English

Contract(s)/Grant(s): RTOP 632-02-00-03

Report No.(s): NASA/TM-2000-209845; NAS 1.15:209845; L-17913; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A nonlinear optimization algorithm for linear predictive speech coding was developed early that not only optimizes the linear model coefficients for the open loop predictor, but does the optimization including the effects of quantization of the transmitted residual. It also simultaneously optimizes the quantization levels used for each speech segment. In this paper, we present an improved method for initialization of this nonlinear algorithm, and demonstrate substantial improvements in performance. In addition, the new procedure produces monotonically improving speech quality with increasing numbers of bits used in the transmitted error residual. Examples of speech encoding and decoding are given for 8 speech segments and signal to noise levels as high as 47 dB are produced. As in typical linear predictive coding, the optimization is done on the open loop speech analysis model. Here we demonstrate that minimizing the error of the closed loop speech reconstruction, instead of the simpler open loop optimization, is likely to produce negligible improvement in speech quality. The examples suggest that the algorithm here is close to giving the best performance obtainable from a linear model, for the chosen order with the chosen number of bits for the codebook.

Author

Estimating; Coding; Speech; Voice Data Processing

20000032105 NASA Glenn Research Center, Cleveland, OH USA

RF Transmission Lines on Silicon Substrates

Ponchak, George E., NASA Glenn Research Center, USA; [1999]; 4p; In English; 1999 European Microwave Conference, 4-8 Oct. 1999, Munich, Germany; Sponsored by Institute of Electrical and Electronic Engineers, USA

Contract(s)/Grant(s): RTOP 632-50-5D; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A review of RF transmission lines on silicon substrates is presented. Through measurements and calculated results, it is shown that attenuation is dominated by conductor loss if silicon substrates with a resistivity greater than 2500 Ohm-cm are used. Si passivation layers affect the transmission line attenuation; however, measured results demonstrate that passivation layers do not necessarily increase attenuation. If standard, low resistivity Si wafers must be used, alternative transmission lines such as thin film

microstrip and Co-Planar Waveguide (CPW) on thick polyimide layers must be used. Measured results presented here show that low loss per unit length is achievable with these transmission lines.
Author
Radio Frequencies; Silicon; Substrates; Transmission Lines; Microwave Circuits; Integrated Circuits

20000032151 NASA Lewis Research Center, Cleveland, OH USA
Impedance Matching of Tapered Slot Antenna using a Dielectric Transformer
Simons, R. N., NASA Lewis Research Center, USA; Lee, R. Q., NASA Lewis Research Center, USA; Electronic Letters; Nov. 26, 1998; Volume 34, No. 24, pp. 2287-2289; In English; No Copyright; Avail: Issuing Activity

A new impedance matching technique for tapered slot antennas using a dielectric transformer is presented. The technique is demonstrated by measuring the input impedance, Voltage Standing Wave Ratio (VSWR) and the gain of a Vivaldi antenna (VA). Measured results at Ka-Band frequencies are presented and discussed.
Author
Dielectrics; Impedance Matching; Slot Antennas; Standing Wave Ratios

20000032338 New Mexico Highlands Univ., NASA Center for Autonomous Control Engineering, Las Vegas, NM USA
An Example of Mixed Processing of Delta-Sigma Modulated Pulse Stream
Gallegos, Marcelina, New Mexico Highlands Univ., USA; Zrilic, Djuro, New Mexico Highlands Univ., USA; Ramirez–Angulo, J., New Mexico Highlands Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 339-341; In English; See also 20000032189
Report No.(s): 98URC063; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper is about mixed processing of a delta-sigma modulated pulse stream with an analog signal. to show that mixed analog/digital processing is possible, we implemented a system for frequency doubling. Hardware design and relevant signals are presented.
Author
Signal Processing; Delta Modulation; Analog to Digital Converters

20000032361 Research and Technology Organization, Studies, Analysis and Simulation Panel, Neuilly-sur-Seine, France
Modelling and Analysis of Command and Control ***Modelisation et Analyse de Processus de Commandement et de Controle***
June 1999; 364p; In English; In French, 12-14 Jan. 1999, Moulineaux, France; See also 20000032362 through 20000032387
Report No.(s): RTO-MP-38; AC/323(SAS)TP/12; ISBN 92-837-0010-4; Copyright Waived; Avail: CASI; A16, Hardcopy; A03, Microfiche

The main objective for this Symposium was to exchange the latest research information in selected focus areas that must be addressed when conducting systematic and disciplined evaluation of C3I systems. A second objective was to provide an opportunity for NATO countries and PfP nations representatives to discuss examples of current best practices in C31 research, modeling, and analysis with recognized experts in the field. The Symposium consisted of six sequential sessions and was based on the format used by the SAS-002 team to assemble its ”Code of Best Practice for the Assessment of Command and Control” [RTO publication TR-9, AC/323(SAS)TP/4]. The opening session comprises a keynote address by French General Marescaux, an overview of the work of the SAS-002 team, and a presentation on significant aspects and contributions of the team’s work. The other sessions are on Measures of Merit (Session 1), Modeling and Simulations (Session 2), Human Factors and Organizations (Session 3), Applications (Session 4), and Special Topics (Session 5).
Derived from text
Command and Control; Communication; Decision Support Systems; Intelligence; Conferences; Computer Techniques; Defense Program

20000032362 Defence Evaluation Research Agency, Centre for Defence Analysis (High Level Studies), Farnborough, UK
The Analysis of Command and Control
Moffat, James, Defence Evaluation Research Agency, UK; Modelling and Analysis of Command and Control; June 1999, pp. 1-1 - 1-16; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Across NATO, there is a growing realisation that the proper representation of Command and Control (C2) within combat models is very important. Some of the reasons for this are: (a) to show the cost-effectiveness of investment in C2 systems, (b) to support Defence programmes such as ’Digitization of the Battlespace’, and (c) the need to represent C2 in order to properly represent overall force behaviour and effectiveness. This includes the need to incorporate emerging understanding of the human

impact on operational effectiveness. There is thus an urgent need to develop methods of properly representing these effects. In consequence, research has been instigated in the UK to investigate ways in which the effects of C2 can be incorporated successfully into constructive simulation models of combat - i.e. simulation models which can run in closed form on a computer, and represent the effects of C2, without the need for human intervention during the simulation run. A major pressure acting on defence operational research studies is the need to address a wider span of likely futures (scenarios) in studies, reflecting increased uncertainty in the post-Cold War world. Another reflection of this uncertainty is the need to consider a wide range of sensitivity analysis, and to do this quickly enough to influence the political process. These point to the need for constructive simulation models, incorporating the effects of C2, which run at rates very much faster than real time, and which are easily transportable across different situations and scenarios. There have been several attempts in the last thirty years to develop simulation models of war which have a proper representation of the C2 process. Proper here means sufficiently good that the models can be used with confidence for studies to advise ministers and other high level public sector decision-makers on major defence budget expenditure (running to billions of pounds) and preferred future force structures for the defence of the country. In such circumstances Operational Analysis (as Operational Research is called in the Ministry of Defence) is subject to another pressure which is to represent processes in sufficient detail to give confidence that the results can be trusted. There is thus a need to strike a balance between such detail and the need for rapid analysis of alternatives. This is the key research challenge.Previous attempts at representing the C2 process in the NATO defence communities have adopted rule based approaches based on expert systems. These have led to models which are slow, difficult to understand, and very difficult to transfer from one scenario to another. They are thus not suited to the new post-Cold War defence environment. A new approach is laid out here, which shows sufficient promise that the ideas concerned are being incorporated into the next generation of simulation models under development at the Centre for Defence Analysis. These models are designed to span the range of likely future defence environments, ranging across Land, Sea and Air, and including lower level operations such as Peacekeeping.
Author
Command and Control; Computerized Simulation; Mathematical Models; Combat; Real Time Operation; Warfare; Expert Systems; Military Operations

20000032363 Norwegian Defence Research Establishment, Kjeller, Norway
Reflections on the use of the ”RSG-19 COBP Report” in C2-Analysis Projects
Langsaeter, Tor, Norwegian Defence Research Establishment, Norway; Modelling and Analysis of Command and Control; June 1999, pp. 2-1 - 2-10; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

RSG-19 has completed a Code of Best Practice (COBP) for the analysis and modelling of Command and Control (C2). FFI has recently conducted a major command and control analysis project for the Norwegian Army, and I have asked myself the hypothetical question: How could this project have benefited from a COBP if it had existed at the time when the project started? I quickly could think of several ways in which the COBP could have been useful, but the potential most important one I had not anticipated when I first asked myself the question. As a result of this thinking process I realised that it was not easy to get a clear appreciation of the value of the COBP in relation to a specific analysis. Therefore I thought my reflections on how the COBP may have been used, and speculations on what impact such use may have had for the result of our study, could be of interest to others, in particular those who are or will be involved in similar studies in the future. Most people making an overall assessment of our C2-project would conclude that the project ended up as a success. However, success is a relative term, and we also experienced serious difficulties during the project of both methodological and project management nature. I have concluded that the potentially most important contribution of a COBP had it existed, would have been to improve the communication within the project team and thus facilitate the project management. This is what I am going to expand on during this presentation. As a background for explaining how I think the COBP could have been used I need to tell you about the project and explain some of the problems we encountered in the study process.
Author
Command and Control; Project Management; Management Planning; Mathematical Models

20000032364 Evidence Based Research, Inc., Vienna, VA USA
Command and Control Evaluation in the Information Age
Kirzl, John E., Evidence Based Research, Inc., USA; Modelling and Analysis of Command and Control; June 1999, pp. 3-1 - 3-13; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The advent of the information age is rapidly accelerating the exchange of information between military components. to take full advantage of the anticipated benefits of the information age, the military is being forced to rethink the way in which it conducts business and organizes the battlefield. The greatest impact of the information age will be on the command and control systems and processes, and in how to apply tile new capabilities of the information age to increase the speed and quality of decision making.

In order to understand how to improve the command and control process, it is necessary to understand what that process is in its basic form. Command and control can be said to consist of a set of primitive functions. These are called primitive because they have historically been shown to be part of any C2 system regardless of the technology or doctrine applied. The functions consist of those necessary to provide the required information to the decision maker and the command and control processes that enable situation assessment, planning, and execution. The information functions include: Seek information, Retrieve information, Archive information, Inform population, Disseminate information, Consult with staffs and decision makers, Report out to staffs and decision maker, and Present information to staffs and decision makers. The information functions enable the command and control processes of: (1) Comprehension of the operating environment which consists of the intelligence, surveillance and reconnaissance process (ISR), and fusion of data and information (identify, situation assessment, threat assessment, action assessment); (2) Understanding which is a sufficient comprehension of the nature of the situation such that action is enabled; (3) Decision making which is the process of course of action (COA) development and assessment, uncertainty management, setting of criteria, and prioritizing; (4) Decide which is the selection of a course of action and the decision to implement it; and (5) Battle management which consists of the creation of a plan or replan and the associated implementation orders.
Author
Command and Control; Decision Making; Information Systems; Information Dissemination; Decision Support Systems

20000032365 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Fysisch en Elektronisch Lab., The Hague, Netherlands
The Role of C3I in Field Artillery Simulation
Kurstjens, S. T. G. L., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Modelling and Analysis of Command and Control; June 1999, pp. 4-1 - 4-11; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In the years 1997 and 1998 the simulation model SMART, which stands for Simulation Model ARTillery, to support the Dutch army in decision making. Main goal was to derive the optimal number and type of Howitzers, and organization of batteries and platoons, in a battalion. Two scenario settings were used to evaluate the performance of the field artillery system. In the first scenario a division appearance in a general defence task (full war) was simulated. In the second simulation a scenario of a brigade in a Peace Enforcing scenario was analysed. In the model the following components were explicitly modelled: Detection resources, Command and Control cells, Fire units, and Units of the enemy. In this model the enemy is modelled as black box and the actions of own forces do not influence the operations of enemy troops. As a consequence damage to own facilities was modelled as a parameter and only inflicted a possible damage after each round of fire. In the model of the Command and Control structure is inflexible. Networks and lines of communications are hard-coded and require a major adaptation in the model when changed. In the near future specific research questions of the Dutch army are expected concerning the Command and Control structure and lines of communications in the field artillery. We expect SMART to be not flexible enough to support these research themes. Therefore the decision was made to build a new research tool called SMARTER (Simulation Model ARTillery Extended and Revised). This paper consists of 5 chapters and is build up as follows. In chapter 2 the goal of the tool will be described. In chapter 3 we will describe how we think SMARTER can be used in a scenario setting. Chapter 4 will describe the elements, processes and measures which will be implemented in the tool SMARTER. In chapter 5 this paper will be concluded.
Author
Command and Control; Decision Making; Computerized Simulation; Mathematical Models; Warfare; Artillery

20000032366 Norwegian Defence Research Establishment, Kjeller, Norway
Evaluating Effect of C2 on Battle Outcome by Tracking Information Quality
Sundfor, Hans Olav, Norwegian Defence Research Establishment, Norway; Modelling and Analysis of Command and Control; June 1999, pp. 5-1 - 5-13; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

During the period 1994-97 FFI performed a large scale cost effect analysis of alternative C2-systems for the Norwegian Army division. Included in this was a study of the effect on expected battle outcome of the main C2 capabilities. The methodology that was used, is currently being refined and further developed, and will be used in future C2 analyses at the institute. The part of this methodology explicitly addressing the relation between C2 efficiency and battle outcome is outlined in the first part of the paper. The methodology consists in mapping alternative courses of a scenario, and then calculating the C2-systems ability to control the development onto a course giving a preferred endstate. In the second part an applied example taken from the past analysis is explained.
Author
Command and Control; Warfare; Decision Making; Cost Analysis

20000032367 EDS Defence Ltd., Fleet, UK

Analysis of Combat System Demands on a C3IS Architecture

Ashton, M., EDS Defence Ltd., UK; Miller, G. D., Defence Evaluation Research Agency, UK; Morgan, P. D., EDS Defence Ltd., UK; Modelling and Analysis of Command and Control; June 1999, pp. 6-1 - 6-10; In English; See also 20000032361
Contract(s)/Grant(s): MOD-CDA/E/295; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A military Command, Control, Communications and Intelligence System (C3IS) provides a Commander with the means of directing and coordinating the operation of his combat resources to achieve his tactical objectives within his operational environment; this requires that the facilities provided by the C3IS match the scope of the tactical objectives, the vagaries of the operational environment and the demands of the various combat resources. In general, C3IS development has followed an evolutionary path in response to the progressive improvement of individual combat systems; however, there are a few occasions when the introduction into service of a new combat system has led to the need to examine the implications for the C3IS. The majority of these have been when the combat system offered a major improvement to the war fighting capability of the force; the arrival during the next few years of the Attack Helicopter (AH) into the British Army's inventory is perceived to be just such an occasion. The modern Attack Helicopter with its onboard mission planning systems and its data transfer communication capabilities is expected to have a major influence on future C3IS requirements of ground forces. The introduction of the Attack Helicopter with its range of new and extended capabilities will enhance the British Army's effectiveness and range of options in a variety of scenarios; however, the control and management of these new capabilities are expected to place new demands on the C3IS which may require modification or extension of the existing C3IS architecture. This paper describes an integrated modelling approach that was developed to support investigation of the C3IS and AH Mission Management System capabilities that will be needed to maximize the effectiveness of battlefield aviation; it discusses the application of the approach, showing how it was used to meet the study requirements.

Derived from text

Command and Control; Helicopters; Support Systems; Combat; Information Systems; Mission Planning; Management Systems

20000032368 Norwegian Defence Research Establishment, Kjeller, Norway

An Approach to Model Development for Effectiveness Analysis of Command and Control Systems

Thorsen, Ulf, Norwegian Defence Research Establishment, Norway; Malerud, Stein, Norwegian Defence Research Establishment, Norway; Feet, Else Helene, Norwegian Defence Research Establishment, Norway; Brathen, Karsten, Norwegian Defence Research Establishment, Norway; Modelling and Analysis of Command and Control; June 1999, pp. 7-1 - 7-10; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper describes model development as part of a cost effectiveness analysis of Command and Control Systems (C2S). The modelling method is developed by and applied in an on-going analysis at the Norwegian Defence Research Establishment (FFI), addressing development of a future C2S for the Royal Norwegian Navy. The scope of the study is the naval tactical level and the maritime part of the joint operational C2 level. The aim of this paper is to present an approach for model development in the context of effectiveness analyses, and as an introduction to this, the framework for cost effectiveness analysis is outlined in order to relate the modelling process to the analysis. The outline gives an overview of the cost effectiveness analysis used to distinguish between a set of system alternatives. Given this overview, we focus on model development and simulations in general and model development in connection with C2S in particular (i.e. the level between sub system analyses and operational consequences). The general part of the model development establishes a hierarchy of desired C2S properties, Measures of Merit (MoMs), and models and experiments used to measure MoMs for each of three modelling levels established for this analysis. The three levels are the C2 sub system level, the C2S level and the operational level. Examples of sub system level models are introduced. C2S level modelling is the scope of this paper, and an outline of a method for developing a C2S model is described in greater detail. Aspects represented in our object oriented approach are given. Finally, experiments employed to relate C2S effectiveness to operational consequences are described. The role of scenarios and use of war games and scenario discussions are central topics in this context. The study is currently in its initial phases and the approach presented in this paper is still under development.

Author

Command and Control; Mathematical Models; Computerized Simulation; Cost Effectiveness; Warfare

20000032369 Industrieanlagen-Betriebsgesellschaft m.b.H., Command, Control, Communications and Intelligence Div., Ottobrunn, Germany

On a Modular Concept for Command and Control in Simulation Models

Dompke, Uwe K. J., Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Tolk, Andreas, Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Modelling and Analysis of Command and Control; June 1999, pp. 9-1 - 9-5; In English;

See also 20000032361; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

This paper describes a principle architecture for the modelling of command and control in simulation systems. It focus on the definition of modules to represent command and control, reconnaissance and communications independent from an actual command level. Hereby, command and control, reconnaissance, communications and effective entities - i.e., atomic elements within the simulation systems modelling the objects that act, interact, move and are victim of attrition - are clearly divided and grouped within respective modules. The communications module builds within this the interfaces connecting all other elements. Author

Command and Control; Mathematical Models; Computerized Simulation

20000032370 Danish Defence Research Establishment, Copenhagen, Denmark

A Meta-Language for specifying the Command and Control Processes

Simonsen, K. J., Danish Defence Research Establishment, Denmark; Modelling and Analysis of Command and Control; June 1999, pp. 10-1 - 10-18; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper will give a general description of the basic ideas, concepts and the methodology chosen to design and implement a meta-language for specifying the ordering of force units including a suitable representation of the Command, Control, Communications and Information (C3I) processes, which forms the basis for the ordering of forces. The meta-language presented here has been incorporated in the land combat model JOHANNES developed at Danish Defence Research Establishment (DDRE). The name Ordrogram Language is used to designate any meta-language used for specifying the ordering of force units. This specification for each force unit is called the Ordrogram for that unit. So in other words, this paper will give a general description of the Ordrogram Language implemented in the JOHANNES model. Furthermore, some illustrative results will given in order to show some of the capabilities of the JOHANNES model. From a study on different options for the set of longer range intelligence gathering systems the time when a major critical decision was taken and the total losses to own forces for the different options will be presented.

Author

Command and Control; Object-Oriented Programming; Communication; Information; Combat; Programming Languages

20000032371 Centre d'Analyse de Defense, Arcueil, France

Representation of C3I in an Object-Oriented Simulation Environment ***Representation du C3R dans un environnement de simulation oriente objet***

Larrieu, M. L., Centre d'Analyse de Defense, France; Modelling and Analysis of Command and Control; June 1999, pp. 11-1 - 11-8; In French; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

CAD (Defense Analysis Center) is an organization within the French Defense Ministry which is responsible for conducting technical operational studies for governmental bodies. In order to best realize this type of study, CAD has developed numerous tools, including a reception structure allowing for research and development of technical operational simulations. The goal of this presentation is to describe the methodology developed by CAD in order to take into account the C3I aspect (Communication, Control, Commands, Information) in this type of simulation. In this article, the environment used by CAD, ESCADRE, as well as the BABYLONE library including reusable software components developed by this center, are presented. Next, C3I modeling in BABYLONE is described in detail. Finally, a study example carried out by CAD, involving the intervention of a complex communication network is presented.

Author

Computer Programs; Computer Techniques; Command and Control; Information; Mathematical Models

20000032372 MATRA Systemes and Information, Velizy-Villacoublay, France

Using Command Agents for Military Planning

Bouche, Jean–Paul, MATRA Systemes and Information, France; Floch, Jean–Pierre, Thomson-CSF Detexis, France; Michel, Martine, SYSECA, France; Modelling and Analysis of Command and Control; June 1999, pp. 12-1 - 12-8; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The main objective of the CARNEADE (Digitized Air Land Battle for Analysis Training and Decision-making) project is to meet the various needs of the French Army and the DGA (the French acquisition directorate of the Ministry of Defense) in the following areas: Training of Headquarter staffs at Brigade level and above, Operational decision support, and Force System analysis, For this main objective, the CARNEADE project consists in the development of a family of tools based on a common air-land battle simulation kernel. Sizing own forces and improving Courses of Action (COA) are complex issues in the combat operations preparation. This paper presents the functional and technical approaches used in the Army Operational Planning Demonstrator (DPO) to provide staff officers with an effective framework for military planning. The corner stone of this

development is the use of Command Agents (CA) modeling the division, regiment and company commanders decision-making processes. The friendly and enemy division CAs elaborate separate Courses of Action and those COA's are then played one after another in the combat simulation system. The simulation results are finally used by the military staff to evaluate and compare the friendly COA's. This paper presents the various techniques used for military knowledge representations of tactics, tasks and missions at the different Army echelons. Issues related to Flexibility and effectiveness of planning services are examined and then problems associated with Command Agents, such as knowledge management and VV&A, are addressed. Finally lessons learned for future developments of the program are considered.
Author
Military Operations; Command and Control; Decision Making; Mathematical Models; Mission Planning

20000032373 Electronic Systems Center, Modeling, Simulation and Training Product Area Directorate, Hanscom AFB, MA USA
Integrating Operational and Systems Architectures: How Modeling and Simulation Can Empower Command and Control Acquisition
Gibson, Richard B., Electronic Systems Center, USA; Modelling and Analysis of Command and Control; June 1999, pp. 13-1 - 13-8; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Both users and developers in the Air Force command and control (C2) community believe that the only way to improve C2 is to acquire and manage it as an integrated weapon system. Building components and hoping the end-user will lash them together correctly is a guarantee for disaster-that is not how we procure and deliver F-22s or M-1A1s. The immediate question about an integrated C2 weapon system is how do we do it? How do we even visualize a single system composed of hundreds or thousands of human beings and workstations and possibly stretching across multiple time zones, out into space and down into the cockpit and foxhole? How do we know the best approaches to improve our operational performance across the spectrum of military operations without this visualization? How do we know the best way to integrate technological innovation into our command and control capabilities? How can we trade different proposals to improve our performance in any meaningful or quantifiable way? The answers depend on perceiving a C2 architecture in at least three complementary ways, and in using processes and modeling and simulation (M&S) tools to integrate these perceptions and the different communities that create and use them. For too long, the acquisition community has built C2 capabilities as if they were end-items. The end result of such behavior is the example in December 1994 when NATO decided to create a Combined Air Operations Center in Vicenza, Italy to manage the air campaign over Bosnia. The US Air Force, as part of a NATO multi-force effort, promptly shipped tons of equipment to Vicenza. The NATO operators on site then faced a problem roughly analogous to what a fighter squadron would face if it received boxes and boxes of F-16 components and had to build its complement of aircraft then and there. The analogy of a C2 system to an F-16 bears up under further scrutiny: An F-16 is composed of thousands of components and subsystems, many of which are built in different locations by different vendors. These components may never come into contact until the assembly line, but they are expected to mesh together and interoperate as a single integrated system within narrow tolerances and without fault. Likewise, the acquisition community and industry will continue to build C2 components individually, but they must adopt practices that ensure that these components are integrable and interoperable when combined into the single weapon system. This is old ground that others have plowed and replowed thoroughly. The solution to the problem of interoperability that the USA Department of Defense has adopted is to build components in compliance with the Joint Technical Architecture, or JTA, and in compliance with a particular instantiation of the JTA called the Defense Information Infrastructure--Common Operating Environment, or DII-COE. Capabilities so built should be able to reside on the same workstation as other capabilities, share data and use common tools and services. The ultimate goal is for capabilities currently residing on separate workstations to eventually evolve into icons and applications residing on the same or compatible workstations. Given that the Air Force is building all of its C2 equipment in compliance with the JTA and DII-COE, have we thereby solved all of our problems? No, because building completely modular components without a blueprint will not guarantee that putting all the modules together will produce anything in particular, e.g., an airplane that will fly or a rocket that will launch. A technical architecture is just one way of looking at an integrated system, and is by itself insufficient to characterize that system. At least two more architectural views exist, the systems architecture and the operational architecture. The Office of the Assistant Secretary of Defense for Command, Control, Communications and Intelligence (OASD/C3I) released version 2.0 of the C4ISR Common Architecture Framework, which defines these three aspects of a command and control architecture and their interrelationships. Having introduced the technical architecture above, we shall discuss the other two in turn.
Author
Systems Engineering; Command and Control; Computerized Simulation; Mathematical Models; System Effectiveness

20000032374 Evidence Based Research, Inc., Vienna, VA USA

Modeling Decision Expertise for C2 Analyses

Noble, David F., Evidence Based Research, Inc., USA; Hayes, Richard E., Evidence Based Research, Inc., USA; Deutsch, Robert D., Evidence Based Research, Inc., USA; Modelling and Analysis of Command and Control; June 1999, pp. 14-1 - 14-10; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Human decision making is central to command and control (C2), and decision quality can significantly impact C2 effectiveness and the achievement of military objectives. Unfortunately, however, the immaturity of decision making models impedes studies in which decision quality is an important factor affecting C2 and mission effectiveness. This paper outlines a methodology for modeling decision quality and timeliness within C2 simulations. It estimates the correctness and timeliness of decisions given the quality of the decision maker's situation picture and his level of expertise, as modified by performance factors such as stress and fatigue, by experience, and by decision support systems. The models employed in this methodology are based on cognitive theories of expertise. This methodology focuses on contingent decision problems in which the decision maker must choose between previously specified alternatives, where policy and doctrine for making the choice are clear, but where the applicability of the policy to the current situation may be obscure. That is, the alternative that should be selected is clear if the situation can be understood correctly, but this understanding may be very difficult. We are not modeling the more complex decision making requiring planning and identification of alternatives.

Derived from text

Command and Control; Decision Making; Mathematical Models; Expert Systems

20000032375 Physics and Electronics Lab. TNO, The Hague, Netherlands

Tactical Information Abstraction Framework in Maritime Command and Control

Treurniet, Willem, Physics and Electronics Lab. TNO, Netherlands; vanDelft, Jan, Institute for Human Factors TNO, Netherlands; Paradis, Stephane, Defence Research Establishment Valcartier, Canada; Modelling and Analysis of Command and Control; June 1999, pp. 15-1 - 15-15; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Various operational trends in naval warfare put the shipboard decision making process under pressure. As an example, there is a continuous advance in threat technology and an ongoing shift to crisis management scenario's in littoral waters. Data must be processed under time-critical conditions and, as a consequence, the risk of saturation in building a tactical picture increases. In this complex context, the decision-makers need to gain a cognitive awareness of what is going on in their environment, by constructing a hierarchical situation model of this environment. This situation model consists of the basic elements present in the environment, relevant for understanding the situation. Furthermore, this situation model consists of combinations of interrelated elements, spatial and temporal structures, and abstractions expressing the situation at a functional and intentional level. Given our problem domain, maritime command and control, we will call this language according to which the situation model can be structured Tactical Information Abstraction Framework (TIAF). The purpose of this paper is to derive and describe a maritime TIAF. This TIAF can be used as a language in which the result of data fusion can be expressed. If we are able to use a TIAF, according to which situation awareness can be structured, in the data fusion process, we can make a smooth match of this process with a situation awareness framework. Thus we will be able to integrate the human element into the design of a decision support system aiding the operators to achieve the appropriate situation awareness.

Author

Command and Control; Decision Making; Man Machine Systems; Real Time Operation; Decision Support Systems; Information Systems

20000032376 National Defence Coll., Dept. of Operational Studies, Stockholm, Sweden

Mission Efficiency Analysis of tactical Joint Cognitive Systems

Worm, Arne, National Defence Coll., Sweden; Modelling and Analysis of Command and Control; June 1999, pp. 16-1 - 16-13; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

It is imperative that effective C3I in military operations ensures that a sufficient amount of information reaches the intended decision-maker in time, and that the information management system sustains the execution of a mission without excessive delay and friction. Information and intelligence must fulfil stringent requirements of reliability, availability, relevance, and diagnosticity. One of many purposes of tactical integrated C3I systems is to secure an omnidirectional, continuous flow of information from the division level down to the platoon and squad levels. Sometimes even individual soldiers and sensor systems must without delay be allowed to affect the decisions and actions of a higher-echelon commander. The main objective for our research undertaking is to actively take part in the fulfilment of the needs mentioned above, and thereby also contribute to the field of C3I system design, assessment and evaluation. In this paper we outline our work on development of theories and models for

acquisition, processing and representation of safety- and time-critical information, intended to aid decision makers performing complex tactical operations. We also tested these concepts in several simulated tactical operations, and finally, validated the concepts in a number of full-scale exercises. Our contention is that integrating relevant and effective methods and tools for analysis, synthesis and development is of the utmost importance to achieve successful improvement of command and control procedures as well as to successfully design and operate future command and control systems.
Derived from text
Command and Control; Cognition; Communication; Intelligence; Military Operations; Information Management; Decision Making

20000032377 Evidence Based Research, Inc., Vienna, VA USA
A Command and Control Operational Architecture for Future Warfighters
Wheatley, Gary, Evidence Based Research, Inc., USA; Noble, David F., Evidence Based Research, Inc., USA; Modelling and Analysis of Command and Control; June 1999, pp. 17-1 - 17-19; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Command and control architectures provide the frameworks to design, develop, and build the C2 systems capable of greatly increasing the effectiveness of military forces. In the USA, there are three classes of architectures involved. These were developed by the US Army Science Board and accepted by the US Defense Science Board and are consistent with generally accepted architecture design criteria, namely, Technical Architecture (the equivalent of building standards), Systems Architecture (the systems engineering), and Operational Architecture (the operational concept and connectivities that determine how the system will be used). This paper focuses entirely on the Operational Architecture, and uses an analytical approach to decompose it in terms of concept, structure, connectivity and activity.
Derived from text
Architecture (Computers); Command and Control; Design Analysis; Systems Engineering; Defense Program

20000032378 Marmara Research Inst., Information Technologies Research Inst., Gebze, Turkey
Quality Criteria for User/System Interfaces
Oren, Tuncer I., Marmara Research Inst., Turkey; Cetin, Selim, Marmara Research Inst., Turkey; Modelling and Analysis of Command and Control; June 1999, pp. 18-1 - 18-8; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

User/system interfaces are essential components of any interactive software, including command and control software. As part of overall quality of any interactive software quality issues of interfaces are very important. A set of 27 interface quality criteria for user/system interfaces are presented in four groups which are convenience (usability), communicativeness, reliability, and evolvability. The convenience criteria are related with: conveniences of the language, terminology, metaphor and the inputs; and functionality, simplicity, consistency, minimum memory load, navigability and least training. Communicativeness criteria cover: informativeness, guidance, perceptiveness, explanation ability, expressiveness, esthetic/cultural acceptance and types of user/system relationship. Reliability criteria are concerned with: error prevention, error tolerance, caution, predictability and access reliability. Evolvability criteria cover: adaptability, customizability, learning ability, maintainability and portability. The criteria can be used for evaluation and comparison of existing interfaces as well as for the design and implementation of new ones. Four tables with appropriate questions are provided to systematize the evaluations.
Author
Human-Computer Interface; Command and Control; Computer Programs

20000032379 Defence Evaluation Research Agency, Centre for Defence Analysis, Farnborough, UK
ICS/ISTAR Balance of Investment Methods Study
Sharp, Lynda, Defence Evaluation Research Agency, UK; Bateman, Alison, Defence Evaluation Research Agency, UK; Modelling and Analysis of Command and Control; June 1999, pp. 19-1 - 19-7; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Centre for Defence Analysis (CDA) within DERA are currently developing a top-down approach to Balance of Investment (BoI) in ICS (Information and Communication Systems) and ISTAR (Intelligence Surveillance Target Acquisition and Reconnaissance) systems. The method aims to assess the benefits of investment in battlefield ICS and ISTAR capabilities and to meet the need for investment in ICS systems to be evaluated alongside weapon systems using the same high level measures of effectiveness. The method also provides insight into the nature and levels of ICS and ISTAR capabilities needed to support planned future concepts of operation. An approach has been developed which is based around the use of constructive simulation models of theatre level warfare. An important part of the method involves identifying the key information flows which would

occur during a campaign. The method enables: (a) identification of the ICS and ISTAR capabilities needed to support planned future concepts of operations; (b) comparison of these with existing and planned procurement; (c) identification of excesses or shortfalls; and (d) measurement of the effect of any shortfalls on the conduct and outcome of an operation. In addition, to contribute fully to the balance of investment debate, the methodology should ideally be able to assess the balance of investment across the full spectrum of land, air and maritime warfare, including joint and combined operations, from a tactical to strategic level.
Derived from text
Information Systems; Communication; Information Flow; Command and Control; Intelligence

20000032380 TRADOC Test and Experimentation Command, Fort Bliss, TX USA
Digitization and the Analysis Process, Lessons from the Assessment of the U.S. Army's Task Force 21
Dzierzanowski, Kenneth, TRADOC Test and Experimentation Command, USA; Modelling and Analysis of Command and Control; June 1999, pp. 20-1 - 20-13; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In March 1997, the U.S. Army executed one of the most complex experiments in the history of land warfare. Utilizing thousands of pieces of advanced equipment and nearly ten thousand soldiers, evaluators, civilian employees, and contractors, the U.S. Army glimpsed the potential garnered from information age technologies. The experiment was conducted in the vastness of the National Training Center (NTC), Fort Irwin, California, on Army installations such as Fort Hood, Texas, and in analytical agencies such as the U.S. Army's Training and Doctrine Command (TRADOC) Analysis Center (TRAC), White Sands Missile Range (WSMR), New Mexico. This paper develops the process, models, and lessons learned from the support of the Task Force 21 (TF-21) Advanced Warfighting Experiment (AWE). First, the TF-21 AWE process is examined with a review of terms, the hypothesis definition process, AWE objectives, information systems, key participants, and experiment initiatives. Next the reader is given an overview of the assessment process that followed the Model-Experiment- Model (MEM) methodology. The MEM discussion details how to replicate field exercises with increased fidelity, limitations, models used, MOEs/MOPs, and "digitizing" the scenarios. Finally, detailed analysis, with models such as Janus and the Combined Arms and Support Task Force Evaluation Model (CASTFOREM), is conducted with results. The paper is concluded by a review of lessons learned and how these lessons will benefit military decision making.
Derived from text
Information Systems; Decision Making; Warfare; Decision Support Systems; Military Operations

20000032381 Physics and Electronics Lab. TNO, The Hague, Netherlands
Evaluation of Battlefield Management Systems
Spaans, Mink, Physics and Electronics Lab. TNO, Netherlands; Modelling and Analysis of Command and Control; June 1999, pp. 21-1 - 21-16; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

TNO is a modem Dutch, knowledge-based organisation providing services in the form of research, development and application of new technologies. TNO's knowledge finds immediate and practical use for all clients, both large and small, in the Netherlands and around the world. TNO provides most Dutch government departments with support in formulating policy, and undertakes projects to ensure that the policy works. The Dutch armed forces use the wide range of TNO services and the TNO defence research institutes are even referred to casually as the ministry of defence's in-house laboratory. Battlefield Management Systems (BMS) is one of the programs TNO is involved in. A BMS aims at reaching an optimal situation awareness while striving for maximal combat power, safety and endurance. Situation awareness can be defined as awareness of the current role and status related to friendly, enemy and neutral troops within the relevant part of the operational area. Situation awareness plays a major role in all decision processes. The first phase of the Dutch Battlefield Management Research and Development program started in 1996 when the Royal Netherlands Army (RNLA) awarded TNO a contract to investigate the phenomenon BMS. The attention for BMS was coupled to the introduction of a new German-Dutch Reconnaissance Vehicle in 2001 (The Fennek). Although this platform will most likely be the first one with a fully integrated BMS, the BMS-study is not limited to this platform. The ultimate goal is that all operational units in the RNLA, starting with the reconnaissance, will have a BMS. Among other things, the first phase led to a global list of functionality's and an identification of relevant developments in the international defence community. One of the outcomes of this study was the TNO- advise to evaluate a number of commercially available BMS'S. It was advised by T'NO to evaluate the systems in a laboratory environment. The purpose of this evaluation was twofold: first of all it would have to assess the systems as a possible solution for a Dutch BMS; secondly, the evaluation would help to refine the requirements of the BMS obtained in the first phase.
Derived from text
Command and Control; Armed Forces; Combat; Information Systems; Management Systems

20000032383 TRADOC Analysis Command, White Sands Missile Range, NM USA

Code of Best Practice for the Assessment of Command and Control

Bennett, Robert, TRADOC Analysis Command, USA; Modelling and Analysis of Command and Control; June 1999, pp. 23-1 - 23-13; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Code of best practice for the assessment of C2 represents over 3 years of team effort and evolved from a series of workshops. It summarizes current state-of-the-art for conducting evaluation and modeling of command and control. It is intended for experienced or analysts with no prior experience in C2 analysis as well as for broad dissemination. The paper contains the following sections: Introduction, Overview and summary of key points; Human factors and organisational issues, Scenarios, Measures of merit; Tools (models) and their application; and Conclusion and recommendations.

CASI

Command and Control; Human Factors Engineering

20000032384 Ministry of Defence, London, UK

The Five Ages of C3 Modelling: A Presentation to the NATO SAS-002 WG

Grainger, P. L., Ministry of Defence, UK; Modelling and Analysis of Command and Control; June 1999, pp. 24-1 - 24-8; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A presentation to the NATO SAS-002 WG on the Five Ages of C3 Modelling is summerized. The paper contains the 13-slides (with their description) used in the presentation. The five ages are: (1) The golden age lasted from about 1938 to 1945, and is a bit of a cheat, since there were hardly any computers then, and no computer models. However, it is well worth including here since it still has a lot to tell us. It also represents a sort of gold standard against which to judge how far we have progressed since (mostly backwards until recently) (2) The dark ages which lasted from about 1945 to 1975, during this period computer models appeared in profusion, the majority of them deterministic models based on the use of Lanchester equations to represent what in reality would be much more complex tactical interactions. The Dark Ages saw an unhealthy separation, still with us, between the ”C3 specialists”, who concentrated typically on radar and communications in rather narrowly defined problem domains which they felt able to tackle, and the OR modellers, who had the wider perspective to address issues at the operational or strategic level, but lacked effective ways of doing so. C3 was simply ignored, or implicitly assumed to work perfectly, and as a result the models usually generated grossly optimistic effectiveness estimates and far too high attrition rates. (3) The renaissance which lasted from about 1975 to 1990. In this period it was increasingly realised just how much C3 mattered, particularly how essential solving the C3 modelling problem was for justifying new C3 hardware to the bean- counters. Faltering attempts were made to represent C3 aspects in models, but often as add-ons to existing model architectures, and often using ”quick fixes” like expert systems, which didn’t really work. UK models like GenKnoFlexE and IMAGE, and analogous models run by other nations, had rule-bases comprising tens of thousands of rules which were so complex that the models became impossible to understand, a problem compounded by the inconvenient tendency towards chaotic behaviour in deterministic models. (4) The enlightenment lasting from about 1990 to 2001. by now we have analysed the problem quite well, and have invested in the fundamental re-thinking required to stand some chance of getting a solution. It is surprising it has taken so long, since the result is simply a common-sense description of how information flows around the C3 system and what happens to it on the way. We have learned that C3 aspects must drive the structure of any or model, which explains why previous attempts to graft it on to existing models largely failed. We have also homed in on the principal technical problems: data fusion and planning. Though we are making visible and very encouraging progress, these problems have not yet been solved, and it may be optimistic to expect enlightenment to be achieved by 2001. (5) The age of realism, at the start of the 5th period, in 2001, we will hopefully have achieved the following: confidence that or model results fairly reflect the influence of C3 aspects; the ability for the first time to carry out cost-effectiveness trade-offs between C3 systems (including ISTAR and communications systems), platforms and weapons; the ability for the first time to explore tricky issues which have so far been completely beyond our grasp, such as alternative command styles and rules of engagement; and as a bonus, we should have considerably speeded up the scenario development process, simply by applying force deployment logic such as genetic algorithms to the start of conflict.

CASI

Command and Control; Communication; Computerized Simulation; Mathematical Models; Histories

20000032385 Metron, Inc., Solana Beach, CA USA

Representation of Command and Control (C2) and Information Operations (IO) in Military Simulations

Stevens, William K., Metron, Inc., USA; Decker, William L., Metron, Inc., USA; Gagnon, Colleen M., Metron, Inc., USA; Modelling and Analysis of Command and Control; June 1999, pp. 25-1 - 25-16; In English; See also 20000032361

Contract(s)/Grant(s): N00014-95-C-2037; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The representation of command and control (C2) and command decision processes, through the use of modeling and simulation (M&S) techniques has become a key element of Department of Defense (DoD) technology initiatives in the areas of analysis and acquisition, operations planning and execution, and training. It has become increasingly apparent that if DoD sponsored military simulations are to effectively represent the entire battle space, it is imperative that they accurately simulate C2 and related command decision activities as well as the impact that deep sensors, communications, and information flows have on these processes. The closely related issues of accurately representing information operations (IO) and command and control warfare (C2W) are also becoming increasingly prominent within the DoD analysis, operational, and training communities. The purpose of this paper is to discuss recent advances in modeling and simulation practice which specifically address the representation of C2, IO, and C2W processes. More specifically, this paper describes the command and control (C2), information operations (IO), and C2 warfare (C2W) representations implemented within the Naval Simulation System (NSS).
Author
Command and Control; Information Systems; Warfare; Computerized Simulation; Mathematical Models; Communication

20000032386 Mitre Corp., McLean, VA USA
Co-Evolving C2 Organizational Processes, Decision Support Technology, and Education/Training: The Role of Evaluation in Cognition Systems Engineering
Ehrhart, Lee Scott, Mitre Corp., USA; Bigbee, Anthony J., Mitre Corp., USA; Modelling and Analysis of Command and Control; June 1999, pp. 26-1 - 26-17; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Advances in simulation environments and AAR support present opportunities to provide robust feedback on technology-supported decision making processes, as well as the combat effectiveness of those decisions. to realize these possibilities, research and development efforts must focus on innovative methods to capture decision process and use analysis of relationships between decision-making process and technology to support system design evolution. For example, what are effective ways to represent and understand process control in a simulated environment with autonomous entities'? How do we select the right concept and simulation abstraction for training future decision makers" This paper presents a conceptual model of a C2 decision system that comprises the command and control organizational functions, tasks, and processes. This metamodel integrates multiple models, including user profiles, decision and functional task models, organizational models (goal hierarchies, control structures, processes, and functions), hardware, software and communication architectures, information models (data structures, and information flow), human-computer interaction models (information presentation and interaction models, and collaboration models). Throughout this paper, we discussed the factors that determine the effectiveness of information technology in supporting the C2 decision system in situation assessment, COA evaluation and selection, and the synchronization of execution. System developers must support decision process capture and analysis to help organizations learn - through discovery-based learning or in training via execution practice. The conceptual model for training and exercise support systems should include an AAR process model that incorporates the instructional objectives and subsequent cognitive requirements in order to drive technology requirements. The complex interactions between the human, machine, and communication components that define C2 decision systems require the synthesis of multiple model types. Our next steps will look at how simulations and the conceptual models that link simulations to C2 decision support systems may best support the multiple goals of system development, organizational process evolution, and discovery learning. The goal of this research is the design of a sufficiently robust framework to guide construction of models that will the exploration and evolution of C2 systems, including: # Analyses of requirements (system objectives, functions, tasks, operational capabilities); # Evaluations of performance and effectiveness characteristics (current and potential); # Exploration of the impacts of new technology on organizational processes; and # Indications of the training and education required to achieve desired results.
Derived from text
Command and Control; Decision Support Systems; Information Systems; Mathematical Models; Decision Making; Computer Programs; Systems Analysis

20000032387 Mitre Corp., McLean, VA USA
Major Challenges Posed by Future C2 Assessments
Starr, Stuart H., Mitre Corp., USA; Modelling and Analysis of Command and Control; June 1999, pp. 27-1 - 27-12; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper looks ten years into the future to identify and characterize the major challenges that assessors of Command and Control (C2) will have to confront. As a context for that assessment, a trend analysis is performed of the factors that are perceived to have the greatest impact on future C2 assessment needs. Using a variant of the framework developed in the NATO Code of Best

Practice (COBP) for C2 Assessment, the results of the trend analysis are aggregated to identify and characterize major challenges posed by future C2 assessments.
Author
Command and Control; Trend Analysis; Computer Techniques; Decision Support Systems

20000032491 Coast Guard, Washington, DC USA
Coast Guard Communications Manual
Sep. 07, 1999; 198p; In English
Report No.(s): PB2000-103009; USCG-COMDTINST-M2000.3C; No Copyright; Avail: National Technical Information Service (NTIS)
The Manual established policy and prescribes procedures for the administration, management, and operation of the Coast Guard Telecommunications System.
NTIS
Coasts; Manuals; Broadcasting

20000032574 National Telecommunications and Information Administration, Washington, DC USA
Measured Occupancy of 5850-5925 MHz and Adjacent 5-GHz Spectrum in the USA
Sanders, F. H.; Dec. 1999; 48p; In English
Report No.(s): PB2000-102872; NTIA-00-373; No Copyright; Avail: National Technical Information Service (NTIS)
Dedicated short-range communication (DSRC) systems have been proposed for operation at locations across the USA in the 5850- to 5925-MHz band. To establish electromagnetic compatibility between DSRC and other 5-GHz systems, it is necessary to understand current and future occupancy of this spectrum. This report summarizes results of measurements made in 5-GHz spectrum for the Federal Highway Administration (FHWA) of emissions from high-power radars and a fixed satellite service (FSS) earth station. Results of 5-GHz spectrum survey measurements in major metropolitan areas are also included.
NTIS
Broadband; Telecommunication; Satellite Communication; Communication Equipment; Spectrum Analysis

20000032576 National Defence Research Establishment, Div. of Sensor Technology, Linkoeping, Sweden
Some Waveguide Simulations of an Array Antenna with Bilateral Notch-Elements ***Nagra Vagledarsimuleringar av en Gruppantenn med Bilaterala Notchelement***
Pettersson, L.; Carlegrim, B.; Jun. 1999; 36p; In Swedish; Original contains color illustrations
Report No.(s): PB2000-103062; FOA-R-99-01202-616-SE; No Copyright; Avail: National Technical Information Service (NTIS)
In the FOA-project Aircraft EW-suite, plane wideband (within the microwave region) array antennas with electrical lobe steering to wide angles are studied. An appropriate antenna element for such an array antenna, is some variant of notch-elements. to determine the electrical properties of a periodic array antenna, waveguide simulators can be used. The first part of the report describes the principles of the waveguide simulators, which have been used to determine the match of a two-dimensional, plane array antenna with bilateral notch elements. Then results from measurements and calculations of some various notch elements placed in the simulators are presented. 'Blind spots' (total mismatch) of the array antenna, can (easily) be generated if the array elements are the traditional bilateral notch elements. A variety of that element, which does not generate these 'blind spots,' is described and evaluated.
NTIS
Antenna Arrays; Simulation; Waveguides; Antenna Components; Simulators

20000032630 National Inst. of Standards and Technology, Electromagnetic Technology Div., Boulder, CO USA
Electronics and Electrical Engineering Laboratory, Electromagnetic Technology Division: Programs, Activities, and Accomplishments
Jan. 2000; 48p; In English
Report No.(s): PB2000-100621; NISTIR-5089; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
Contents include the following: Welcome; Fields of Technology; Magnetic Recording Metrology; Magnetic Instruments and Materials Characterization; Nanoprobe Imaging for Magnetic Technology; Superconductor Standards and Technology; Superconductor Interfaces and Electrical Transport; Josephson Array Development; Nanoscale Cryoelectronics; High Performance Sensors, Infrared Detectors, and Mixers; High Tc Electronics; Appendix (A) Major Laboratory Facilities; Appendix

(B) Postdoctoral Opportunities; Appendix (C) Electromagnetic Technology Division Staff; Appendix (D) Prefixes for the International System of Units (SI).
NTIS
Electrical Engineering; Magnetic Recording; Imaging Techniques; Electromagnetic Fields

20000032632 National Defence Research Establishment, Dept. of Command and Control Warfare Technology, Linkoeping, Sweden
Characterization of a Wideband Microwave Receiver ***Karakterisering av en Bredbandeg hf-Mottagare pa Mikrovagsomradet***
Notstrand, J.; May 1999; 64p; In Swedish
Report No.(s): PB2000-103043; FOA-R-99-01149-616-SE; No Copyright; Avail: National Technical Information Service (NTIS)
When using the DDOA technique for Electronic Warfare (EW) purpose, high demands on accurate frequency measurement exists. to accomplish this, a receiver that has a minimal distortion of the signal is required. In this report a wideband receiver using the superheterodyne technique is described. Furthermore, the report is focused on the receivers non-linear characteristics, hoping to accomplish two different goals. In the first place, to investigate how the receivers analogue parts affect quick and accurate frequency estimation. Secondly, a simulation environment for future receiver design.
NTIS
Superheterodyne Receivers; Frequency Measurement; Signal Distortion; Electronic Warfare; Microwaves

20000032915 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Hardware Implementation of Associative Memory System for Time Series Signal
Sato, Atsushi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 491-492; In Japanese; Copyright; Avail: Issuing Activity
This paper proposes a new associative memory system for time series signal. This system is composed of an analog MOS circuit and analog memories, which are called Double Tunnel SDAM (DTSDAM). It can store and recall analog time series signal directly. The chip of this system has been designed and fabricated in our original 4/micron NMOS&SDAM process and VDEC 1.2 micron CMOS process. Experimental results show that DTSDAM's update time is less than 6 micro sec and its resolution is more than 10 Bits. It is confirmed that each component of the system has operated successfully.
Author
Associative Memory; Chips (Electronics); CMOS

20000032925 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Design of High-Radix VLSI Dividers
Miura, Osamu, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 453-454; In Japanese; Copyright; Avail: Issuing Activity
This paper presents the design and evaluation of radix-4 and radix-8 parallel dividers for high-speed signal and data processing applications. The presented divider designs are based on the unified high-radix division algorithm. by prescaling the operands and converting the representation of each partial remainder into partially non-redundant, representation, the quotient digit, ran be obtained directly from the integer part of the partial remainder without using quotient digit selection tables. Performance evaluation shows that the proposed radix-4 and radix-8 divider architectures achieve faster computation with less hardware complexity, in comparison with the binary (radix-2) counterparts.
Author
Algorithms; Very Large Scale Integration; Quotients

20000033000 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Traffic Performance Analysis and Design on Limited Talk Time Communication System
Suzuki, Kouzo, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 185-188; In Japanese; Copyright; Avail: Issuing Activity
MCA(Multi-channel Access Dispatch Communication system) of Japan is working on a large zone structure for 80OMHz band. The main concept of the MCA system is to limit talk-time to 60 seconds per call by forcing a call to terminate in progress. This method improves frequency usage efficiency. This paper shows the traffic analysis of the proposed MCA-system and reports

20% of improvement the permissible maximum number of subscriber stations to be accommodated compared with the mode of unlimited talk time conditions.
Author
Telecommunication; Performance Tests; Access Control; Reliability Analysis; Channel Capacity; Multiple Access

20000033001 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Traffic Control in High Speed Communication Networks
Piya, Tanthawichian, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 181-184; In English; Copyright; Avail: Issuing Activity

This paper focuses on how to deal with two major problems in preventive control functions of high speed communication networks in order to prevent network congestion and utilize the network resource efficiently. Specifically, we propose effective Usage Parameter Control (UPC) schemes, which can monitor traffic violations accurately and promptly, and a cost-effective Call (Connection) Admission Control (CAC) scheme based on an upper bound on bandwidth allocation, which can decide whether to accept or not a new call in real time while gaining a satisfactory network resource utilization.
Author
Bandwidth; Communication Networks; Real Time Operation; Access Control

20000033036 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Interactions between Spatial Frequency Components on Visual Figure-Ground Segmentation
Takeshi, Suzuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 307-308; In Japanese; Copyright; Avail: Issuing Activity

Weisstein showed that a region filled with relatively higher spatial frequency tends to be seen in front. But this phenomenon is inconsistent with an idea called ”detail perspective” introduced by Gestalists, and also with the study of shape from texture. The purpose of this paper is to solve the inconsistency, and we showed following two points with psychophysical experiments: (1) A region filled with relatively lower spatial frequency tended to be seen in front, under special edge conditions such as compatible edge recognition; (2) Coherence spatial frequency components with zero phase lag, and familiar shape of region made the region seen in front. Consequently, we see that a feature of edge tends to belong to higher spatial frequency region caused the region seen in front. In addition to the above, a dependency of apparent depth on shape of region suggests a close relationship between apparent depth and figure-ground segmentation and a mutual dependency between region and its edge recognition.
Author
Spatial Dependencies; Textures; Edge Detection; Space Perception

20000033044 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on a Very Low Bit Rate Speech Coding Method Using a Speech Recognition Techniques
Sato, Junsei, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 279-280; In Japanese; Copyright; Avail: Issuing Activity

This paper describes a very low bit rate coding method for spectrum information of speech using HMM(Hidden Markov Model) which shows a good performance in speech recognition. The proposal system can reduce the redundancy in the LSP coefficients of the input speech waveform and enable very low bit rate coding with keeping the quality, because of encoding the LSP as a state sequence of HMM in which the arcs is limited. In this paper, 2 method is evaluated through experiments: first applying a small continuous Ergodic HMM and second a large discrete HMM. As a result, the proposed method was able to quantize LSP at 513 bps, where the cepstral distortion was 2.44 dB.
Author
Coding; Ergodic Process; Speech Recognition; Voice Data Processing

20000033050 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Measurements of Radiation Efficiency of Antennas in the Vicinity of Human Head Model
Yoshioka, Hiroki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 265-266; In Japanese; Copyright; Avail: Issuing Activity

In recent years, widespread application of the cellular phones, personal handy-phone systems, etc. causes a frequent use of antenna in the vicinity of the human body. The fact that presence of the human head in the near zone of the antenna affects the antenna performances and results in decreasing of the antenna radiation efficiency, calls for the necessity of theoretical and experimental investigations on this question. In this study, two different methods are applied for measuring the radiation efficiency

of the antenna located in the vicinity of the human head model. Special attention is also paid to estimation of change in the radiation efficiency caused by the differences in kinds of the antennas and human head models.
Author
Electromagnetic Interference; Radio Antennas; Radio Transmission; Signal Measurement

20000033051 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Estimation of Near Field Excited by Electromagnetic Sources by using Spherical Scanning Technique
Tsuhara, Koichi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 263-264; In Japanese; Copyright; Avail: Issuing Activity

Recently, the electromagnetic interference caused by the digital equipment has become serious problem due to the increase of frequency used in this equipment. In order to overcome the problem, it is important to estimate the near field excited by the sources of the interference, and the planar electromagnetic holography technique has been used. However, this technique can not be used in the low frequency region, since the dimension of the scanning area are required to be several wavelengths. In this report, a fundamental study of a method to visualize the electromagnetic field in the vicinity of sources by using a spherical scanning technique is presented.
Author
Electromagnetic Interference; Near Fields; Frequency Scanning

20000033052 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Radiation Efficiency and its Improvement of Small Loop Antenna
Sasaki, Makoto, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 261-262; In Japanese; Copyright; Avail: Issuing Activity

It is well known that the radiation efficiency of small loop antenna used for pager is very low. It has been pointed out that the low efficiency is mainly caused by the copper losses of the antenna from the study of the relation between the conductivity of copper and the radiation efficiency. However, the decrease of radiation efficiency caused by the copper losses of the ground plane and the dielectric losses of capacitors in pager have not been investigated. In this report, experimental results and numerical results using the moment method for the small loop antenna with a ground plane and a matching circuit including capacitors are presented, and the possibility of improvement of radiation efficiency is shown.
Author
Loop Antennas; Circuits; Capacitors; Transmission Loss

20000033082 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Investigation of Spread Spectrum Communication Modem
Kameda, Suguru, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 359-360; In Japanese; Copyright; Avail: Issuing Activity

We have developed SS-CDMA (Spread Spectrum-Code Division Multiple Access) systems using SAW (Surface Acoustic Wave) convolvers for the reverse-link of the wireless indoor network. In order to elude the near-far problem, the signal design has been reported for approximately synchronized CDMA systems. In this work, the novel signal set is proposed using the 4-phase sequences with appropriate auto- and cross-correlation characteristics (QS-I). It is confirmed that the cellular system can be implemented by assigning a QS-I sequence to each cell. Soft-handover process can be performed using time-divided channels. The maximum data rate in the designed system is over 1 Mbps, which is sufficient for transmission of moving pictures. The SS-CDMA system using the QS-I set is applicable for wireless multimedia communication system.
Author
Code Division Multiple Access; Modems; Spread Spectrum Transmission

20000033087 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Modulation of Submillimeter Wave Radiation
Minamide, Hiroaki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 126-129; In Japanese; Copyright; Avail: Issuing Activity

The modulation of submillimeter wave (SMMW) radiation is demonstrated by laser-produced free carriers in semi-conductors and by a Schottky diode(SBD) generating tunable side bands. In the technique using the free carriers, the modulation of 215 micron radiation is achieved by irradiating non-doped Si and GaAs wafers with optical pulses of a Q-switched Nd:YAG laser. There are three parameters to characterize the modulation: 1) recombination time of free carriers, 2) penetration depth of optical pulses into semiconductors, and 3) relative direction of the submillimeter and optical waves irradiated onto the

semiconductor wafer. The effects of these parameters are theoretically and experimentally examined. This technique is applied to generating submillime(er wave pulses of variable duration, Q-switching optically-pumped SMMW gas laser, and measuring the recombination coefficient and diffusion constant in Si and GaAs wafers. In the technique using the SBD, the modulation degrees in some various AC-bias conditions are examined for 435 micron radiation. The measured result qualitatively agrees with the calculation from equivalent circuit for this modulation system.
Author
Submillimeter Waves; Modulation; Electromagnetic Pulses; Semiconductors (Materials)

20000033104 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Motion Picture Restoration by Nonlinear Digital Signal Processing
Notoya, Youji, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 339-340; In Japanese; Copyright; Avail: Issuing Activity

This paper presents several robust motion estimation methods for motion picture restoration. The block matching algorithms of these robust motion estimation methods use nonlinear measures in the matching criterion. The measures of the proposed block matching algorithms are the median absolute error, the nonlinear mean absolute error, the alpha-trimmed-mean absolute error and the greater-trimmed-mean absolute error. In addition, a hybrid method combining the median absolute, error and the mean absolute error is presented. Simulation results show that each method is more robust in the presence of blotches than the method which uses the mean absolute error.
Author
Motion Pictures; Nonlinearity; Signal Processing; Errors

20000033147 Air Force Research Lab., Directed Energy Directorate, Kirkland AFB, NM USA
A Three-Dimensional Finite-Difference Time-Domain Formulation for Nonlinear Materials With the Frequency-Dependent Electronic Conductivity and Polarization ***Final Report, 1 Jul. - 31 Dec. 1999***
Yakura, S. Joe; Dietz, David; Dec. 20, 1999; 16p; In English
Contract(s)/Grant(s): AF Proj. 5797
Report No.(s): AD-A373895; AFRL-DE-TR-1999-1098; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present a three dimensional finite difference time domain (FDTD) algorithm that is used to evaluate the propagation of electromagnetic waves in conductive and dispersive materials that exhibit the frequency dependent electric conductivity and polarization. We consider a case where the electric conductivity has the linear property, specifically through the first order (linear) electric conductivity function, and the electric polarization has both linear and nonlinear properties, specifically through the first order (linear) and third order (nonlinear) electric susceptibility functions. The resulting FDTD algorithm shows that the nonlinear dispersive material with a third order susceptibility function results in coupled nonlinear cubic equations for the three components of the electric field vector, relating the next time step electric field vector to the previous time step electric field vector. This contrasts the usual algorithm of the linear conductive and dispersive material, which has a simple linear relationship between the next time step electric field and the previous time step electric field. Consequently, the coupled nonlinear cubic equations must be solved at each time step to simulate the behavior of the electric field vector in the nonlinear dispersive material that contains both frequency dependent electric conductivity and polarization.
DTIC
Finite Difference Time Domain Method; Electrical Resistivity; Wave Propagation; Computational Electromagnetics

20000033149 Institut Franco-Allemand de Recherches, Saint-Louis France
Preliminary Tests for the Detection of Arrow Projectiles by by Means of a Continuous Radar Receiver-Transmitter of Low Power
Sterzelmeier, K.; Gauthier–Blum, C.; Nusing, R.; Wolf, Th.; Mar. 04, 1999; 34p; In German
Report No.(s): AD-A373920; ISL-RT-504/99; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

One of the essential conditions for the realization of active protection systems is the availability of sensors or adapted units of detection, which allow detection of the assailing projectiles from their phase of approaching the target. This implies above all space determination of the direction of the flight of approach and the speed of the threat. In complement of work already carried out with ISL in the field of the projectiles detection, a first series of preliminary tests took place meanwhile for the detection of projectiles arrows of average gauge to the aid of continuous radar receptor transmitter of low power. The results obtained thus that certain particular aspects of the detection of projectiles by means of Doppler radar sensors are the subject of this report. One

particularly interesting advantage of this method of detection is the use of filters band pass of very low cost which makes it possible to carry out a fast and reliable selection type of threat.
DTIC
Projectiles; Radar Receivers; Radar Transmitters; Transmitter Receivers

20000033159 NASA Goddard Space Flight Center, Greenbelt, MD USA
Application of ANFIS to Phase Estimation for Multiple Phase Shift Keying
Drake, Jeffrey T., NASA Goddard Space Flight Center, USA; Prasad, Nadipuram R., New Mexico State Univ., USA; Mar. 08, 2000; 6p; In English; World Automation Congress 2000, 10-18 Jun. 2000, Maui, HI, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The paper discusses a novel use of Adaptive Neuro-Fuzzy Inference Systems (ANFIS) for estimating phase in Multiple Phase Shift Keying (M-PSK) modulation. A brief overview of communications phase estimation is provided. The modeling of both general open-loop, and closed-loop phase estimation schemes for M-PSK symbols with unknown structure are discussed. Preliminary performance results from simulation of the above schemes are presented.
Author
Fuzzy Systems; Systems Analysis; Phase Shift Keying; Modulation

20000033182 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Realization of Performance Pager Equipment
Nakamura, Seizo, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 13-15; In Japanese; Copyright; Avail: Issuing Activity

Radio paging is widely used as one of the most convenient mobile communication systems. The performance of the radio paging terminals has been improved by applying various techniques developed to meet the requirements such as the reduction of the volume, the weight and the power consumption, and higher performance under limited operational conditions. In this paper, the background and technical problems concerning the realization of higher performance of radio paging terminals are discussed, and techniques to improve the performances of built in antenna, a digitalization method of demodulation circuit and a method to predict the bit error rate caused by the impulsive noise are proposed.
Author
Mobile Communication Systems; Radio Communication

20000033195 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on an Automatic Labeling System of Speech with High Accuracy
Maeda, Teruhiko, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 435-436; In Japanese; Copyright; Avail: Issuing Activity

A large size of speech database with phoneme label information is important for developing speech processing method. In this paper, I have made an automatic labeling system with high accuracy for continuous speech. First, I compared the performance among the various methods, as a result, the best method is using a speaker adaptation based model. Second, I have developed the system using the adaptation method to an input test sample. I computed the difference between the boundary given by the expert and that with the system. The mean of the difference was about zero and the standard deviation of the difference was 15ms. The system showed similar performance to the human expert.
Author
Speech Recognition; Marking

20000033197 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Spoken Dialogue System by Taking Account of Linguistic Behavior on Spontaneous Speech
Amakasu, Tetsuo, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 431-432; In Japanese; Copyright; Avail: Issuing Activity

This paper proposes a dialogue system based on semantic analysis that can understand meanings of spontaneous speeches including ill-formed sentences such as omissions and inversions. to analyze the ill-formed spoken sequences, I did not use regular grammar analyses but developed a semantic frame agent based analysis method. I constructed a prototype system based on the method. An experiment result for phoneme sequences produced by a simulated speech recognition system showed that the proposed system can understand more than 80% of input utterances.
Author
Grammars; Phonemes; Speech Recognition

20000033199 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of Flexible Asynchronous Messaging System

Kitagata, Gen, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 427-428; In Japanese; Copyright; Avail: Issuing Activity

Asynchronous Messaging Systems like e-mail systems today need some advanced feature, such as intelligence, controllability and scalability, to accomplish more effective and sophisticated message handling. In this paper, we propose a model of Flexible Asynchronous Messaging System(FAMES), which consists of autonomous and collaborative software agents. In FAMES, various messaging functions are composed as software agents, and user-centered messaging services are provided through cooperative behavior of agents. In this paper, we describe a model of FAMES and discuss it's availability by the experiments with prototype system.

Author

Message Processing; Knowledge Based Systems; Artificial Intelligence

20000033213 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of Communication Supporting Environment with Mobile Computer

Ebina, Akira, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 415-416; In Japanese; Copyright; Avail: Issuing Activity

In recent years, the performance improvement of a mobile computer changes a form for its usage from mere current mobile network terminal to the computer which had the peculiar added value to itself. In the future, the function which help an action in human various scene will become necessary to mobile computer. In this paper, we focus on face-to-face communication assistance of a mobile computer and develop mobile face-to-face communication assist system 'mobile-casys'.

Author

Mobile Communication Systems; Personal Computers

20000033214 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Adaptive Interface Management for Flexible Videoconference System

Abe, Fumitake, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 413-414; In Japanese; Copyright; Avail: Issuing Activity

How to use the resources effectively, and to control multimedia applications such as videoconference system dynamically to satisfy QoS, have remained remarkable problems. to solve these problems, a Flexible Videoconference System based on a multi-agent system using ADIPS framework was proposed. by experimental results with a prototype system, the lack of flexibility from the view of user-orientation have been pointed out. In this paper, I propose a concept of adaptive interface management which controls window operations such as positioning, resizing, iconifying and so forth. Moreover, I explain an architecture of this function using multi-agent framework and implement a prototype system.

Author

Management Systems; Teleconferencing; Video Communication; Human-Computer Interface

20000033357 Optical Society of America, Washington, DC USA

Organization of the 1999 Integrated Photonics Research Topical Meeting ***Final Report, 1 Jun. 1999 - 30 May 2000***

Thorner, John A.; Feb. 29, 2000; 409p; In English, 19-21 Jul. 1999, Santa Barbara, CA, USA

Contract(s)/Grant(s): N00014-99-1-0894

Report No.(s): AD-A374202; LC-98-89994; LC-98-63509; ISBN 1-55752-575-7; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

The 1999 Integrated Photonics Research Conference was one of the most important international conferences specializing in the science and technology of photonics. It provided an annual forum for the dissemination of new results involving all experimental and theoretical aspects of integrated photonic components. These included the design, simulation, fabrication, materials, characterization, packaging, and application of photonic devices as well as specific, timely and emerging topics which are represented by special symposia. IPR also provided a unique educational experience for students interested in photonic devices due to both its topical scope and its size. In scope, IPR was highly focused on issues relevant to photonic devices for use in communications, signal processing, and sensors, and thus provided an in-depth perspective on this field. The conference was large enough to provide comprehensive coverage of photonic device-related issues, ranging from materials to simulations to applications, while remaining sufficiently small to provide the informal atmosphere conductive technical interchanges.

DTIC

Conferences; Photonics; Optical Communication

20000033437 Indian Space Research Organization, Communication and Microwave Group, Bangalore, India

GaAs FET Phase Shifter for Phased Array Applications

SuryanarayanaRao, K. N., Indian Space Research Organization, India; Neelavathi, M., Indian Space Research Organization, India; Journal of Spacecraft Technology; Jan. 1998; Volume 8, No. 1, pp. 94-97; In English; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

There has been an increased use of the Phased Arrays in a variety of applications in Communication and radar. In the field of Spacecrafts, the Phased Arrays provide a convenient means of beam steering and reconfigurability. One important element of the Phased Array is the Phase Shifter. There is a need for electronically controllable Phase Shifters in many of the array applications. Typical applications call for a simple design which can give a phase shift variation of about +60 degrees. Suitability for implementation in MMIC version is desirable. Keeping this in view, a variable Phase Shifter Suitable for spacecraft Antenna Array application has been design using GAAs FET. The particular features of the phase shifter include the fairly linear phase shift upto about +60 degrees over a bandwidth of nearly 1 Ghz in C Band and simple design using few components. Computer optimization for the circuit has been done for the phase shift and the insertion loss. An equivalent circuit for the GaAs FET has been evolved for the purpose. The measured performance is presented. Similar design are feasible at frequency bands.

Author

Beam Steering; Phased Arrays; Field Effect Transistors; Antenna Arrays; Gallium Arsenides; Phase Shift; Phase Shift Circuits; Spacecraft Antennas

20000033631 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France

Electronic Warfare Test and Evaluation, Volume 17, Flight Test Techniques Series ***les Essais et l'Evaluation du Materiel de Guerre Electronique***

Banks, H., Editor, Research and Technology Organization, France; McQuillan, R., Editor, Research and Technology Organization, France; March 2000; 91p; In English

Report No.(s): RTO-AG-300-Vol-17; AC/323(SCI)TP/24; ISBN 92-837-1034-7; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche; C01, CD-ROM

The past decade has seen an enormous increase in the use and importance of the "electronic battlefield." As a result of the continuing growth in this area, this volume has been prepared to serve as an introductory reference to the process of testing and evaluating Electronic Warfare Systems. Electronic Warfare (EW) is the mission area responsible for establishing and maintaining a favorable position in the electromagnetic domain. Test and evaluation (T&E) of those devices used on modem military aircraft to prosecute this critical mission area requires the use of a wide range of test techniques and analytical methods to assure users of the readiness of EW systems to meet the challenges of the combat environment. Actual in-flight testing comprises a relatively small portion of the EW T&E process. Today's tester makes judicious use of a plethora of models, simulations, and hardware-in-the-loop test facilities prior to and during the more realistic open-air range and installed system test facility events. Analysis of data derived from each of these test opportunities leads to the overall evaluation of the EW system. This volume will introduce the concept of the EW Test Process and subsequently show how it is applied in each class of test facility and to each major division of EW systems. The reader will find that the concentration in this document is far broader than "flight test" - ranging from laboratory efforts to establish the system performance baseline through complex ground-based simulations and finally the limited, but vitally important, verification accomplished in the open air range environment.

Author

Hardware-In-The-Loop Simulation; Computerized Simulation; Electronic Warfare; Flight Tests; Performance Tests

20000033643 Research Inst. of National Defence, Div. of Defence Analysis, Stockholm, Sweden

Critical Infrastructure Vulnerability and Logical, IT-Related Threats ***Infrastrukturens Sarbarhet med Avseende pa Logiska, IT-Relaterade Hot***

Mittermaier, E.; Westrin, P.; Apr. 1999; 118p; In Swedish

Report No.(s): PB2000-103044; FOA-R-99-01052-240-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This report comments the review made in the project of previous FOA-studies in the area of technical infrastructure vulnerability in the electricity and telecommunication systems. The review was made in order to relate IW (Information Warfare) and IT-related threats to previously studied threats (in respect of i.e. methods used for data collection and analysis).

NTIS

Vulnerability; Telecommunication

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.

20000032223 Prairie View Agricultural and Mechanical Coll., CARR, TX USA

Verification and Quantification of Single Event Effects on High Speed SRAM in Terrestrial Environments

Huff, H., Prairie View Agricultural and Mechanical Coll., USA; You, Z., Prairie View Agricultural and Mechanical Coll., USA; Williams, T., Prairie View Agricultural and Mechanical Coll., USA; Nichols, T., Prairie View Agricultural and Mechanical Coll., USA; Attia, J., Prairie View Agricultural and Mechanical Coll., USA; Fogarty, T. N., Prairie View Agricultural and Mechanical Coll., USA; Kirby, K., Prairie View Agricultural and Mechanical Coll., USA; Wilkins, R., Prairie View Agricultural and Mechanical Coll., USA; Lawton, R., Space Environments Consulting, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volume 2 and 3, pp. 71-75; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

As integrated circuits become more sensitive to charged particles and neutrons, anomalous performance due to single event effects (SEE) is a concern and requires experimental verification and quantification. The Center for Applied Radiation Research (CARR) at Prairie View A&M University has developed experiments as a participant in the NASA ER-2 Flight Program, the APEX balloon flight program and the Student Launch Program. Other high altitude and ground level experiments of interest to DoD and commercial applications are being developed. The experiment characterizes the SEE behavior of high speed and high density SRAM's. The system includes a PC-104 computer unit, an optical drive for storage, a test board with the components under test, and a latchup detection and reset unit. The test program will continuously monitor the stored checkerboard data pattern in the SW and record errors. Since both the computer and the optical drive contain integrated circuits, they are also vulnerable to radiation effects. A latchup detection unit with discrete components will monitor the test program and reset the system when necessary. The first results will be obtained from the NASA ER-2 flights, which are now planned to take place in early 1998 from Dryden Research Center in California. The series of flights, at altitudes up to 70,000 feet, and a variety of flight profiles should yield a distribution of conditions for correlating SEES. SEE measurements will be performed from the time of aircraft power-up on the ground throughout the flight regime until systems power-off after landing.

Author

Integrated Circuits; Radiation Effects; Atmospheric Radiation; Aerospace Environments; Computer Components; Charged Particles

20000032237 New Mexico Highlands Univ., Dept. of Engineering, Las Vegas, NM USA

NOVEL LINEAR AND NONLINEAR OSCILLATOR ARCHITECTURES

Rice, Catharine, New Mexico Highlands Univ., USA; Ramirez–Angulo, J., New Mexico State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 618-622; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Operational transconductance amplifiers can be used to implement oscillators with control over a wide range of oscillating frequencies. An advantage of these oscillators, besides programmability, is that they can operate at much higher frequencies than op-amp based oscillators. In this paper we report on novel linear and nonlinear oscillator structures using operational transconductance amplifiers. Two of the structures using a novel approach denoted OTA-OP-AMP approach have not been reported previously.

Derived from text

Nonlinearity; Linearity; Oscillators

20000032250 Prairie View Agricultural and Mechanical Coll., Center for Applied Radiation Research, TX USA

Radiation Effects on Resonant Tunneling Diodes: Preliminary Results

Wilkins, R., Prairie View Agricultural and Mechanical Coll., USA; Ardalan, Shojah S., Prairie View Agricultural and Mechanical Coll., USA; Jackson, Eric, Prairie View Agricultural and Mechanical Coll., USA; Gryko, J., Jacksonville State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 125-130; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

We have observed enhanced bistability (hysteresis) in the current-voltage characteristics of gamma irradiated resonant tunneling diodes. This bistability occurs in the negative differential conductance region for voltages larger than 1.1 V. We discuss possible mechanisms for the observed phenomena and also discuss the measurements sensitivity to the external circuit.
Author
Radiation Effects; Resonant Tunneling; Tunnel Diodes; Negative Conductance; Negative Resistance Devices

20000032252 Fisk Univ., Fisk Center for Photonic Materials and Devices, Nashville, TN USA
Temperature Dependence of Diffusion and Reaction at a Pd/SiC Contact
Shi, D.T., Fisk Univ., USA; Lu, W. J., Fisk Univ., USA; Bryant, E., Fisk Univ., USA; Elshot, K., Fisk Univ., USA; Lafate, K., Fisk Univ., USA; Chen, H., Fisk Univ., USA; Burger, A., Fisk Univ., USA; Collins, W. E., Fisk Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 131-136; In English; See also 20000032189
Contract(s)/Grant(s): NAGW-2925; NAG3-1430; NAG3-2012; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Schottky diodes of Palladium/SiC are good candidates for hydrogen and hydrocarbon gas sensors at elevated temperature. The detection sensibility of the diodes has been found heavily temperature dependent. In this work, emphasis has been put on the understanding of changes of physical and chemical properties of the Schottky diodes with variation of temperature. Schottky diodes were made by depositing ultra-thin palladium films onto silicon carbide substrates. The electrical and chemical properties of Pd/SiC Schottky contacts were studied by XPS and AES at different annealing temperatures. No significant change in the Schottky barrier height of the Pd/SiC contact was found in the temperature range of RT-400 C. However, both palladium diffused into SiC and silicon migrated into palladium thin film as well as onto surface were observed at room temperature. The formation of palladium compounds at the Pd/SiC interface was also observed. Both diffusion and reaction at the Pd/SiC interface became significant at 300 C and higher temperature. In addition, silicon oxide was found also at the interface of the Pd/SiC contact at high temperature. In this report, the mechanism of diffusion and reaction at the Pd/SiC interface will be discussed along with experimental approaches.
Author
Temperature Dependence; Diffusion; Chemical Reactions; Palladium; Thin Films; Palladium Compounds; Silicon Carbides; Schottky Diodes

20000032440 GenCorp Aerojet, Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Performance Verification Report: Initial Comprehensive Performance Test Report, P/N 1331200-2-IT, S/N 108/A2
Linn, J., GenCorp Aerojet, USA; March 2000; 472p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): AEROJET-11657; CDRL-208; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

This is the Performance Verification Report, Initial Comprehensive Performance Test Report, P/N 1331200-2-IT, S/N 108/A2, for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).
Author
Advanced Microwave Sounding Unit; Performance Tests; Tables (Data)

20000032452 Yamagata Univ., Faculty of Engineering, Japan
An Accurate Electrochemical Test for Lithium - Ion Battery Materials
Matsuki, Kenzo, Yamagata Univ., Japan; Tachibana, Kazuhiro, Yamagata Univ., Japan; Endo, Takashi, Yamagata Univ., Japan; Nishina, Tatsuo, Yamagata Univ., Japan; Bulletin of Yamagata University (Engineering); February 2000; ISSN 0085-834X; Volume 26, No. 1, pp. 25-32; In English; Copyright; Avail: Issuing Activity

Cell performance of active materials is generally evaluated electrochemically by using a test cell which consists of the specially designed half cell for research purpose. However the results obtained often depend on the test cells with different configuration, and this makes the exact evaluation difficult. These cells consist of multiphase system such as active material, electrolyte, conductive filler, current collector and so on, and all the electrons or ions pass through each boundary layer during cell operation. Thus the path-ways of current flow would be profoundly affected by the state of these interfaces. In this report, we focused on the functions of hetero-contact phases between the cell component materials to design a test cell which enable us to know real cell performance of the active materials. Combinations of the electrolytes and the current collector materials, function of the conductive additive (carbon material) and the anodic oxide film on aluminum current collector were examined by using

our unified test cell. The relationship between the cell performance and these functional hetero-contact phase at the cell component materials were discussed in detail.
Author
Electrochemistry; Electric Batteries; Metal Ions; Lithium Batteries

20000032468 GenCorp Aerojet, Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Engineering Test Report: AMSU-A2 S/N 108 Disturbance Torque and Angular, Momentum Measurements ***Final Report***
Bahng, R., GenCorp Aerojet, USA; Mar. 09, 2000; 37p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): AEROJET-11653; CDRL-207; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This is the Engineering Test Report, AMSU-A2 S/N 108 Disturbance Torque and Angular Momentum Measurements, for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).
Author
Advanced Microwave Sounding Unit; Angular Momentum; Torque; Performance Tests

20000032485 Istituto Nazionale di Fisica Nucleare, Lab. Nazionali di Frascati, Frascati, Italy
Numerical study of the frequency and temperature dependence of the ac magnetic susceptibility in presence of a static magnetic field in HTS
Di Gioacchino, D.; Tripodi, P.; Celani, F.; Testa, A.; Pace, S.; Oct. 31, 1998; 8p; In English
Report No.(s): DE99-731279; LNF-P-98-033; No Copyright; Avail: Department of Energy Information Bridge
The temperature dependence of the harmonics ((chi)n) of the ac magnetic susceptibility in HTS have been investigated by numerical solutions of the non linear diffusion equation for the magnetic flux. Within the framework of the collective pinning model, the Authors show that the transition between different regimes for the flux dynamics is determined by the field frequency for a fixed dc field, or by the dc field for a fixed frequency. As a consequence, a non universal behavior arises for the temperature dependence of (chi)n. In particular, in this approach the frequency dependencies of both amplitude and temperature of the peak of the imaginary part of the first harmonic and of the modulus of the third harmonic are discussed.
NTIS
Magnetostatic Fields; Numerical Analysis; Temperature Dependence; High Temperature Superconductors; Alternating Current; Magnetic Permeability; Frequency Distribution

20000032543 Aerojet-General Corp., Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Performance Verification Report: Final Comprehensive Performance Test Report, P/N 1331200-2-TST, S/N 108/A2
Linn, J., Aerojet-General Corp., USA; March 2000; 532p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): AEROJET-11658; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche
This is the Performance Verification Report, Final Comprehensive Performance Test Report, P/N 1331200-2-TST, S/N 108/A2, for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).
Author
Advanced Microwave Sounding Unit; Performance Tests; Earth Observing System (EOS)

20000032575 National Telecommunications and Information Administration, Washington, DC USA
Nonlinear Operation of a MMIC RF Power Amplifier and Its Effects on Battery Current, Interference and Link Margin
Dalke, R. A.; Achatz, R. J.; Lo, Y.; 1999; 48p; In English
Report No.(s): PB2000-103008; NTIA-00-375; No Copyright; Avail: National Technical Information Service (NTIS)
This report describes measurement, modeling, and simulation methods that are used to analyze the relationship between nonlinear operation of a typical PCS portable transceiver power amplifier and battery current, out-of-band power, and link margin. First the nonlinear characteristics of the PCS amplifier and associated battery current were obtained from amplifier measurements at various bias voltages and RF output signal levels. A mathematical model of the power amplifier based on these measurements was then used to simulate the communications link for purposes of determining the power spectral density and symbol-error ration

for a variable envelope digitally modulated signal used pi/4 DQPSK with 35% root raised cosine filtering. The out-of-band power and symbol-error ratio were computed to determine the link margin for a maximum symbol-error ratio of 10 to the 3rd power.
NTIS
Electric Batteries; Mathematical Models; Microwave Circuits; Power Amplifiers; Simulation; Transmitter Receivers; Wireless Communication; Radio Frequencies

20000032633 National Inst. of Standards and Technology, Office of Law Enforcement Standards, Gaithersburg, MD USA
Electronics and Electrical Engineering Laboratory. Office of Law Enforcement Standards. Programs, Activities, and Accomplishments
Jan. 2000; 52p; In English
Report No.(s): PB2000-101325; NISTIR-6432; No Copyright; Avail: National Technical Information Service (NTIS)
The Office of Law Enforcement Standards (OLES) helps law enforcement, corrections, and criminal justice agencies ensure that the equipment they purchase and the technologies they use are safe, dependable, and effective. The Office, with a staff of eight, is based in Gaithersburg, Maryland, and is one of the two offices within the Electronics and Electrical Engineering Laboratory at NIST. OLES conducts research on protective clothing, communication systems, emergency equipment, investigative aids, protective and enforcement equipment, security systems, traffic enforcement systems, vehicles, weapons and ammunition, and analytical techniques and standard reference materials used by the forensic science community. The composition of OLES projects, varies depending on the priorities of the criminal justice community at any given time, and, as necessary, draws upon the resources of EEEL, NIST divisions external to OLES, and outside agencies.
NTIS
Research and Development; Equipment; Procurement; Security; Surveillance; Standards

20000032759 GenCorp Aerojet, Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Performance Verification Report, Final Comprehensive Performance Test Report, P/N 1331720-TST, S/N 108/A1
Maciel, R., GenCorp Aerojet, USA; March 2000; 466p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): AEROJET-11648; CDRL-208; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche
This is the Performance Verification Report, Final Comprehensive Test Report, P/N 1331720-2-TST, S/N 108/A1, for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).
Author
Advanced Microwave Sounding Unit; Performance Tests

20000032800 Lappeenranta Univ. of Technology, Finland
Analysis and control of excitation, field weakening and stability in direct torque controlled electrically excited synchronous motor drives
Pyrhoenen, O.; Dec. 31, 1998; 123p; In English
Report No.(s): DE99-771570; LTKK-TJ-74; ISBN 951-764-274-1; No Copyright; Avail: Department of Energy Information Bridge
Direct torque control (DTC) is a new control method for rotating field electrical machines. DTC controls directly the motor stator flux linkage with the stator voltage, and no stator current controllers are used. With the DTC method very good torque dynamics can be achieved. Until now, DTC has been applied to asynchronous motor drives. The purpose of this work is to analyse the applicability of DTC to electrically excited synchronous motor drives. Compared with asynchronous motor drives, electrically excited synchronous motor drives require an additional control for the rotor field current. The field current control is called excitation control in this study. The dependence of the static and dynamic performance of DTC synchronous motor drives on the excitation control has been analysed and a straightforward excitation control method has been developed and tested. In the field weakening range the stator flux linkage modulus must be reduced in order to keep the electro motive force of the synchronous motor smaller than the stator voltage and in order to maintain a sufficient voltage reserve. The dynamic performance of the DTC synchronous motor drive depends on the stator flux linkage modulus. Another important factor for the dynamic performance in the field weakening range is the excitation control. The field weakening analysis considers both dependencies. A modified excitation control method, which maximizes the dynamic performance in the field weakening range, has been developed. In synchronous motor drives the load angle must be kept in a stabile working area in order to avoid loss of synchronism. The traditional vector control methods allow to adjust the load angle of the synchronous motor directly by the stator current control. In the DTC synchronous motor drive the load angle is not a directly controllable variable, but it is formed freely according to the

motor's electromagnetic state and load. The load angle can be limited indirectly by limiting the torque reference. This method is however parameter sensitive and requires a safety margin between the theoretical torque maximum and the actual torque limit. The DTC modulation principle allows however a direct load angle adjustment without any current control. In this work a direct load angle control method has been developed. The method keeps the drive stabile and allows the maximal utilisation of the drive without a safety margin in the torque limitation.
NTIS
Excitation; Directional Control; Torque; Synchronous Motors; Asynchronous Motors

20000032812 NASA Lewis Research Center, Cleveland, OH USA
Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13)
September 1994; 452p; In English; 13th; Space Photovoltaic Research and Technology, 14-16 Jun. 1994, Cleveland, OH, USA; See also 20000032813 through 20000032858
Contract(s)/Grant(s): NAS1-19592; NAS3-26703; NAS3-27004; NAG3-1466; RTOP 233-01-0A
Report No.(s): NASA-CP-3278; E-9083; NAS 1.55:3278; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche
The Thirteenth Space Photovoltaic Research and Technology (SPRAT) Conference gathered representatives from 26 commercial corporations, 8 universities and 7 governmental agencies, including Europe, for two and a half days of presentations and discussions regarding the status and future of space photovoltaics. The conference was well attended, with over 100 attendees, and included 38 technical papers, 6 program reviews and 5 workshop discussions. The effects of shrinking research and development budgets were evident in the focus and tone of this SPRAT. Most attendees appeared to be oriented toward near term, system oriented projects and fewer were involved in long term, high risk research. It was generally agreed that space power requirements would continue to move toward smaller (less than 2kW) power levels. Most future applications are believed to be in traditional orbits (LEO, GEO) although interesting opportunities may be found in high radiation, mid-altitude orbits useful for global communication networks. New solar cell devices and materials will be difficult to introduce unless they are mission enabling, or offer significant cost and/or performance benefits. The attendees were unable to come to a consensus regarding the type of array (e.g. rigid, concentrator, flexible) suitable for specific missions. Many factors outside the realm of photovoltaics influence the selection process. These topics and many more are covered in the following pages of this record.
Author
Conferences; Photovoltaic Conversion; Communication Networks; Solar Cells; Research Management; Coherent Electromagnetic Radiation

20000032834 Naval Research Lab., Washington, DC USA
Annealing of Irradiated n(+)p InP Buried Homojunctions
Walters, R. J., Naval Research Lab., USA; Summers, G. P., Naval Research Lab., USA; Timmons, M. L., Research Triangle Inst., USA; Venkatasubramanian, R., Research Triangle Inst., USA; Hancock, J. A., Research Triangle Inst., USA; Hills, J. S., Research Triangle Inst., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 203-212; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche
At the last SPRAT conference, the Naval Research Laboratory (NRL) presented results from two experiments. One studied n(+)p diffused junction (DJ) InP solar cells, and the other studied n(+)p shallow homojunction (SHJ) InP mesa diodes grown by metalorganic chemical vapor deposition (MOCVD). The former work showed that a DJ solar cell in which the maximum power (P(sub max)) had been degraded by nearly 80% under irradiation recovered completely under short circuit illumination at 450 K. The recovery was accompanied by the removal of all but one of the radiation-induced defect levels. The latter work, on the other hand, showed that the radiation-induced defects in the SHJ diodes did not anneal until the temperature reached 650 K. These results suggest that an irradiated DJ solar cell, under illumination, will anneal at a temperature 200 K lower than an irradiated SHJ cell. This is an unexpected result considering the similarity of the devices. The goal of the present research is to explain this different behavior. This paper investigates two points which arose from the previous studies. The first point is that the DJ cells were annealed under illumination while the SHJ diodes were annealed without bias. Given the known sensitivity of radiation-induced defects in InP to minority carrier injection-annealing, it is possible that the illumination is the cause of the lower annealing temperature. to test this, irradiated SHJ InP solar cells of the same structure as the diodes have been annealed under illumination at temperatures ranging from 300-500 K. The results of these experiments are presented here. The conclusion is that the illumination had no effect on the annealing, and the annealing follows that which was expected from the diode study, i.e. the recovery is limited by a lack of defect annealing in this temperature range. The second point investigated here is that the emitters of the DJ and SHJ devices were significantly different.
Derived from text
Annealing; Irradiation; Indium Phosphides; Experimentation; Diffusion; Homojunctions; P-N Junctions

20000032846 NASA Lewis Research Center, Cleveland, OH USA

Rare Earth Garnet Selective Emitter

Lowe, Roland A., Kent State Univ., USA; Chubb, Donald L., NASA Lewis Research Center, USA; Farmer, Serene C., NASA Lewis Research Center, USA; Good, Brian S., NASA Lewis Research Center, USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 335-339; In English; See also 20000032812; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Thin film Ho-YAG and Er-YAG emitters with a platinum substrate exhibit high spectral emittance in the emission band (epsilon(sub lambda) approx. = 0.75, sup 4)|(sub 15/2) - (sup 4)|(sub 13/2),for Er-YAG and epsilon(sub lambda) approx. = 0.65, (sup 5)|(sub 7) - (sup 5)|(sub 8) for Ho-YAG) at 1500 K. In addition, low out-of-band spectral emittance, epsilon(sub lambda) less than 0.2, suggest these materials would be excellent candidates for high efficiency selective emitters in thermophotovoltaic (TPV) systems operating at moderate temperatures (1200-1500 K). Spectral emittance measurements of the thin films were made (1.2 less than lambda less than 3.0 microns) and compared to the theoretical emittances calculated using measured values of the spectral extinction coefficient. In this paper we present the results for a new class of rare earth ion selective emitters. These emitters are thin sections (less than 1 mm) of yttrium aluminum garnet (YAG) single crystal with a rare earth substitutional impurity. Selective emitters in the near IR are of special interest for thermophotovoltaic (TPV) energy conversion. The most promising solid selective emitters for use in a TPV system are rare earth oxides. Early spectral emittance work on rare earth oxides showed strong emission bands in the infrared (0.9 - 3 microns). However, the emittance outside the emission band was also significant and the efficiency of these emitters was low. Recent improvements in efficiency have been made with emitters fabricated from fine (5 - 10 microns) rare earth oxide fibers similar to the Welsbach mantle used in gas lanterns. However, the rare earth garnet emitters are more rugged than the mantle type emitters. A thin film selective emitter on a low emissivity substrate such as gold, platinum etc., is rugged and easily adapted to a wide variety of thermal sources. The garnet structure and its many subgroups have been successfully used as hosts for rare earth ions, introduced as substitutional impurities, in the development of solid state laser crystals. Doping, dependent on the particular ion and crystal structure, may be as high as 100 at. % (complete substitution of yttrium ion with the rare earth ion). These materials have high melting points, 1940 C for YAG (Yttrium Aluminum Garnet), and low emissivity in the near infrared making them excellent candidates for a thin film selective emitter. As previously stated, the spectral emittance of a rare earth emitter is characterized by one or more well defined emission bands. Outside the emission band the emittance(absorptance) is much lower. Therefore, it is expected that emission outside the band for a thin film selective emitter will be dominated by the emitter substrate. For an efficient emitter (power in the emission band/total emitted power) the substrate must have low emittance, epsilon(sub S). This paper presents normal spectral emittance, epsilon(sub lambda), measurements of holmium(Ho) and erbium (Er) doped YAG thin film selective emitters at (1500 K), and compares those results with the theoretical spectral emittance.

Author

Rare Earth Elements; Emitters; Yttrium-Aluminum Garnet; Emittance; Fabrication; Spectral Emission; Spectrum Analysis; Thermophotovoltaic Conversion

20000032931 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of Electric and Light Addressing Type Matrix Display with Fast Switching Liquid Crystal

Kobayashi, Jun–ichi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 331-332; In Japanese; Copyright; Avail: Issuing Activity

A new display system, named electric and light addressing type matrix display, is proposed. It is composed of an LC panel with stripe electrodes and a stripelighting source which are crossed orthogonally. Since this new system can display any color by the very simple structure, it is promising to apply a large color LCD. In this study, the driving scheme is discussed. Shuttering of the LC panels by the stripe electrodes is synchronized to the stripelighting. In this case, here are two scanning methods. One is the scanning by the LC shutter and the other one is by the stripelighting. It is clarified that the problem in the both scanning methods is decrease of brightness according to increase of scanning line numbers. We propose solutions of this problem by using hybrid scanning and multi-line scanning methods.

Author

Display Devices; Liquid Crystals; Scanning

20000032932 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on Improvement of SOI MOSFET Using Tantalum-Gate Structure

Kawai, Kunihiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 325-326; In Japanese; Copyright; Avail: Issuing Activity

Tantalum-gate fully-depleted SOIMOSFET has been proposed for the low-power and high-speed device. Ta-gate structure has excellent threshold voltage adjustment for 1V power supply in both NMOS and PMOS by controlling the work function of gate material. In this work, Ta-gate SOICMOS has been fabricated and worked for the first time. Moreover, Ta reaction with gate oxide in Ta-gate MOS process has been experimentally investigated for the first time. The reacted thin layer at Ta/SiO2 interface is thermally stable and realize reliability of Ta-gate MOS devices.
Author
Field Effect Transistors; Metal Oxide Semiconductors; SOI (Semiconductors); Tantalum; Gates (Circuits)

20000032944 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Studies on Electron Tunneling Cathode with Single Crystaline Multi layers
Neo, Yoichiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 43-46; In Japanese; Copyright; Avail: Issuing Activity

The paper proposes a resonant tunneling electron emission cathode (RTC) fabricated by single crystalline multi layers and describes basic studies on the RTC. The resonant tunneling emission from a RTC was first demonstrated by using a GaAs-AlAs quantum structure. The epitaxial growth of Aluminum and Aluminum oxide thin films were examined to construct an ideal RTC and was successfully grown on a silicon substrate by a gas source molecular beam epitaxy using dimethyl-ethyl amine alane (DMEAA). Crystalline structure and properties of the grown films, such as orientation dependence of Al growth and optimum growth condition of Al2O3 on Si substrates were examined by RHEED, AFM, XPS and SEM. In addition, electrical properties of Al2O3 were studied by measuring the C-V characteristics in a MOS structure.
Author
Cathodes; Electron Emission; Electron Tunneling; Resonant Tunneling; Epitaxy; Thin Films

20000032985 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Flux Control and Applications of Orthogonal-Core in High Frequency Range
Sato, Yoshiyuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 233-234; In Japanese; Copyright; Avail: Issuing Activity

Many applications of the orthogonal-core for power converters and power controllers have been presented. Few papers, however, have reported the quantitative analysis and optimum design of the orthogonal-core and its application circuit in high frequency range. This paper presents analysis and design methods for the ferrite orthogonal-core and its application circuits use in high frequency range. The calculated and experimental results show a good agreement. Furthermore, the author presents some applications utilizing ferrite orthogonal-core in high frequency applications.
Author
High Frequencies; Power Converters; Quantitative Analysis

20000032986 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of High Performance Switched Reluctance Motor
Kimura, Mamoru, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 229-230; In Japanese; Copyright; Avail: Issuing Activity

Switched Reluctance Motor (SRM) is expected as the motors for electric vehicle, household electric appliance and aircraft. Because SRM has desirable features which include simple construction high speed and low cost. However, for practical applications, it is necessary to improve the efficiency and torque. This paper describes a method for improving the performance of SRM on the basis of simulations and experiments. The main results are as follows: (1) Optimization of timing and width of exciting voltage are effective to improve the torque and the efficiency. (2) Evaluation of iron loss and mechanical loss for analysis and design. (3) Static torque depends on the arc width of both the rotor and the stator poles.
Author
Electric Motors; Torque; Propulsive Efficiency

20000033012 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Coherent Power Combining of Resonant Tunneling Diodes for a Submillimeter Wave Source
Fujii, Tetsu, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 122-125; In Japanese; Copyright; Avail: Issuing Activity

A resonant tunneling diode (RTD)is a promising device for generating signals in the millimeter and submillimeter wave regions. However, a RTD has a two problems : (i) its output power is very small in these regions. (ii) its inherently broadband negative differential resistance (NDR) usually leads to undesirable low frequency spurious oscillations. to get more power, one

of solutions is coherent power combining of multi-RTD's using a quasi-optical resonator. A Fabry-Perot resonator with a grating has been used for coherent power combining of a RTD array in the millimeter wave region. Coherent power combining with two RTD's in the resonator has been successfully observed for the fundamental TEM(sub 00) resonator mode at the frequency of 75 GHz. to eliminate unwanted low frequency spurious oscillations, we propose using a series connection of two RTD's and present some preliminary results. Due to DC instability of the series connection, it is difficult to bias all RTD's in the NDR region. We have experimentally demonstrated RF switching of the bias points to the NDR region. Therefore, this circuit has been demonstrated as an amplifier or a frequency multiplier when the bias point is in the NDR region.
Author
Diodes; Millimeter Waves; Resonant Tunneling; Submillimeter Waves; Optical Resonators

20000033039 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Integration of Functional Components into Planar Lightwave Circuit
Hoshino, Yasutaka, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 295-296; In Japanese; Copyright; Avail: Issuing Activity

This paper describes the construction of a polarization independent PLC (Planar Lightwave Circuit)-integrated optical isolator by hybrid integration of two LPS (Laminated Polarization Splitter)'s. The LPS's are composed of a-Si:H/SiO2 multilayer, and work at the wavelength of 1.55 microns. to decrease diffraction losses at the components insertion sections, at the isolator's structure is applied the new discovery of transitional phase distribution of electric field after a diffraction at a gap. In the characteristic measurements of the isolator, the insertion losses and backward losses were about 3.1 dB and 22 dB on the average.
Author
Integrated Circuits; Isolators

20000033073 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Device Design of Multi-Pillar SGT for High Speed and Low Power Operation
Tominaga, Kenichiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 377-378; In Japanese; Copyright; Avail: Issuing Activity

In this study, the device design principles of M-Single Gate Transistor (M-SGT) for high speed and low power operation is made clear. The necessary conditions which reduce the occupied area of M-SGT are made clear, regarding the diameter of the pillar and the space between pillars of M-SGT, regarding pillar arrangement, regarding the gate thickness. With these conditions, the occupied area of M-SGT can be reduced to about 56% of that of SGT. Moreover, the propagation delay the power consumption, and the PD product of CMOS inverter chain with 8 stages using M-SGT's under the area reductive condition is analyzed. In this analysis, the PD product of CMOS inverter chain with 8 stages using M-SGT's can be reduced to about 72% of that of CMOS inverter chain with 8 stages using SGT's.
Author
Transistors; Gates (Circuits); Design Analysis

20000033078 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Contacts of Group IV Semiconductors with Electrodes
Deng, Chunyang, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 367-368; In Japanese; Copyright; Avail: Issuing Activity

Contacts of group IV semiconductors Si(1-x)Ge(x)(heavily doped with B and P) with electrode metals of Al, Ti and W were investigated in order to lower the contact resistivity between them. It is clarified that Si(1-x) Gex with the high Ge fraction and the high carrier concentration is favorable for low contact resistivity between B-doped Si(1-x)Ge(x) and metals, while in the case of P-doped Si(1-x)Ge(x)) the low Ge fraction for the high carrier concentration is important as well as using Ti and W as a metal.
Author
Electrical Resistivity; Electrodes; Semiconductors (Materials); Carrier Density (Solid State)

20000033080 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Wireless CDMA System Using SAW Matched Filter
Motoyoshi, Katsuyuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 363-364; In Japanese; Copyright; Avail: Issuing Activity

The SS-CDMA system using SAW matched filter (MF) has been developed for indoor wireless network. Using SAW MF, the down-link code synchronization circuit can be simply designed and implemented. At first, the novel packet configuration has been proposed. The implemented downlink system have shown the stable code synchronization and CDMA performance from

the BER characteristic measurement. Furthermore, the modified packet has been proposed for the multi-cell environment application. It is concluded that the implemented system using SAW MF is applicable for wireless multimedia SS-CDMA system. Author

Code Division Multiple Access; Matched Filters; Surface Acoustic Wave Devices

20000033081 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

RF Silicon Integrated Circuits

Morimoto, Akihiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 361-362; In Japanese; Copyright; Avail: Issuing Activity

Class-B complimentary MOSFETs (CMOS) push-pull power amplifier has been investigated for GHz spread spectrum code division multiple access (SS-CDMA). Miniaturized Si MOSFETS can be used for GHz application. The GHz SS-CDMA power amplifiers require the linearity, the wide band width and the low power consumption (i.e. high efficiency) at the same time. In this work, in order to satisfy the linearity and low power consumption, the class-B CMOS push-pull power amplifier has been designed and fabricated using 0.8 micron Si CMOS technology. The balancing of the output power levels and the phase differences between n-MOSFET and p-MOSFET is a key issue for the second harmonics suppression. For the balancing, we have introduced the gate length tuning of n-MOSFET and the finger number design of p-MOSFET. The simulation results have shown that the designed push-pull power amplifier has a power added efficiency (PAE) of 60.5% at 1 dB gain compression point with the second harmonics suppression at 0.885 GHz. The fabricated n-MOSFET has exhibited a high efficiency of 63.8% of PAE. The Si CMOS power amplifier is applicable for GHz application.

Author

CMOS; Code Division Multiple Access; Field Effect Transistors; Integrated Circuits; Metal Oxide Semiconductors; Push-Pull Amplifiers; Spread Spectrum Transmission

20000033083 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on Transmission of Information and Power using Feed Line for Inverter Drive Systems

Kimura, Takayuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 227-228; In Japanese; Copyright; Avail: Issuing Activity

In variable-speed drive systems used in industrial application fields, PWM inverter and AC motor are often located far from each other. Therefore, the feed line between the inverter and motor shows the characteristics of distributed constant line pronouncedly, and it results in various problems. In this paper. to solve these problems, we set inverter and motor next to each-other, and send both power and information through same DC feed line. The results of experiments shows that the proposed two-way transmission system is efficient.

Author

Inverters; Data Transmission; Power Transmission; Direct Current

20000033084 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of Harmonic Elimination in Orthogonal-Core Type Variable Inductor Base on Instantaneous Current Control

Wang, Hui, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 201-202; In Japanese; Copyright; Avail: Issuing Activity

The orthogonal-core type variable inductor is expected as power controlling device because of its simple construction, high reliability and controllability. For practical use, however, it is necessary to reduce the harmonics of the output current. The author proposes one method for harmonic elimination based on instantaneous current control of the primary. In order to design the control system, the author also presents a numerical model for MATLAB/SIMULINK. The simulation and experimental results indicate that the harmonics of the output current are reduced by the instantaneous current control.

Author

Inductors; Harmonic Control; Current Regulators

20000033088 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Analysis of Dynamical Behaviour of 2-D Adaptive Digital Filters

Shadaydeh, Maha, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 111-113; In English; Copyright; Avail: Issuing Activity

This papers contains three contributions to the area of 2-D adaptive filtering. The first one is a bias removal algorithm for 2-D equation error cascade IIR adaptive filters. The key idea of the proposed algorithm is to use a scaled value of the output error of each of the cascaded sections as an estimate for the measurement noise embedded in the signal part of the coefficient-update

procedure of that section. The second contribution concerns the convergence analysis of a 2-D LMS algorithm in which the filter's weights are updated along both vertical an horizontal directions according to 2-D doubly-indexed dynamical systems. We address the mathematical problems encountered in this analysis and then propose a method for solving them. The third contribution is the development and convergence analysis of the block-wise processing version of the 2-D doubly-indexed LMS. In addition to improving the tracking ability in non-stationary environments, the 2-D doubly-indexed block LMS (2DDI-BLMS) is shown to be very suitable for parallel processing.
Author
Adaptive Filters; Dynamical Systems; Algorithms; Convergence

20000033098 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of SAW Propagation Characteristics in the Stressed Medium and its Application to the Temperatures Stable SAW Substrate
Kotani, Kenji, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 355-356; In Japanese; Copyright; Avail: Issuing Activity
In this paper, SAW composite substrates with high electro-mechanical coupling coefficient(K squared) and low propagation loss and small temperature coefficient of delay (TCD) are investigated theoretically and experimentally. The composite substrate has a layered structure comprising a relatively thin LiNbO3, single crystal and a material with a small thermal expansion coefficient (TEC). In this case, thermal strain in LiNbO3, are used to improve temperature dependence of the SAW device. Therefore, we studied the propagation of SAW in stressed medium using higher-order elasticity theory. From computation result, we could obtain zero TCD at 64 degree Y-X LiNbO3/fused quartz structure. At room temperature, we fabricated a composite substrate utilizing a thin LiNbO3, (40 micron) and a glass substrate with manias TEC(-0.6ppm/C). The temperature coefficient of frequency (TCF) was improved to -19 ppm/C from -76 ppm/C.
Author
Surface Acoustic Wave Devices; Substrates

20000033129 GenCorp Aerojet, Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Engineering Test Report, AMSU-A1 S/N 108 Disturbance Torque and Angular Momentum Measurements
Bahng, R., GenCorp Aerojet, USA; Mar. 15, 2000; 29p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): AEROJET-11643; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This is the Engineering Test Report, AMSU-A1 S/N 108 Disturbance Torque and Angular Momentum Measurements, for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).
Author
Advanced Microwave Sounding Unit; Earth Observing System (EOS); Remote Sensing; Satellite Sounding; Meteorological Satellites; Angular Momentum; Torque

20000033144 Defense Threat Reduction Agency, Dulles, VA USA
Department of Defense: Military Critical Technologies, Part 3, Developing Critical Technologies
Nov. 1999; 169p; In English
Report No.(s): AD-A373757; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
Developing Critical Technologies identifies those technologies that will produce increasingly superior performance of military systems or maintain a superior capability more affordably. The object of the document is to look beyond the Department of Defense (DoD) planning period (5+ years) and as far into the future as is reasonable. Although it may not be possible to identify all technologies that will be used in future military systems, the focus will be on those technologies that have the greatest potential of fulfilling the requirements outlined by the Joint Chiefs of Staff (JCS) and the respective Services in their visions and Science and Technology (S&T) plans.
DTIC
Defense Program; Military Technology; Energy Technology; Technology Assessment

20000033158 NASA Goddard Space Flight Center, Greenbelt, MD USA
System-on-Chip Data Processing and Data Handling Spaceflight Electronics
Kleyner, I., Orbital Sciences Corp., USA; Katz, R., NASA Goddard Space Flight Center, USA; Tiggeler, H., Surrey Univ., UK; [1999]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents a methodology and a tool set which implements automated generation of moderate-size blocks of customized intellectual property (IP), thus effectively reusing prior work and minimizing the labor intensive, error-prone parts of the design process. Customization of components allows for optimization for smaller area and lower power consumption, which is an important factor given the limitations of resources available in radiation-hardened devices. The effects of variations in HDL coding style on the efficiency of synthesized code for various commercial synthesis tools are also discussed.
Author
Data Processing; Data Systems; Control Data (Computers); Coding; Computer Programs; Chips (Electronics)

20000033170 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Extraction of Instantaneous and Average PLL Jitter using Analytic Signal Technique
Yamaguchi, Takahiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 99-104; In Japanese; Copyright; Avail: Issuing Activity

This paper presents a method based on analytic signal theory to extract both instantaneous and average jitter from phase-locked loop (PLL) output measurements. The theoretical basis is described and simulated results are compared with existing techniques to demonstrate the performance and utility of this method.
Author
Signal Analysis; Vibration Damping; Phase Locked Systems

20000033171 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Ultra Small Metal-gate SOI Devices
Ushiki, Takeo, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 95-98; In Japanese; Copyright; Avail: Issuing Activity

A reliable metal-gate silicon-on-insulator (SOI) device technology, which can drastically reduce the number of process steps, has been developed. The use of xenon (Xe) plasma instead of argon (Ar) plasma in tantalum (Ta) film sputtering deposition for gate electrode formation exhibits 1.5 times higher breakdown field and five times higher 50%-charge-to-breakdown (Q(sub BD)) for gate oxide. Moreover, by using the ultraclean low-temperature processing, Ta-gate fully-depleted-silicon-on-insulator (FDSOI) MOSFET's with 0.15 micron gate length have achieved good on/off characteristics. These results demonstrate that metal-gate SOI device technology is promising to use in future 0.1 micron design rule GSI's for low cost, low power applications.
Author
SOI (Semiconductors); Gates (Circuits); Xenon; Sputtering

20000033173 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Study on the Integrated Circuit Technology of the Intelligent Image Processing Techniques
Maruo, Kazuyuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 84-87; In Japanese; Copyright; Avail: Issuing Activity

This paper outlines a defect detection system which automatically extracts defect information from complicated background LSI patterns. Based on a scanning electron microscope (SEM) image, the defects on the wafer are characterized in terms of their locations, sizes and the shape of defects. For this purpose, the Hough Transform and wavelet transform, have been employed. In addition to improve the throughput of the defect detection, the implementation of the Hough Transform algorithm on VLSI hardware has been investigated. By experiments, it has been demonstrated that the system is very effective in defect identification and will be used as an integral part in future automatic defect pattern classification systems.
Author
Fault Detection; Image Processing; Wavelet Analysis; Edge Detection

20000033176 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of the High Speed CMOS Optical Communication ICs
Tanabe, Akira, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 65-68; In Japanese; Copyright; Avail: Issuing Activity

A Single Chip 2.4 Gb/s CMOS Optical Receiver IC has been fabricated for the first time using 0.15 micron bulk CMOS process. to achieve GHz operation of CMOS analog-digital mixed circuits, parasitic resistance and capacitance of MOSFETs and substrate crosstalk have been studied. The crosstalk was explained by the simple analytic formulas. From these formulas, several techniques to suppress crosstalk, high gate bias design technique which improve crosstalk sensitivity, shallow pocket implantation technique which reduce crosstalk from threshold voltage fluctuation, and asymmetrical channel implantation technique which reduce transmission coefficient of crosstalk, were proposed.
Author
Optical Communication; CMOS; Optical Interconnects; Receivers

20000033177 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Study on the High Power-Durable Thin-Film Electrodes for Surface Acoustic Wave Devices
Kimura, Noritoshi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 32-35; In Japanese; Copyright; Avail: Issuing Activity

Surface acoustic wave (SAW) devices are widely used in RF circuits of portable and cellular phones as interstage filters and antenna duplexers. The SAW devices used at RF-range require narrow and thin electrodes. Thus, it had been difficult to ensure the power-durability of Al electrodes. This paper shows new power-durable thin film electrodes for RF SAW devices. First, the power durability of double-mode SAW (DMS) filters, which were used as a power durability test device to evaluate new film electrodes was investigated. Al-Cu alloy electrodes, which have been widely used as power-durable electrodes, were improved in power durability by Cu atom segregation to the grain boundary using a heat treatment. It is found that the power durability of Al-0.5wt%Cu alloy electrodes was improved by about three times after heated at 200 C for 5-24 hours. Next, the power durability of new Al-M (M: refractory metal such as Ta and W) alloy electrodes have been evaluated. It was shown that the power durability of Al-W alloy electrodes became approximately five times greater than that of Al-Ti alloy electrodes which have been known as high power-durable electrodes. However, the addition of M increased the insertion loss (IL) of DMS filters due to the increase in their film resistivity. to realize both low-loss and high power-durable electrodes, single-crystal Al films were successfully grown on 64 deg Y-X LiNbO3 substrates using a Ti buffer-layer (AI/Ti film structure). The Ti films as buffer-layer grown on 64 deg Y-X LiNbO3 substrates and the Al films grown on the Ti (001) were recognized as single-crystal Ti (001) and Al (110), respectively. It was revealed that the IL of the single-crystal Al/Ti electrodes in the DMS filters was superior to that of polycrystalline Al, Al-Cu alloy and Al-W alloy electrodes. Moreover, the power durability of the single-crystalline electrodes became approximately 20,000 and 700 times longer than that of the polycrystalline Al and the Al-Cu alloy electrodes respectively.
Author
Electrodes; Metal Films; Radio Frequencies; Surface Acoustic Wave Devices; Thin Films

20000033447 National Taiwan Univ., Dept. of Electrical Engineering, Taipei, Taiwan, Province of China
Composite Adaptive Speed Controller for Induction Motor with Input-Output Linearization
Wang, Chun–Chieh, National Taiwan Univ., Taiwan, Province of China; Wang, Wen–Jieh, National Taiwan Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Nov. 1997; ISSN 0253-3839; Volume 20, No. 6, pp. 669-679; In English
Contract(s)/Grant(s): NSC-85-2213-E-011-050; Copyright; Avail: Issuing Activity

A composite adaptive speed controller for an induction motor with input-output linearization is proposed in this paper. The rotor flux is estimated with the simplified rotor flux observer on the rotor reference frame and the input-output linearization theory is used to decouple the motor speed and the rotor flux. Subsequently, the composite adaptive algorithm is used as the speed controller of the induction motor with input-output linearization. Some experimental results are provided to demonstrate the effectiveness of the proposed adaptive controller. Good speed tracking and load regulating responses can be obtained by the proposed composite adaptive controller. Moreover, the system can be operated in a wide range of speed and robust to the parameter variations.
Author
Adaptive Control; Controllers; Induction Motors; Control Systems Design; Speed Control; Feedforward Control; Microelectronics; Rotor Speed

20000033454 ISRO Satellite Centre, Peenya, Bangalore, India
Free Space Capacitance of Conducting Surfaces
Hariharan, V. K., ISRO Satellite Centre, Peenya, India; Shastry, S. V. K., ISRO Satellite Centre, Peenya, India; Chakraborty, Ajay, Indian Inst. of Tech., India; Katti, V. R., ISRO Satellite Centre, Peenya, India; Journal of Spacecraft Technology; Jan. 1998; Volume 8, No. 1, pp. 61-73; In English; Copyright; Avail: Issuing Activity

Capacitance computation is an important step in the development of a spacecraft equivalent circuit model for predicting the surface charge build up. Since different parts of the spacecraft may be represented in terms of standard geometrical shapes, this paper presents a numerical procedure developed for computing the capacitance of such standard objects located in free space. The objects considered are conducting and hence the analysis assumes an equipotential surface having an unknown charge distribution. The charge distribution and the total charge are evaluated using the moment method by triangular patch modelling of the surface. The capacitance in free space of planar, cubic and wedge shaped conducting geometries have been numerically computed using the above technique. The results obtained for some of these geometries have been compared with the results available in the literature.

Author

Charge Distribution; Spacecraft Charging; Method of Moments; Capacitance

20000033535 Oxford Univ., Dept. of Engineering Science, Oxford, UK

High Density, Ultra-Fast Dynamics of Quasiparticles in High Temperature Superconductors

Stevens, C. J., Oxford Univ., UK; Smith, D. C., Oxford Univ., UK; Gay, P., Oxford Univ., UK; Ryan, J. F., Oxford Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 160-161; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Measurements of photo-excited carrier relaxation in High Tc materials provide a technique with which to investigate the fundamental quasiparticle interaction in the superconducting and quasi-metallic phases. Many measurements have been reported at low excitation powers on a range of high-Tc materials but little work has been carried Out at high densities where the photo-excited Population can significantly disrupt the superconducting condensate. Further almost all measurements have only Studied the quasiparticle response at a few discrete wavelengths making interpretation of the probe interaction rather uncertain. In order to address these issues we have carried out measurements using the RAL Ultrafast Spectroscopy facility in order to better understand the probe interaction and the dynamics at high intensities.

Author

Density (Number/Volume); Elementary Excitations; Superconductivity; Thin Films; High Temperature Superconductors; Semiconductors (Materials)

20000033613 California Inst. of Tech., Pasadena, CA USA

Very High Current Density Nb/AlN/Nb Tunnel Junctions for Low-Noise Submillimeter Mixers

Kawamura, Jonathan, California Inst. of Tech., USA; Miller, David, California Inst. of Tech., USA; Chen, Jian, California Inst. of Tech., USA; Zmuidzinas, Jonas, California Inst. of Tech., USA; Bumble, Bruce, Jet Propulsion Lab., California Inst. of Tech., USA; LeDuc, Henry G., Jet Propulsion Lab., California Inst. of Tech., USA; Stern, Jeff A., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 6p; In English

Contract(s)/Grant(s): NAG5-4890; NAGW-107; NAG2-1068; NSF AST-96-15025

Report No.(s): Rept-2000-5; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have fabricated and tested submillimeter-wave superconductor-insulator-superconductor (SIS) mixers using very high current density Nb/AlN/Nb tunnel junctions (J(sub c) approximately equal 30 kA/sq cm) . The junctions have low resistance-area products (R(sub N)A approximately 5.6 Omega.sq micron), good subgap to normal resistance ratios R(sub sg)/R(sub N) approximately equal 10, and good run-to-run reproducibility. From Fourier transform spectrometer measurements, we infer that omega.R(sub N)C = 1 at 270 GHz. This is a factor of 2.5 improvement over what is generally available with Nb/AlO(x)/Nb junctions suitable for low-noise mixers. The AlN-barrier junctions are indeed capable of low-noise operation: we measure an uncorrected receiver noise temperature of T(sub RX) = 110 K (DSB) at 533 GHz for an unoptimized device. In addition to providing wider bandwidth operation at lower frequencies, the AlN-barrier junctions will considerably improve the performance of THz SIS mixers by reducing RF loss in the tuning circuits.

Author

High Current; Current Density; Electric Current; Submillimeter Waves; SIS (Superconductors); Semiconductor Junctions; Tunnel Junctions; Niobium Alloys; Aluminum Oxides

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.

20000032220 Florida Agricultural and Mechanical Univ., Center for Nonlinear and Nonequilibrium Aeroscience, Tallahassee, FL USA

Water Injection for Mixing Noise Reduction of a Heated Supersonic Rectangular Jet

Washington, D.; Krothapalli, A.; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 67-70; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Over the past several decades researchers have been interested in reducing the noise of supersonic jets. The starting point for most of these noise suppression techniques comes from theories concerning aerodynamic noise from Lighthill's analogy. In Lighthill's theory, the equations of motion are broken down into the inhomogeneous wave equation where a distribution of acoustic sources (in the flow field) are responsible for the inhomogeneous terms. Unfortunately, this source distribution is of unknown origin and magnitude. Consequently researchers have had difficulties devising effective noise suppression techniques without incurring significant thrust penalties on existing aircraft. One currently available noise suppression method is to use non-circular nozzle geometries in order to produce streamwise vortices in the jet flow field. This idea comes from Pannu and Johannesen who suggested that these types of structures could redirect the noise in jets. However, subsequent investigations have shown that streamwise vortices create at best only modest magnitudes of noise reduction in the jet Overall Sound Pressure Level (OASPL). Despite the many active and passive noise suppression schemes devised by researchers until now, no method has been developed which has lead to OASPL reductions significant enough for use in the High Speed Civil Transport (HSCT) program. In 1970's, a 15 percent thrust penalty was sustained in order to produce a 12 dB reduction in jet noise. Similarly, in the 80's and 90's this improved to a 7 and 5 percent thrust penalty respectively, to reach this 12 dB reduction. However, the goal of the HSCT program currently has not been met, since it requires that a 12 dB reduction in jet noise can have at most a 2.5 percent thrust penalty. Evidence has been presented in the current paper which supports the idea that the source of the turbulent mixing noise is located downstream of the potential core. In an effort to suppress the turbulent mixing noise, atomized water is injected into a heated Mach 2.0 rectangular jet. The injection of water into the jet causes a change in the overall structure of the shear-layer instabilities. It is believed that the shear-layer modification attributed to water injection will cause a reduction of the OASPL in the jet even for low mass flow ratios of water to air (approximately 0.1). This assertion comes from the fact that a portion of the jet energy will be required to complete the evaporation process of the atomized water. Furthermore, the momentum exchange between the water and air in the jet shear-layer will add to this OASPL suppression. Thus, preliminary experimental results have shown positive benefits toward mixing noise reduction. In addition to the results already presented aerodynamic experiments will be conducted in the future. These experiments will consist of pressure surveys, PLS images, PIV, and IR images. The combination of this experimental data will be used to determine how the shear-layer dynamics of the jet are modified as water is injected into the jet. This will allow us to interpret the results of the far-field acoustic measurement that will also be obtained in a subsequent investigation.

Derived from text

Jet Aircraft Noise; Noise Reduction; Supersonic Jet Flow; Supersonic Transports; Turbulent Mixing; Water Injection; Wave Equations; Acoustic Measurement; Equations of Motion

20000032272 North Carolina Agricultural and Technical State Univ., Coll. of Engineering, Greensboro, NC USA

Computational Analysis of a Laminar Jet in a Cross-Flow

Jeffries, Damon K., North Carolina Agricultural and Technical State Univ., USA; Krishnamurthy, R., North Carolina Agricultural and Technical State Univ., USA; Chandra, S., North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 177-181; In English; See also 20000032189

Contract(s)/Grant(s): NAGW-2924; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

A jet in cross-flow (JIFC) consists of a jet exhausting at a large angle into a freestream flow. It is a flow field which is relevant to a wide variety of technologies and applications. Despite the nearly 65 years of JIFC research there are few results available for laminar hypersonic flows, a combination which will be encountered by re-entry and high altitude vehicles over some portion of their flight path. This research consists of developing a numerical model to investigate the interaction of a normal sonic jet

exhausting into a hypersonic cross-flow. The model was validated by comparing experimental measurements with corresponding numerical results generated by the model.
Derived from text
Cross Flow; Jet Flow; Laminar Flow; Mathematical Models; Computational Fluid Dynamics; Computerized Simulation

20000032340 Clarkson Univ., Dept. of Mechanical and Aeronautical Engineering, Potsdam, NY USA
Multipoint Measurements in an Axisymmetric Sudden Expansion
Eaton, Erroll L., Clarkson Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 954-957; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

A flying wire system was utilized in conjunction with a rake of nine cross-wire probes to obtain simultaneous velocity measurements in an axisymmetric sudden expansion at a Reynolds number of 41,000. From these measurements, the correlation tensor could be calculated. Knowledge of the two-point correlation tensor reveals more in-depth information of the physical attributes of this flow. The two point correlation tensor allowed for calculation of the integrated length scales in both the radial and axial directions. This gives insight into the growth of structures with increasing downstream distance and at different radial locations through out the sudden expansion. The length scales were calculated by integrating the two-point correlation tensor in the radial direction from the centerline to the outer pipe wall and by integrating between several step heights for the axial direction. Calculated correlations at z/h = 8 and 9 at r/R = 0.46 showed a correlation length of 1/3 step height for the radial direction. It was found that length scales in the radial direction became larger with increasing radius with peaks at 0.70 e r/R c 0.81 but then decreased slightly towards the wall. Length scales in the axial direction yielded a recirculating bubble on the order of 3 step heights in the recirculating region. After the recirculating region, the length scales decreased to 1/4 of a step height.
Author
Wiring; Wire; Axisymmetric Bodies; Expansion; Velocity Measurement; Flow Measurement

20000032453 Yamagata Univ., Faculty of Engineering, Japan
Transport Properties and Heat Transfer Coefficient of Coal: Water Mixture Under Laminar Pipe Flow Condition
Konno, Hirotaka, Yamagata Univ., Japan; Kuriyama, Masafumi, Yamagata Univ., Japan; Tokanai, Hideki, Yamagata Univ., Japan; Harada, Eiji, Yamagata Univ., Japan; Bulletin of Yamagata University (Engineering); February 2000; ISSN 0085-834X; Volume 26, No. 1, pp. 33-39; In Japanese; Copyright; Avail: Issuing Activity

Measurements of transport properties of highly loaded coal-water mixture (CWM), such as specific heat, thermal conductivity, and flow curve, are performed to investigate the characteristics of heat transfer in pipe flow. The specific heat of CWM depends on both the specific heat values of coal and water, and correlates well with the mass fraction of coal. The thermal conductivity, on the other hand, correlates well with the volume fraction of coal and is shown to be expressed well by Maxwell's equation. Heat transfer experiments are also performed for CWM flowing through a vertical circular pipe to obtain the average heat transfer coefficients. The data are shown in laminar flow and for uniform wall temperature conditions. Through the experiments, pressure drop data are also measured to determine the flow characteristics, i.e., the flow curves. It is shown that the flow behavior of CWM is able to be approximated well by a Bingham plastic fluid model. Using the above mentioned transport properties, correlation of the average heat transfer coefficients is attempted and the applicability of a previously proposed correlation equation is discussed.
Author
Transport Properties; Heat Transfer Coefficients; Laminar Flow; Pipe Flow; Flow Measurement

20000032454 Yamagata Univ., Faculty of Engineering, Japan
Membrane Separation and Diffusion Phenomena: A Flow of My Study in This Faculty
Suzuki, Fumio, Yamagata Univ., Japan; Bulletin of Yamagata University (Engineering); February 2000; ISSN 0085-834X; Volume 26, No. 1, pp. 1-18; In Japanese; Copyright; Avail: Issuing Activity

A flow of my study in this faculty was summarized. This program has been started by a heterogeneous saponification of Poly (Vinyl Acetate) (PVAc) to simplify the process of making of PVA fiber. A preliminary partial saponification of PVAC shows a excellent acceleration on the reaction rate in this system. to analyze the phenomenum, a diffusion of alkali ion and pervaporation technique, for examining of diffusion of reactants, were investigated experimentally. The pervaporation has related with my later work as follows; 1. It is found that one diffusant, in the case of existence of plural diffusants, is affected synergetically on the diffusivity by plasticizing of coexisting diffusant. 2. The cases of anomalous diffusant, like as case II, two stages and sigmoidal were examined on the systems of crystalline polymer solids and diffusants having considerable affinity. 3. The permeselective and pore size controlled inorganic membrane were prepared using the sol-gel technique and the forming of composites of the

inorganic/organic substances or polymer. The materials was used as the catalyst for hydrogen isomerization. 4. The membrane reactor which has both catalysis and separability is examined in now to try a shift of equilibrium.
Author
Membranes; Diffusion

20000032608 Saitama Inst. of Tech., Saitama, Japan
Oblique Reflection of a Weak Shock Wave: Three-Shock Theory with Divergence Effect of Slipstream
Kobayashi, Susumu, Saitama Inst. of Tech., Japan; Adachi, Takashi, Saitama Inst. of Tech., Japan; Suzuki, Tateyuki, Toyama Prefectural Univ., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 22-29; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Oblique reflection of a weak shock wave is investigated numerically. A modified three-shock theory is introduced to explain the well-known von Neumann paradox for weak Mach reflection. The effect of divergence of slipstream behind the triple point is taken into account. The angle of divergence is given parametrically to calculate some characteristics around the triple point, e.g., the angle of reflection. Numerical results are compared with experiment. It is shown that for weak Mach reflection, the modified three-shock theory gives physically realistic solutions, even when von Neumann's three-shock theory has no solution. All the experimental data lie in the domain given by the modified three-shock theory proposed here.
Author
Reflected Waves; Shock Waves; Slipstreams; Mach Reflection; Plane Waves; Transonic Speed; Wedges

20000032622 Saitama Inst. of Tech., Saitama, Japan
Laboratory Experiments on Blocking
Saito, Takayuki, Saitama Inst. of Tech., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 56-59; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Fluid experiments on baroclinic wave were conducted using the rotating fluid annulus with a partially widened channel. A flow pattern corresponding to a rotation speed of 1.4 rad/sec is considered. The clockwise rotating eddy is located closer the inner wall of the widened channel and the counterclockwise-rotating eddy is located closer the outer wall. This flow pattern is similar to the blocking pattern observed in the upper level of the atmosphere. It is well known that in the winter the monthly-mean contours of geopotential height above the Pacific Ocean are characterized as being widely separated in the central area and close together to the west and east. This distribution of the contours is similar to the form of the widened channel in the present experiment. Therefore, applying the present experimental results, the development of blocking patterns may be related to the characteristic pattern of geopotential height contours.
Author
Baroclinic Waves; Blocking; Rotating Fluids; Vortices; Simulation

20000032958 NASA Goddard Space Flight Center, Greenbelt, MD USA
Testing of a Loop Heat Pipe Subjected to Variable Accelerating Forces
Ku, Jentung, NASA Goddard Space Flight Center, USA; Ottenstein, Laura, NASA Goddard Space Flight Center, USA; Kaya, Tarik, ISU, USA; Rogers, Paul, Army Tank-Automotive Research and Development Command, USA; Hoff, Craig, Kettering Univ., USA; [2000]; 30p; In English; 11th; 11th Annual Spacecraft Themal Control Technology Workshop, 1-3 Mar. 2000, El Segundo, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents viewgraphs of the functionality of a loop heat pipe that was subjected to variable accelerating forces. The topics include: 1) Summary of LHP (Loop Heat Pipe) Design Parameters; 2) Picture of the LHP; 3) Schematic of Test Setup; 4) Test Configurations; 5) Test Profiles; 6) Overview of Test Results; 7) Start-up; 8) Typical Start-up without Temperature Overshoot; 9) Start-up with a Large Temperature Overshoot; 10) LHP Operation Under Stationary Condition; 11) LHP Operation Under Continuous Acceleration; 12) LHP Operation Under Periodic Acceleration; 13) Effects of Acceleration on Temperature Oscillation and Hysteresis; 14) Temperature Oscillation/Hysteresis vs Spin Rate; and 15) Summary.
CASI
Heat Pipes; Design Analysis; Performance Tests; Acceleration (Physics)

20000033160 NASA Goddard Space Flight Center, Greenbelt, MD USA
Thermal Vacuum Test of GLAS Propylene Loop Heat Pipe Development Model
Barker, Charles, Orbital, USA; Butler, Dan, NASA Goddard Space Flight Center, USA; Ku, Jentung, NASA Goddard Space Flight Center, USA; Kaya, Tarik, ISU, USA; Nikitkin, Michael, DCI, USA; Mar. 01, 2000; 23p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents viewgraphs on Thermal Vacuum Tests of the GLAS (Geoscience Laser Altimeter System) Propylene Loop Heat Pipe Development Model. The topics include: 1) Flight LHP System (Laser); 2) Test Design and Objectives; 3) DM (Development Model) LHP (Loop Heat Pipe) Test Design; 4) Starter Heater and Coupling Blocks; 5) CC Control Heaters and PRT; 6) Heater Plates (Shown in Reflux Mode); 7) Startup Tests; 8) CC Control Heater Power Tests for CC Temperature Control; and 9) Control Temperature Stability.
CASI
Geophysics; Heat Pipes; Laser Altimeters; Propylene; Thermal Vacuum Tests

20000033412 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Experimental Study on Heat Transfer and Friction in Pin Fin Channel Flow
You, Hisien–I, National Chung Hsing Univ., Taiwan, Province of China; Chang, Chung–Hsing, National Chung Hsing Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; 2000; ISSN 0253-3839; Volume 23, No. 1, pp. 117-123; In English
Contract(s)/Grant(s): NSF-83-0401-E005-068; Copyright; Avail: Issuing Activity
Experimental work is conducted to examine the effect of porosity, originated from the theory of the porous medium flow, on both the heat transfer rate and friction behavior for flow through a pin fin channel. Four units of the pin fin matrix having different porosities are used in the flow test. The heat transfer rates are obtained using the LMTD method. It is found that the heat transfer rate is higher for flow through a high porosity pin fin matrix, which possesses a higher heating surface area. For a relatively large Reynolds number flow, the friction factors are found to depend only on the flow porosity due to the presence of the roughness-like pin fin protruding through the viscous sublayer. Average friction factors are then suggested for every pin fin channel.
Author
Experimentation; Data Acquisition; Heat Transfer; Friction; Pins; Fins; Channel Flow

20000033435 Tamkang Univ., Dept. of Water Resources and Environmental Engineering, Taipei, Taiwan, Province of China
The Effects of Turbulence on Mean Flow Past Fixed and Oscillating Rectangular Prisms
Lu, Po–Chien, Tamkang Univ., Taiwan, Province of China; Cheng, Chii–Meng, Tamkang Univ., Taiwan, Province of China; Kao, Chung–Ren, Tamkang Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Nov. 1997; ISSN 0253-3839; Volume 20, No. 6, pp. 615-622; In English
Contract(s)/Grant(s): NSC-85-2211-E-032-016; Copyright; Avail: Issuing Activity
The characteristics of vortex wakes of rectangular prisms, with and without forced oscillation, were experimentally investigated, as placed in different uniform turbulent flows. The experimental parameters were the turbulence intensities and length scales of the uniform turbulent flows and the depth-to-width ratios and vibrating frequencies, with fixed amplitudes, of the rectangular prisms. Measurements were taken on the lateral pressure and base pressure of the prisms, the point velocity in the wake, and the phase angle between lateral pressure and body displacement. The pressure coefficients (-C(p), -C(pb), C(p), C'(pb)) are much greater when the oscillating cylinder is in lock-in range and reach peak values at resonant frequencies in a uniform flow. High turbulence intensity weakens the vortex shedding, thereby decreasing the pressure coefficients and peak values of the spectra. Increasing the turbulent length scale causes the pressure coefficients to increase. The critical depth- to-width ratio is found at H/D = 0.6, while decreasing in this ratio results owing to increases in turbulence intensities.
Author
Turbulence Effects; Vortices; Uniform Flow; Buildings; Rectangular Panels; Prisms; Wakes; Pressure Effects; Oscillations

20000033450 National Chung Hsing Univ., Dept. of Environmental Engineering, Taichung, Taiwan, Province of China
Laminar Separating Flow Over a Symmetric Cavity in Drinking Water Pipes
Lu, Chungsying, National Chung Hsing Univ., Taiwan, Province of China; Jean, Chih–Yih, National Chung Hsing Univ., Taiwan, Province of China; Lee, Lian–Yan, National Chung Hsing Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Nov. 1997; ISSN 0253-3839; Volume 20, No. 6, pp. 701-708; In English
Contract(s)/Grant(s): NSC-85-2211-E-005-023; Copyright; Avail: Issuing Activity
This paper describes the determination of fluid flow fields for pipes on the dead end or off the main network branch consisting of a straight pipe and a symmetric cavity in a drinking water distribution system. The Navier-Stokes equation and the continuity equation were normalized into dimensionless form and solved by the explicit finite difference scheme. The performance of the

model is validated by comparing its predictions with the existing analytical solutions available in the literature. The model is then applied for determining fluid flow fields of a flow over a symmetric cavity in a drinking water distribution system.
Author
Continuity Equation; Finite Difference Theory; Navier-Stokes Equation; Pipe Flow; Laminar Flow; Fluid Flow; Contaminants

20000033687 AYT Corp., Cleveland, OH USA
Adiabatic Effectiveness and Heat Transfer Coefficient on a Film-Cooled Rotating Blade
Garg, Vijay K., AYT Corp., USA; Numerical Heat Transfer; 1997; Part A, pp. 32:811-830; In English
Report No.(s): ASME Paper 96-GT-221; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

three-dimensional Navier-Stokes code has been used to compute the adiabatic effectiveness and heat transfer coefficient on a rotating film-cooled turbine blade. The blade chosen is the United Technologies Research Center(UTRC) rotor with five film-cooling rows containing 83 holes, including three rows on the shower head with 49 holes, covering about 86% of the blade span. The mainstream is akin to that under real engine conditions with stagnation temperature 1900 K and stagnation pressure 3 MPa. The blade speed is taken to be 5200 rpm. The adiabatic effectiveness is higher for a rotating blade as compared to that for a stationary blade. Also, the direction of coolant injection from the shower-head holes considerably affects the effectiveness and heat transfer coefficient values on both the pressure and suction surfaces. In all cases the heat transfer coefficient and adiabatic effectiveness are highly three-dimensional in the vicinity of holes but tend to become two-dimensional far downstream.
Author
Turbine Blades; Heat Transfer Coefficients; Film Cooling; Adiabatic Flow; Navier-Stokes Equation; Engine Parts; Thermal Analysis

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.

20000032200 Hampton Univ., Dept. of Physics, VA USA
Development of an OPO-Based Lidar System and Differential Absorption Measurements of Methane
Lee, Sang W., Hampton Univ., USA; Zenker, T., Hampton Univ., USA; Chyba, T. H., Hampton Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 11-16; In English; See also 20000032189
Contract(s)/Grant(s): NCC1-214; NAGW-2929; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

An optical parametric oscillator (OPO) ground-based lidar system in the wavelength region of 1.45 - 4 pm for the remote measurement of methane will be described. The laser transmitter consists of an injection-seeded ND:YAG laser which pumps an OPO. The OPO output is tunable from 1.45 - 4 pm, with a bandwidth less than 500 MHz, and a pulse energy of 1 to 3 mJ at 3.29 microns. The receiver is cart-mounted and consists of a 14” telescope with 1.57 and 3.29 micron detector channels. A fast oscilloscope is used for data acquisition. The system performance will be tested through measurements of sources of atmospheric methane.
Author
Optical Radar; Oscilloscopes; Fabrication; Absorption Spectroscopy; Data Acquisition; Methane; Remote Sensing

20000032206 NASA Goddard Space Flight Center, Greenbelt, MD USA
Structural Loading on the QCM/SAW Instrument Aboard the ER-2 Used for Atmospheric Testing
Bainum, Peter M., Howard Univ., USA; Jones, Phyllis D., Howard Univ., USA; Irish, Sandra M., NASA Goddard Space Flight Center, USA; Xing, Guang–Qian, Howard Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volume 2 and 3, pp. 28-33; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Several experiments have been proposed to capture and evaluate samples of the atmosphere where SST’s travel. One means to achieve this is to utilize the quartz crystal microbalance (QCM) / surface acoustical wave (SAW) instrument installed aboard the ER-2, formerly the U-2 reconnaissance aircraft. The QCM is a cascade impactor designed to perform in-situ, real-time measurements of aerosols and chemical vapors at an altitude of 60,000-70,000 feet. The primary use of the ER-2 is by NASA for Earth resources to test new sensor systems before being placed aboard satellites. One of the main reasons the ER-2 is used for this

flight experiment is its capability to fly approximately twelve miles above the sea level (can reach an altitude of 78,000 feet). Because the ER-2 operates at such a high altitude, it is of special interest to scientists interested in space exploration or supersonic aircraft. The purpose of some of the experiments is to extinct data from the atmosphere around the ER-2. For the current CSTEA flight experiment, the housing of the QCM is in a frame that connects to an outer pod that attaches to the fuselage of the ER-2. Due to the location of the QCM within the housing frame and the location of the pod on the ER-2, the pod and its contents are subject to structural loads. In addition to structural loads, structural vibrations are also of importance because the QCM output data is based on the determination of beat frequencies between a pair of oscillators (one coated, the second uncoated, according to the chemical reaction being monitored). A structural analysis of this system can indicate whether potential resonances may exist between the (higher) structural modal frequencies and the beat frequencies. In addition undesirable deformations may result due to maximum expected static or dynamic loads during typical flight conditions. If the deformations are excessive they may adversely affect the accuracy the instrumentation output.
Derived from text
Onboard Equipment; Quartz Crystals; Microbalances; Aerosols; Vapors; Surface Waves; Real Time Operation; Atmospheric Sounding

20000032297 NASA Lewis Research Center, Cleveland, OH USA
Gas Sensors Based on Single-Arm Waveguide Interferometers
Sarkisov, Sergey, Alabama A & M Univ., USA; Curley, Michael, Alabama A & M Univ., USA; Diggs, Darnell, Alabama A & M Univ., USA; Adamovsky, Grigory, NASA Lewis Research Center, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 257-262; In English; See also 20000032189
Report No.(s): 98URC047; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
Various optical technologies can be implemented in chemical sensing. Sensitive, rugged, and compact systems will be more likely built using interferometric waveguide sensors. Currently existing sensors comprise dual-arm systems with external reference arm, dual-arm devices with internal reference arm such as integrated Mach-Zehnder interferometer, and single-arm systems which employ the interference between different waveguide modes. These latter ones are the most compact and rugged but still sensitive enough to monitor volatile pollutants such as NH3 coming out of industrial refrigerators and fertilizer plants and stocks, NO, NO2, SO2, emitted by industrial burning processes. Single-arm devices in planar waveguide configuration most frequently use two orthogonally polarized modes TE (sub i) and TM (sub i) of the same order i. Sensing effect is based on the difference in propagation conditions for the modes caused by the environment. However, dual-mode single-order interferometers still have relatively low sensitivity with respect to the environment related changes in the waveguide core because of small difference between propagation constants of TE (sub i) and TM (sub i) modes of the same order. Substantial sensitivity improvement without significant complication can be achieved for planar waveguide interferometers using modes of different orders with much greater difference between propagation constants.
Derived from text
Gas Detectors; Waveguides; Mach-Zehnder Interferometers; Thin Films; Pollution Monitoring

20000032465 GenCorp Aerojet, Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Engineering Test Report: AMSU-A2 METSAT Instrument (S/N 108) Acceptance Level Vibration Tests of Dec 1999/Jan 2000 (S/O 784077, OC-454)
Heffner, R., GenCorp Aerojet, USA; Mar. 13, 2000; 15p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): AEROJET-11655; CDRL-207; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This is the Engineering Test Report, AMSU-A2 METSAT Instrument (S/N 108) Acceptance Level Vibration Test of Dec 1999/Jan 2000 (S/O 784077, OC-454), for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).
Author
Advanced Microwave Sounding Unit; Vibration; Performance Tests

20000032624 Saitama Inst. of Tech., Saitama, Japan
Studies of Ceramic Gas Sensors: Effects of Various Oxide Additives
Nakajima, Akira, Saitama Inst. of Tech., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 46-51; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
Ceramic gas sensors fabricated from the sintered mixtures on the material base of tin dioxide have been studied with a view to their improvements in sensitivity, mechanical strength, temporal response, etc. In this work it has been found that the appropriate

addition of some sorts of oxides, such as SiO2, Y203, and SRO, to SnO2-based elements can provide the better device properties. It has also been demonstrated (promising) that the sensor devices with appreciably good characteristics will be realized in the ternary or more component systems.
Author
Additives; Gas Detectors; Tin Oxides; Fabrication; Ceramics

20000032804 NASA Goddard Space Flight Center, Greenbelt, MD USA
Performance Modeling of an Airborne Raman Water Vapor Lidar
Whiteman, D. N., NASA Goddard Space Flight Center, USA; Schwemmer, G., NASA Goddard Space Flight Center, USA; Berkoff, T., NASA Goddard Space Flight Center, USA; Plotkin, H., NASA Goddard Space Flight Center, USA; Ramos–Izquierdo, L., NASA Goddard Space Flight Center, USA; Pappalardo, G., NASA Goddard Space Flight Center, USA; Feb. 15, 2000; 49p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A sophisticated Raman lidar numerical model had been developed. The model has been used to simulate the performance of two ground-based Raman water vapor lidar systems. After tuning the model using these ground-based measurements, the model is used to simulate the water vapor measurement capability of an airborne Raman lidar under both day-and night-time conditions for a wide range of water vapor conditions. The results indicate that, under many circumstances, the daytime measurements possess comparable resolution to an existing airborne differential absorption water vapor lidar while the nighttime measurement have higher resolution. In addition, a Raman lidar is capable of measurements not possible using a differential absorption system.
Author
Performance Prediction; Airborne Equipment; Water Vapor; Mixing Ratios; Temperature Profiles; Optical Radar; Differential Absorption Lidar

20000032805 NASA Goddard Space Flight Center, Greenbelt, MD USA
High T(sub c) Superconducting Bolometer on Chemically Etched 7 Micrometer Thick Sapphire
Lakew, B., NASA Goddard Space Flight Center, USA; Brasunas, J. C., NASA Goddard Space Flight Center, USA; Pique, A., Neocera, Inc., USA; Fettig, R., Raytheon Co., USA; Mott, B., NASA Goddard Space Flight Center, USA; Babu, S., NASA Goddard Space Flight Center, USA; Cushman, G. M., Raytheon Co., USA; Jan. 01, 1997; 21p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A transition-edge IR detector, using a YBa2Cu3O(7-x) (YBCO) thin film deposited on a chemically etched, 7 micrometer thick sapphire substrate has been built. to our knowledge it is the first such high T(sub c) superconducting (HTS) bolometer on chemically thinned sapphire. The peak optical detectivity obtained is l.2 x 10(exp 10) cmHz(sup 1/2)/W near 4Hz. Result shows that it is possible to obtain high detectivity with thin films on etched sapphire with no processing after the deposition of the YBCO film. We discuss the etching process and its potential for micro-machining sapphire and fabricating 2-dimensional detector arrays with suspended sapphire membranes. A 30 micrometer thick layer of gold black provided IR absorption. Comparison is made with the current state of the art on silicon substrates.
Author
High Temperature Superconductors; Superconductivity; YBCO Superconductors; Thin Films; Superconducting Films; Sapphire; Substrates

20000032946 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Micro Magnetic Sensors
Takezawa, Masaaki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 36-39; In Japanese; Copyright; Avail: Issuing Activity

This paper examines high-frequency carrier-type thin-film magnetic field sensors, which are based on impedance changes caused by magnetic field dependence of permeability and skin effect at high frequencies. Investigations of CoNbZr films showed that the permeability due to the applied magnetic field can be explained by the susceptibility theory. Moreover, the impedance change of the sensor can be estimated quantitatively on the basis of the dc field of the permeability. Based on the studies, I also discussed the enhancement of the sensitivity and linearity of the sensor. Consequently a high sensitivity of 3 x 10(exp -6) Oe and linearity of 0.70% was achieved. The specification should be enough for sensing the position of buried magnets under the road, being used for Intelligent Transport which would guide cars automatically on highways.
Author
Magnetic Fields; Sensors; Electrical Impedance; Ferromagnetic Films

20000032952 NASA Langley Research Center, Hampton, VA USA

Design of Mechanisms for Deployable, Optical Instruments: Guidelines for Reducing Hysteresis

Lake, Mark S., NASA Langley Research Center, USA; Hachkowski, M. Roman, Raytheon Systems Co., USA; March 2000; 23p; In English

Contract(s)/Grant(s): RTOP 632-64-00-06

Report No.(s): NASA/TM-2000-210089; L-17970; NAS 1.15:210089; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper is intended to facilitate the development of deployable, optical instruments by providing a rational approach for the design, testing, and qualification of high-precision (i.e., low-hysteresis) deployment mechanisms for these instruments. Many of the guidelines included herein come directly from the field of optomechanical engineering, and are, therefore, neither newly developed guidelines, nor are they uniquely applicable to the design of high-precision deployment mechanisms. This paper is to be regarded as a guide to design and not a set of NASA requirements, except as may be defined in formal project specifications. Furthermore, due to the rapid pace of advancement in the field of precision deployment, this paper should be regarded as a preliminary set of guidelines. However, it is expected that this paper, with revisions as experience may indicate to be desirable, might eventually form the basis for a set of uniform design requirements for high-precision deployment mechanisms on future NASA space-based science instruments.

Author

Deployment; Optical Equipment; Design Analysis

20000033264 NASA Langley Research Center, Hampton, VA USA

Evaluation of GE-167 Silicone Rubber (RTV) For Possible Service As A Moisture-Barrier For Certain Strain Gage Applications

Hare, David A., NASA Langley Research Center, USA; Moore, Thomas C., Sr., NASA Langley Research Center, USA; April 2000; 22p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 992-35-12-18

Report No.(s): NASA/TM-2000-210087; L-17931; NAS 1.15:210087; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Langley Research Center uses strain gages in a wide variety of demanding test environments. Strain gage installations, depending on the testing scenario, may see high temperatures, cryogenic temperature, moisture accumulation, mechanical abuse, or any combination of these conditions. At Langley, there is often a need to provide protection for strain gages against moisture and mechanical abuse, especially when large-scale, harsh environment testing is to be encountered. This technical memorandum discusses the evaluation of a room temperature curing silicone rubber sealant manufactured by the General Electric Company for consideration as a moisture-barrier for certain strain gage installations.

Author

Protection; Silicone Rubber; Strain Gages; Sealers; Load Tests

20000033462 Michigan State Univ., Dept. of Physics and Astronomy, East Lansing, MI USA

Component Designs for SOAR's Spartan IR Camera

Polsgrove, Daniel E.; Feb. 17, 2000; 57p; In English

Report No.(s): AD-A374158; AFIT-FY00-77; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Students and faculty from Michigan State University, in partnership with three other groups, are currently conducting research in a joint effort to construct a 4-meter telescope on a mountaintop in the Chilean Andes by the year 2002. The SOAR (SOuthern Astrophysical Research) project will take advantage of the telescope's size to observe the unique astronomic phenomena of the Southern Hemisphere in greater detail than ever before. Michigan State is responsible for building the Spartan IR Camera, an instrument that will be used for making observations at infrared wavelengths. This report is a compilation of five self-sufficient and informal papers describing original design concepts for several components of the Spartan IR Camera. The first paper addresses the 200 mm diameter silica window to be used as an optical barrier between the outside atmosphere and vacuum conditions inside the instrument. This 15 psi pressure gradient will cause the window to bend that is modeled by a fourth-order polynomial equation. The second paper illustrates the effects of gravity on the 11 individual optical elements that will be mounted on the optical bench of the IR Camera. The final three papers describe three independent design ideas for the two primary camera structures: the optical bench and liquid nitrogen reservoir. The structural limitations on these structures include: 1) they must both fit inside a space 1m x .75m x .75m and 2) have a combined mass as far below the maximum limit of 120 kg as possible. Additional

criteria state that the reservoir must hold at least 40 lbs (18.2 kg) of liquid nitrogen and there must not be any greater than a 5 arcsecond angular deflection anywhere on the top surface of the optical bench. Each of the three designs (labeled A through C) complies with the criteria, but they each have certain advantages and disadvantages with regards to total mass, manufacturing difficulty, etc.
DTIC
Telescopes; Cameras; Infrared Spectra; Manufacturing

20000033478 Imperial Coll. of Science, Technology and Medicine, Dept. of Physics, London, UK
First Observations of the Laser Hosing Instability
Najmudin, Z., Imperial Coll. of Science, Technology and Medicine, UK; Krushelnick, K., Imperial Coll. of Science, Technology and Medicine, UK; Clark, E. L., Imperial Coll. of Science, Technology and Medicine, UK; Salvati, M., Imperial Coll. of Science, Technology and Medicine, UK; Santala, M. I. K., Imperial Coll. of Science, Technology and Medicine, UK; Tatarakis, M., Imperial Coll. of Science, Technology and Medicine, UK; Dangor, A. E., Imperial Coll. of Science, Technology and Medicine, UK; Malka, V., Ecole Polytechnique, France; Neely, D., Rutherford Appleton Lab., UK; Allott, R., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 18-19; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

Propagation of ultra-high intensity laser beams in plasmas has recently received much attention with regard to potential applications such as X-ray lasers, plasma based accelerators, and ”Fast-ignition” of compressed Inertial Confinement Fusion pellets. For all of these applications, it is crucial that a high intensity beam can he propagated controllably, often over long distances. In the simplest case, it has been proposed that a laser beam can overcome the natural limits of refraction, and can remain focused due to its own non-linear interaction with the plasma. In particular, the relativistic quiver velocity of electrons in an intense laser field can lead to an increased on-axis index of refraction. This, in conjunction with the increase in refractive index from the reduction of on-axis electron density due to the pondcromotive force of the intense pulse, leads to the formation of a self-focusing structure. This can balance or even overcome the natural diffraction of the laser beam to give long-distance propagation of the beam or higher peak intensities than could be achieved by focusing in vacuum. A simple treatment, for an ideallized Gaussian beam, gives a critical power at which the natural diffraction is balanced by self-focusing. This critical power is P(sub cr) = 17(n(sub cr)/n(sub c) GW, where n(sub e), is the initial plasma density and n(sub cr) is the critical density. We report here on an experiment to study the propagation of an ultra-high power laser beam. In particular, to study the initial channel formation, we performed shadowgraphy of the laser beam focused into a supersonic gas jet. For this a second short pulse low energy frequency-doubled laser beam is passed orthogonal to the direction of propagation of the channel forming beam as a probe.
Derived from text
Laser Outputs; Laser Beams; Plasmas (Physics); Experimentation; Propagation (Extension); Shadowgraph Photography; Stability

20000033532 Kings Coll., Dept. of Physics, London, UK
The Laboratory Scanning X-Ray Microscope
Michette, G., Kings Coll., UK; Buckley, C. J., Kings Coll., UK; Pfauntsch, S. J., Kings Coll., UK; Arnot, N. R., Kings Coll., UK; Wilkinson, J., Kings Coll., UK; Wang, Z., Kings Coll., UK; Shaikh, W., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 151-153; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

The laboratory scanning X-ray microscope has been installed on dedicated target chamber in the LSF X-ray laboratory, and has en used to obtain preliminary images. All components of the microscope have performed well, although some upgrading is needed in order to produce a user-friendly facility. However, significant problems remain which degrade the quality of the images. These are vibration and electrical noise; major ’orts have been taken to reduce the effects of these, but spatial solutions are still limited to approx. 0.4 microns at best.
Author
Microscopes; Scanners; X Rays; Performance Tests

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.

20000032111 Tel-Aviv Univ., Ramat-Aviv, Tel-Aviv, Israel
Neuroprotective Treatment of Laser-Induced Retinal Injuries ***Annual Report, 1 Sep. 1998 - 1 Sep. 1999***
Rosner, Mordechai; Solberg, Yoram; Belkin, Michael; Oct. 1999; 14p; In English
Contract(s)/Grant(s): DAMD17-98-1-8631
Report No.(s): AD-A373617; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Laser induced retinal injuries are operational and medical problem in the battlefield as a result of lasers used in military equipment and the introduction of visually incapacitating laser weapons. It is not possible to prevent all these injuries and there is no treatment. This study was designed to evaluate the neuroprotective effect of dextromethorphan, which is FDA approved and clinically used drug, in our rat model of laser-induced retinal-lesions.

DTIC
Operational Problems; Laser Weapons; Retina

20000032271 Hampton Univ., VA USA
Production of High Intracavity UV Power From a CW Laser Source
David, R. T., Hampton Univ., USA; Chyba, T. H., Hampton Univ., USA; Keppel, C. E., Hampton Univ., USA; Gaskell, D., Oregon State Univ., USA; Ent, R., Thomas Jefferson National Accelerator Facility, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 745-750; In English; See also 20000032189
Contract(s)/Grant(s): NAGW-2929
Report No.(s): 98URC133; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The goal of this research project is to create a prototype high power CW source of ultraviolet (UV) photons for photon-electron scattering at the Thomas Jefferson National Accelerator Facility (TJNAF), Hall B. The facility will use optical resonant cavities to produce a high photon flux. The technical approach will be to frequency-double the 514.5 mn light from an Argon-Ion Laser to create 0.1 to 1.0 watt in the UV. The produced UV power will be stored in a resonant cavity to generate an high intracavity UV power of 102 to 103 watts. The specific aim of this project is to first design and construct the low-Q doubling cavity and lock it to the Argon-Ion wavelength. Secondly, the existing 514.5 nm high-Q build-up cavity and its locking electronics will be modified to create high intracavity UV power. The entire system will then be characterized and evaluated for possible beam line use.

Author
Cavity Resonators; Continuous Wave Lasers; Laser Outputs; Ultraviolet Radiation; Photon-Electron Interaction; Q Factors

20000032312 Hampton Univ., Research Center for Optical Physics, VA USA
Evaluation of Manganese Doped Ca5(PO4)3F as a Near Infrared (1-2 microns) Solid-State Laser Material
Turner, Matthew, Hampton Univ., USA; Hoemmerich, Uwe, Hampton Univ., USA; Loutts, George B., Norfolk State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 854-859; In English; See also 20000032189
Contract(s)/Grant(s): NCC1-251
Report No.(s): 98URC152; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Tunable solid-state lasers are of enormous interest for applications including fundamental spectroscopy, remote sensing of the earth atmosphere, medical surgery, and optical communications. Efficient and widely tunable lasers have been developed for the 800-1100 nm region based on transition metal doped insulators like e.g. Ti:Sapphire. The development of transition metal lasers operating at longer wavelength, however, has been limited by the luminescence efficiency of existing materials. We are currently evaluating Mn doped Ca5(PO4)3F as a new solid-state laser material for the 1-2 micro-m region. Preliminary spectroscopic studies revealed that Mn:Ca5(PO4)3F exhibits an intense near infrared luminescence which extends from 1100-1300 nm. Based on lifetime measurements we estimated the luminescence quantum efficiency to be as high as 90 deg./0

at room temperature. The near infrared luminescence properties of Mn doped Ca5(PO4)3F and its potential for solid-state laser applications will be discussed in detail.
Author
Doped Crystals; Laser Materials; Near Infrared Radiation; Solid State Lasers; Tunable Lasers; Laser Applications; Spectroscopic Analysis; Calcium Compounds; Fluorine Compounds

20000032359 NASA Lewis Research Center, Cleveland, OH USA
Laser Pencil Beam Based Techniques for Visualization and Analysis of Interfaces Between Media
Adamovsky, Grigory, NASA Lewis Research Center, USA; Giles, Sammie, Jr., Toledo Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 445-450; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Traditional optical methods that include interferometry, Schlieren, and shadowgraphy have been used successfully for visualization and evaluation of various media. Aerodynamics and hydrodynamics are major fields where these methods have been applied. However, these methods have such major drawbacks as a relatively low power density and suppression of the secondary order phenomena. A novel method introduced at NASA Lewis Research Center minimizes disadvantages of the ”classical” methods. The method involves a narrow pencil-like beam that penetrates a medium of interest. The paper describes the laser pencil beam flow visualization methods in detail. Various system configurations are presented. The paper also discusses interfaces between media in general terms and provides examples of interfaces.
Author
Laser Beams; Pencil Beams; Flow Visualization; Schlieren Photography; Interferometry

20000032849 NASA Langley Research Center, Hampton, VA USA
P/N In(Al) GaAs Multijunction Laser Power Converters
Wojtczuk, Steven, Spire Corp., USA; Parodos, Themis, Spire Corp., USA; Walker, Gilbert, NASA Langley Research Center, USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 363-371; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Eight In(Al)GaAs P/N junctions grown epitaxially on a semi-insulating wafer were monolithically integrated in series to boost the approx. 0.4 V photovoltage per typical In(Al)GaAs junction to over 3 volts for the 1 sq cm laser power converter (LPC) chip. This is the first report of a multijunction LPC for the 1.3 to 1.5 microns wavelength range. This wavelength range is optimum for laser power transmission over low- loss single-mode silica optical fiber, and is also useful with high efficiency 1.315 microns iodine lasers in free-space power transmission. Advantages of multijunction LPC designs include the need for less circuitry for power reconditioning and the potential for lower I(exp 2)R power loss. As an example, these LPCs have a responsivity of approx.1 amp/watt. With a single junction LPC, 100 watts/sq cm incident power would lead to about 100 A/sq cM short-circuit current at approx. 0.4 V open-circuit voltage. One disadvantage is the large current would lead to a large 1(exp 2)R loss which would lower the fill factor so that 40 wattS/sq cm output would not be obtained. Another is that few circuits are designed to work at 0.4 volts, so DC-DC power conversion circuitry would be necessary to raise the voltage to a reasonable level. The multijunction LPC being developed in this program is a step toward solving these problems. In the above example, an eight-junction LPC would have eight times the voltage, approx. 3 V, so that DC-DC power conversion may not be needed in many instances. In addition, the multijunction LPC would have 1/8 the current of a single-junction LPC, for only 1/64 the 1(exp 2)R loss if the series resistance is the same. Working monolithic multijunction laser power converters (LPCs) were made in two different compositions of the ln(x)Al(y)Ga(l-x-y)As semiconductor alloy, In(0.53)Ga(0.47)As (0.74 eV) and In(0.5)Al(0.1)Ga(0.4)As (0.87 eV). The final 0.8 sq cm LPCs had output voltages of about 3 volts and output currents up to about one-half amp. Maximum 1.3 microns power conversion efficiencies were approx. 22%. One key advantage of multijunction LPCs is that they have higher output voltages, so that less DC-DC power conversion circuitry is needed in applications.
Author
P-N Junctions; Gallium Arsenides; Laser Power Beaming; Voltage Converters (DC to DC); Epitaxy; Photovoltages; Power Converters; Semiconductors (Materials); Wafers; Fabrication

20000032940 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of 1.3 micron-band Optical Fiber Amplifier/Laser
Isshiki, Kunihiko, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 59-60; In Japanese; Copyright; Avail: Issuing Activity

Practical 1.3 micron m-band optical fiber amplifier/laser with reliable 1 - micron-band pump laser diode modules and efficient praseodymium-doped In-based fluoride fibers are presented. High-power 1-micron-band laser diode modules have been developed for most efficient pumping. Praseodymium-doped In-based fluoride fibers are characterized using measurable parameters, and amplified characteristics are theoretically analyzed. Signal output power of +16.2 dBm (42 mW) is achieved for a praseodymium-doped In/Ga-based fluoride fiber amplifier pumped by four 1.01-micron laser diode modules. Lasing output power of 10-28 mW in tuning wavelength range of 1.29-1.33 microns is achieved for a ring laser with a praseodymium-doped In/Pb-based fluoride fiber amplifier, a wavelength tunable optical bandpass filter and a 10-dB coupler.
Author
Fiber Lasers; Optical Fibers; Semiconductor Lasers; Amplifiers

20000033011 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Semiconductor Lasers for Analog Optical Communication
Watanabe, Hiroshi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 138-141; In Japanese; Copyright; Avail: Issuing Activity

Nonlinearity of distributed feedback (DFB) lasers has been investigated. Nonlinear property of the laser is essentially originated from three factors: 1) longitudinal spatial hole burning (LSHB), 2) leakage current, and 3) intrinsic nonlinear response. This paper provides several approaches to improve the linearity by examining these factors theoretically and experimentally. In addition, noise characteristics related to laser property after fiber transmission is also discussed. These studies significantly develop DFB lasers for analog optical communication.
Author
Distributed Feedback Lasers; Nonlinearity; Optical Communication; Semiconductor Lasers

20000033035 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Frequency-Shjifted Feedback Fiber Laser
Yoshida, Masato, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 311-312; In Japanese; Copyright; Avail: Issuing Activity

In the frequency-shifted feedback laser (FSF laser), a frequency shift is imposed on an intracavity light field by feedback of the first order diffracted light of an acousto-optic modulator (AOM). It has been proven that the laser output consists of a chirped frequency comb evenly spaced at a cavity-free spectral range. Here we investigate this type of laser with an erbium-doped fiber as a gain medium and its application to optical reflectometry.
Author
Fiber Lasers; Frequency Shift; Acousto-Optics; Light Modulators

20000033042 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Superdonductive Terahertz Mixer
Kobayashi, Eisuke, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 289-290; In Japanese; Copyright; Avail: Issuing Activity

Using high-Tc grain boundary Josephson junctions (GBJJs) made of YBa2Cu3O(7-delta)(YBCO), both response and mixing properties at terahertz waveband were investigated. Radiation from a far infrared (FIR) laser was coupled to the junction, via an extended hyperhemispherical Si lens. The direct response at 2.525THz was obtained for the YBCO GBJJ on Si bicrystal substrates, and the operation temperature was up to 70K. Also, the heterodyne mixing properties were investigated. At 2.525THz the high-order harmonic mixing at zero and finite bias voltage has been demonstrated.
Author
Electric Potential; Grain Boundaries; Josephson Junctions; YBCO Superconductors

20000033047 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Fabrication of Hollow Fibers for High-Power Nd:YAG Laser Pulses
Hanamoto, Konosuke, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 271-272; In Japanese; Copyright; Avail: Issuing Activity

Hollow fibers are proposed to deliver high-power Nd:YAG laser pulses. The fibers are composed of glass capillary tubing, a thin silver layer formed by a silver mirror plating technique and a polymer film deposited by liquid-flow method. Experimental

results show that the polymer-coated hollow fibers of 0.7-1 mm in bore diameter and 1-2 m in length provide low transmission losses of 0.1-0.4 dB for radiation of Nd:YAG laser pulses.
Author
Capillary Tubes; Glass Fibers; Plating; Thin Films; Polymeric Films

20000033049 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Fabrication of ALuminum Hollow Fibers for Delivery of Excimer Laser
Chinda, Yusuke, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 267-268; In Japanese; Copyright; Avail: Issuing Activity
Hollow fibers with inner aluminum coating are proposed as a flexible and low loss delivery medium for excimer laser light. A fabrication process based on aluminum sputtering deposition and nickel electroplating is developed. In this process, the fiber is formed upon the outside of glass capillary tube which is etched away in the final process. It is shown that, by choosing an appropriate outer coating on the bass glass tube, a fiber with low loss properties for excimer lasers can be fabricated.
Author
Aluminum Coatings; Deposition; Electroplating; Glass Fibers; Sputtering

20000033085 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Lateral Current Confinement in Semiconductor Lasers for Optical Transmission Systems
Nishi, Hiroshi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 134-137; In Japanese; Copyright; Avail: Issuing Activity
This paper describes lateral current confinements in GaAlAs and InGaAsP double heterostructure (DH) lasers having narrow stripe widths (less than 10 microns), which are emitting wavelengths of 0.85 microns and 1.3 microns, respectively. Structures of the current confinement were achieved by diffusing the sulfur selectively into heterostructure layers for GaAlAs lasers, and by growing the buried n-type InGaAsP layer, named an anti-guiding layer, into the p-type InP cladding layer for InGaAsP lasers, respectively. Excellent characteristics such as a low threshold current, a fundamental transverse mode oscillation, a high modulation speed and a long life were obtained.
Author
Indium Gallium Arsenides; Light Transmission; Semiconductor Lasers; Aluminum Gallium Arsenide Lasers; Confinement

20000033101 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Function for Laser-Pumped THz Parametric Oscillator
Morikawa, Akihiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 349-350; In Japanese; Copyright; Avail: Issuing Activity
A tunable THz-wave source has been realized by THz parametric oscillator utilizing the polariton mode scattering of LiNbO3. This technique has several advantages such as wide tunability and compact system. In this paper, we demonstrate an efficient THz-wave radiation by using a new cavity configuration with a trapezoidal LiNbO3 crystal. A tunable range of 130-310 microns has been achieved without a coupling device. This method reduces an influence of the propagation loss in the crystal, so that the shorter wavelength oscillation is enhanced.
Author
Lithium Niobates; Parametric Amplifiers; Polaritons; Laser Pumping

20000033156 New Mexico Univ., Optical Sciences Center, Albuquerque, NM USA
Power Scaling and Frequency Stabilization of an Injection-Locked Laser
Teehan, Russell F.; May 2000; 154p; In English
Report No.(s): AD-A374244; AFIT-FY00-65; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
The power scaling and frequency stabilization aspects of a high power, injection-locked, arc-lamp pumped Nd:YAG rod laser at 1.064 micrometers are considered. A complete theoretical analysis is performed on the Pound-Drever-Hall injection-locking technique used to lock the oscillation frequency of a high power laser to that of a low power frequency-stable laser. The explicit form of the injection-locking error signal is derived and an effective frequency noise control loop is established, which serves as a building block for describing more elaborate stabilization techniques. I achieve a 24-W, TEM00, linearly-polarized (97:1) output with an M2 of 1.07, using one such elaborate stabilization technique. I demonstrate the similarity between the frequency stability of the output field of an external cavity frequency-doubled laser and the injection-locked laser. I establish a frequency reference

at 1 micrometers with a frequency stability of 10(exp -13) at one second by locking the frequency-doubled NPRO to an electronic transition in I2.
DTIC
Arc Lamps; Frequency Stability; Injection Locking; Injection Lasers; High Power Lasers; Mathematical Models

20000033220 Kyushu Univ., Graduate School of Engineering, Fukuoka, Japan
3-Dimensional Measurement for Profile of Drill Flank: A Precision Measurement Using Virtual Slit Moire Method by Line Laser
Yoshitomi, Kenichirou; Sajima, Takao; Onikura, Hiromichi; Technology Reports of Kyushu University; January 2000; ISSN 0023-2718; Volume 73, No. 1, pp. 33-39; In Japanese; Copyright; Avail: Issuing Activity

A measurement of tool profile is an important factor for accurate machining. There are some measurement parameters on tool, i.e. length, angle, profile of curved surface, etc. It is difficult to measure 3-dimensional profile of curved surface. So, a precision and low cost measurement method for tool profile is required. Although there are many 3-dimensional measurement methods, we propose 3-Dimensional Profile Measurement Using Virtual Slit Moire Method by Line Laser, This method is highly effective for tool profile measurement. In this paper, a profile of drill flank is measured by the proposed method. Drill is used very often for machining. Drill flank affects machining condition, so that profile must be measured precisely. Result of measurement by the proposed method is compared with one by Laser Displacement Sensor.
Author
Measurement; Drilling; Laser Applications; Precision; Machine Tools

20000033263 AC Materials, Inc., Winter Park, FL USA
Diode-Pumped Tunable 3 Micron Laser Sources ***Final Report, 23 Apr. 1999 - 22 Jan. 2000***
Cassanho, Arlete; Jenssen, Hans; Feb. 21, 2000; 14p; In English
Contract(s)/Grant(s): DASG60-99-M-0088
Report No.(s): AD-A373886; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this work was to evaluate two laser host materials doped with Tm and Dy as potential 3 um, diode pumped lasers. BaY2Fs single crystals were grown and spectroscopy identified efficient Tm to Dy energy transfer. The Dy stimulated emission cross section was measured to be comparable to other IR lasers. A new crystalline structure, NaYF4 was also studied. In this crystal it was found, in addition to efficient pumping, a longer fluorescent lifetime for the 3 um Dy laser transition. Both materials are promising candidates for a tunable 3 um laser source. Potential benefits: A compact, power scalable frequency agile solid state laser operating near the 3 um spectral hand is a desired technology for numerous BMDO and DOD programs including various active sensor and countermeasure applications. Commercial applications would he in the area of laser surgery, dentistry and dermatology. Further potential applications would be in instrumentation for scientific and spectroscopic studies, especially the 0-H bond.
DTIC
Solid State Lasers; Laser Pumping; Tunable Lasers; Doped Crystals; Semiconductor Lasers

20000033474 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK
Central Laser Facility, Rutherford Appleton Laboratory ***Annual Report, 1998 - 1999***
Wyborn, Brian, Editor, Rutherford Appleton Lab., UK; Neely, David, Editor, Rutherford Appleton Lab., UK; Rose, Steven, Editor, Rutherford Appleton Lab., UK; Langley, Andrew, Editor, Rutherford Appleton Lab., UK; Parker, Tony, Editor, Rutherford Appleton Lab., UK; Danson, Colin, Editor, Rutherford Appleton Lab., UK; Hirst, Graeme, Editor, Rutherford Appleton Lab., UK; Allott, Ric, Editor, Rutherford Appleton Lab., UK; Notley, Margaret, Editor, Rutherford Appleton Lab., UK; 1999; ISSN 1358-6254; 236p; In English; See also 20000033475 through 20000033556; Original contains color illustrations
Report No.(s): RAL-TR-1999-062; ISBN 0902376950; Copyright; Avail: Issuing Activity

This report contains scientific accounts of the work which has been carried out at the Central Laser Facility (CLF) at the Rutherford Appleton Laboratory both by university users and facility staff during the financial year 1999/99. The Vulcan laser has continued to provide the focus of the very strong, international research programme in laser-plasma interactions. A significant contribution to the success of this programme has been the further increase in the intensity which can be produced by Vulcan operating in the CPA mode. By improving further the beam quality and using F1 parabolic reflectors for focusing, intensities up to 5 x 10(exp 19) W/sq cm have been produced. At these very high intensities, the laser-plasma interaction gives rise to the generation of energetic electrons and ions. Ultra-high magnetic fields and, by producing highly-directional beams of gamma-rays, to the nuclear activation of elements via (gamma, n) processes. Other areas which have been studied include the development and use of X-ray lasers for radiography of laser-produced plasma and the study of instabilities and the use of shock wave propagation

in low density foams to test new concepts in inertial confinement fusion. This programme will be carried out over the next three years in parallel with the users' scientific programmes. The Astra laser is a 30fs, 10 Hz CPA TiS which, during the year has been moved to a new laboratory and upgraded to produce intensities of 10(exp 18) W/sq cm. The new laboratory enables two user experimental areas to be operated simultaneously and this has been highly beneficial in enhancing access to this facility. A further upgrade, funded by EPSRC was commenced and this will provide target intensities of up to 10(exp 19)W/sq cm to be produced in one of the two areas. The programme so far has concentrated on the interaction of intense, ultrashort pulses with neutral and ionic molecules and, with the den,development of the high intensity configuration, laser-plasma and short-pulse X-ray studies will become possible. The highly successful science programme has continued within the Lasers fr Science Facility (LSF). A significant development has been the enhancement of the Raman and ps-TR(sup 3) capability by construction of a fast Kerr gate for the rejection of fluorescence signals which obscure the Raman signal. This has enabled intramolecular electron transfer in some large organic molecules to be observed for the first time and has improved our understanding of how ultrafast changes in molecular structure influence their efficiency. The Laser Loan Pool has benefited from an ongoing investment programme in laser and diagnostic equipment which has been funded by EPSRC and has enabled state of the art lasers to be made available to university users in their own laboratories.
Derived from text
Research Facilities; Electron Transfer; High Power Lasers; Inertial Confinement Fusion; Laser Plasma Interactions; Magnetic Fields; Shock Wave Propagation

20000033475 Imperial Coll. of Science, Technology and Medicine, London, UK
Collimated Ionization Channels in Glass Targets Irradiated by Ultra-Intense Laser Pulses
Borghesi, M., Imperial Coll. of Science, Technology and Medicine, UK; Mackinnon, A. J., Imperial Coll. of Science, Technology and Medicine, UK; Bell, A. R., Imperial Coll. of Science, Technology and Medicine, UK; Malka, G., Imperial Coll. of Science, Technology and Medicine, UK; Vickers, C., Imperial Coll. of Science, Technology and Medicine, UK; Willi, O., Imperial Coll. of Science, Technology and Medicine, UK; Davies, J. R., Instituto Superior Tecnico, Portugal; Pukhov, A., Max-Planck-Inst. fuer Quantenoptik, Germany; Meyer–ter–Vehn, J., Max-Planck-Inst. fuer Quantenoptik, Germany; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 11-13; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Recent computational papers have predicted that, during (he interaction of ultra-intense laser pulses with dense plasmas, collimated beams of very energetic electrons are produced. In particular, Particle-in-Cell (PIC) simulations predict that MeV electrons, ponderomotively accelerated along the propagation axis, are confined radially by large, self-generated magnetic fields. This confinement can lead to a well collimated electron beam propagating into the high density plasma. At high density the electrons will eventually lose their energy through collisions and will be stopped after a characteristic range depending on their energy. Recent experimental results seem to indicate that the electron beam stays collimated during its propagation through a solid plastic target. This was inferred from observations of small extent plasma plumes on the rear of 200 microns thick CH targets irradiated at 10(exp 19) W/sq cm. Simulations performed with a Fokker-Planck hybrid code suggest that inside the solid target the electrons are collimated by a magnetic field generated at the edge of the electron beam. The production and propagation of electron beams through high density plasmas are of topical interest for fast ignitor applications, it is essential for the fast ignitor scheme to be successful that the electron energy required to start ignition is deposited in the high density core of the compressed fusion fuel. These electrons are produced at densities close to critical and have to propagate to the core through a dense plasma. So far no direct observations of collimated electron beams have been reported. Experimental observations of the interaction of ultra-intense laser pulses with aluminium over-coated solid glass (SiO2) targets are reported here. Time-resolved optical probing revealed, immediately after the interaction, the presence of narrow opaque filaments in the glass. Computational modelling indicates that the observations are consistent with collimated propagation of a fast electron beam through the target.
Author
Collimation; Ionization; Glass; Irradiation; Laser Beams; Pulse Radar; Targets

20000033476 Imperial Coll. of Science, Technology and Medicine, Dept. of Physics, London, UK
Multi-MeV Ion Generation from High Intensity Laser Interactions with Underdense Plasmas
Krushelnick, K., Imperial Coll. of Science, Technology and Medicine, UK; Clark, E. L., Imperial Coll. of Science, Technology and Medicine, UK; Najmudin, Z., Imperial Coll. of Science, Technology and Medicine, UK; Salvati, M., Imperial Coll. of Science, Technology and Medicine, UK; Santala, M. I. K., Imperial Coll. of Science, Technology and Medicine, UK; Tatarakis, M., Imperial Coll. of Science, Technology and Medicine, UK; Dangor, A. E., Imperial Coll. of Science, Technology and Medicine, UK; Malka, V., Ecole Polytechnique, France; Neely, D., Rutherford Appleton Lab., UK; Allott, R., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 14-15; In English; See also 20000033474; Copyright; Avail: Issuing Activity

There have been rapid advances in the use of high power, short pulse lasers over the past several years. In particular, the potential of such lasers for applications in particle acceleration, X-ray generation, and inertial confinement fusion seems promising. However, much of the highly nonlinear plasma physics which occurs during such interactions is not well understood and experiments which address the fundamental physics of these interactions are required in order to properly evaluate the suitability of these intense laser-produced plasmas for such applications. In this report, we discuss measurements of accelerated ions produced by the ”Coulomb explosion” of a high intensity laser produced plasma . In this situation, ions are accelerated by electrostatic forces caused by charge separation induced by the laser ponderomotive pressure. It is found that a spatially resolved measurement of the high energy ions can provide a direct and simple estimate of the laser intensity in the plasma, by imaging the ion emission it is possible to determine how the intensity of the laser pulse changes as it propagates through the underdense plasma. In these experiments, we have measured peak ion energies of 1.0 MeV for deuterium gas interactions, 3.6 MeV for helium interactions and greater than 6 MeV for interactions with neon.
Derived from text
Ion Emission; Generation; High Power Lasers; Laser Plasmas; Inertial Confinement Fusion; Electromagnetic Interactions

20000033484 Glasgow Univ., Dept. of Physics and Astronomy, UK
Quantitative Measurement of Suprathermal Electron Temperature in Ultra-Intense Laser-Solid Interactions Via Nuclear Activation Techniques
Spencer, I., Glasgow Univ., UK; Singhal, R. P., Glasgow Univ., UK; Ledingham, K. W. D., Glasgow Univ., UK; McCanny, T., Glasgow Univ., UK; Santala, M. I. K., Imperial Coll. of Science, Technology and Medicine, UK; Clark, E., Imperial Coll. of Science, Technology and Medicine, UK; Watts, I., Imperial Coll. of Science, Technology and Medicine, UK; Beg, F. N., Imperial Coll. of Science, Technology and Medicine, UK; Zepf, M., Imperial Coll. of Science, Technology and Medicine, UK; Krushelnick, K., Imperial Coll. of Science, Technology and Medicine, UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 31-32; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

With remarkable advancements in laser technology in recent years, due to the development of chirped-pulse amplification techniques (CPA), focused intensities of 10(exp 19) - 10(exp 21) W/sq cm are now achievable. When these intensities arc incident on a solid target, free electrons can quiver relativistically with ponderomotive energies in the MeV range. These fast electrons can produce bremsstrahlung in high Z targets. These bremsstrahlung photons can then be used to induce photo-nuclear reactions. The study of high intensity laser-plasma interactions is of current interest in many fields of research e.g. the Fast Ignitor scheme for inertial confinement fusion (ICF), plasma particle accelerators and astrophysics as well as laser-induced nuclear effects described above. The temperature of electrons produced in the laser-plasma interactions is a fundamental parameter and hence it is of great importance to measure it experimentally. This report describes a procedure which can be used to determine this value, using the measured activities of isotopes which have been produced by the laser induced photon beam.
Author
Electrical Measurement; Electromagnetic Interactions; Free Electrons; Laser Plasma Interactions; Temperature Measurement; Amount

20000033485 Imperial Coll. of Science, Technology and Medicine, Blackett Lab., London, UK
Energy Transport in High Intensity Laser Solid Interactions
Zepf, M., Imperial Coll. of Science, Technology and Medicine, UK; Beg, F. N., Imperial Coll. of Science, Technology and Medicine, UK; Clark, E., Imperial Coll. of Science, Technology and Medicine, UK; Dangor, A. E., Imperial Coll. of Science, Technology and Medicine, UK; Krushelnick, K., Imperial Coll. of Science, Technology and Medicine, UK; Tatarakis, M., Imperial Coll. of Science, Technology and Medicine, UK; Watts, I. F., Imperial Coll. of Science, Technology and Medicine, UK; Davies, J. R., Instituto Superior Tecnico, Portugal; Norreys, P., Rutherford Appleton Lab., UK; Machacek, A., Oxford Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 33-34; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

Energy transport in high intensity laser-solid interaction has been a focus of interest particularly in connection with the Fast Ignitor Scheme for Inertial Confinement Fusion”. Briefly, the idea underpinning this scheme is to separate the heating of the fusion pellet from its compression, thereby making the fusion process more efficient and possibly easier to achieve. The heating of the fusion pellet to sufficiently large temperatures (less than 10 keV) is then achieved using the fast electrons (-MeV) generated in high intensity less than 10(exp 19) W/sq cm laser solid interactions. Very large amounts of energy (much greater than IkJ) need to be deposited in a small fraction of the fuel pellet in a very short period of time (approx. 10ps). PIC code simulations have predicted large conversion efficiencies from laser radiation into fast electrons and their existence has been confirmed experimentally. However in a typical fusion scenario the electrons will be generated a long distance from the compressed core

(approx. 100 microns). Understanding the physics underlying the electron transport and energy deposition in these interactions is therefore paramount. The currents required (greater than 50 MA) far exceed the Alfven-Lawson limit for the propagation of an electron beam in vacuum (approx. 0.1 MA for a relativistic gamma = 5). Therefore the beam has to be almost perfectly compensated by a return current to enable propagation. Consequently the process of electron propagation and energy deposition cannot be approximated by the trajectory of a single electron but instead has to be viewed as a collective phenomenon dominated by the fields and currents set up by the fast electron beam. In this report we will show the first quantitative measurements of the energy deposition by a fast electron beam in a solid glass target.
Derived from text
Electron Transfer; Electromagnetic Interactions; Laser Beams; Magnetohydrodynamic Waves; High Power Lasers

20000033486 Glasgow Univ., Dept. of Physics and Astronomy, UK
Studies of Novel Laser-Solid Interactions at High Intensities on Vulcan Using Nuclear Techniques
Ledingham, K. W. D., Glasgow Univ., UK; Spencer, I., Glasgow Univ., UK; McCanny, T., Glasgow Univ., UK; Singhal, R. P., Glasgow Univ., UK; Santala, M. I. K., Imperial Coll. of Science, Technology and Medicine, UK; Clark, E., Imperial Coll. of Science, Technology and Medicine, UK; Watts, I., Imperial Coll. of Science, Technology and Medicine, UK; Beg, F. N., Imperial Coll. of Science, Technology and Medicine, UK; Zepf, M., Imperial Coll. of Science, Technology and Medicine, UK; Krushelnick, K., Imperial Coll. of Science, Technology and Medicine, UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 35-38; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

The last few years have witnessed a dramatic upsurge in short pulse laser technology with its concomitant high achievable peak powers. This has been brought about by the development of chirped-pulse amplification (CPA). Now table-top terrawatt lasers are to be found in many university and national laboratories and recently the first petawatt laser has been developed at Livermore with others being proposed elsewhere. With these high power lasers, focused intensities between 10(exp 19) - 10(exp 20) W/sq cm have been achieved. At these intensities free electrons can quiver in a laser focus totally relativistically with ponderomotive energies of MeV. A number of mechanisms are proposed which can cause the electrons in plasmas to be accelerated to many times the ponderomotive potential such as wakefield acceleration plasma wave breaking, vxB acceleration in the presence of an azimuthal magnetic field, and resonance absorptions. The reason for the current and burgeoning interest in high intensity laser-plasma interactions is their relevance to a number of diverse fields e.g. advanced concepts of plasma high energy particle accelerators, laser induced nuclear photophysics, astrophysics and inertial confinement fusion (ICF). Specifically the question of carrying out nuclear physics using a laser source has been addressed by a number of authors using high repetition rate, fs lasers and by using single shot ultrahigh intensity lasers like the petawatt laser at the NOVA facility and Vulcan. A seminal theoretical paper written by Boyer, Luc and Rhodes more than ten years ago predicted the possibility of optically induced nuclear fission. The first quantitative measurement of bremsstrahlung photons with energies less than 2 MeV from the interaction of a laser with matter was reported by Sherman, Burnett and Enright. They showed that they were produced by relativistic electrons when a 600 ps, CO2 laser pulse interacted with thick targets. Recently more energetic electrons have been produced by terrawatt and petawatt lasers of 1 micron light in less than or equal to ps pulses. The motivation for writing the present letter is to show how a 50 TW laser (Vulcan) can be used to carry out (gamma, n) and (gamma, f) reactions. These reactions are the simplest photo-nuclear reactions for gamma-ray beams with an end-point up to about 30 MeV, generated by bremsstrahlung from the energetic electrons produced by laser intensities of about 10(exp 19) W/sq cm. Typically (gamma, n) reactions produce proton rich isotopes which decay to stability by positron emission, electron capture (EC) or both and have thresholds for production (Q values) which are typically less than 8MeV. The (gamma, f) reactions are also energetically favoured having thresholds of about 4 MeV.
Author
Laser Plasma Interactions; High Power Lasers; Electromagnetic Interactions; Electron Capture; Energy Transfer; High Energy Electrons; Magnetic Fields

20000033487 Imperial Coll. of Science, Technology and Medicine, Blackett Lab., London, UK
Shock Wave Collisions in Low Density Foams
Schiavi, A., Imperial Coll. of Science, Technology and Medicine, UK; Borghesi, M., Imperial Coll. of Science, Technology and Medicine, UK; Pasley, J., Imperial Coll. of Science, Technology and Medicine, UK; Willi, O., Imperial Coll. of Science, Technology and Medicine, UK; Neely, D., Rutherford Appleton Lab., UK; Notley, M., Rutherford Appleton Lab., UK; Nazarov, W., Dundee Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 39-40; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

In recent years the availability of low density foams has given scientists the opportunity to investigate the formation and propagation of subsonic, transonic and supersonic waves. Such studies are of major importance for the development and testing of new ideas in Inertial Confinement Fusion". Foam targets also allow direct observation of the development of shock waves. The collision of shock waves in this density regime has never been investigated before at these energy densities, and experimental data is required to test theoretical modelling. In this experiment shock fronts were driven through a low density foam target by high intensity laser pulses. The propagation of shock waves through the target was detected by time resolved point projection absorption spectroscopy. From image processing of the exposed Films and comparison with synthetic absorption spectra, it was possible to reconstruct temperature and density profiles of the shocked foam.
Author
Absorption Spectra; Absorption Spectroscopy; Flux Density; Foams; High Power Lasers; Image Processing; Observation; Shock Wave Propagation

20000033489 Oxford Univ., Clarendon Lab., Oxford, UK
Measurements of the Change in XUV Opacity of Al Due to Shock Compression
Wolfrum, E., Oxford Univ., UK; Allen, A. M., Oxford Univ., UK; Burnett, P. D. S., Oxford Univ., UK; Wark, J. S., Oxford Univ., UK; Keenan, R., Queens Univ., UK; ORourke, R. M. N., Queens Univ., UK; Lewis, C. L. S., Queens Univ., UK; Dobosz, S., Essex Univ., UK; Tallents, G. J., Essex Univ., UK; Rose, S. J., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 43-45; In English; See also 20000033474; Copyright; Avail: Issuing Activity

The opacity of shock-compressed material in the XUV spectral region is of general scientific interest for laboratory and astrophysical plasmas and of particular interest in inertially confined fusion (ICF) research. Radiography with laser produced plasma X-ray sources is widely used in ICF research to probe the hydrodynamics of spherical shell implosions or accelerated planar foil analogues, driven at megabar pressures either directly by laser light or indirectly by thermal XUV radiation in a laser-heated hohlraum. Recently both thermal and laser XUV sources have been used to study the very small-scale hydrodynamic perturbations induced by laser speckle. to interpret such experiments, knowledge of the opacity of shock-compressed material is required. We present here the first experimental determination of the increase in the mass absorption coefficient for shock compressed aluminium. Experiments which were carried out to study imprint and subsequent Rayleigh Taylor (RT) growth due to single mode imprint yielded radiographs showing two dominant features. These were, firstly, the large amplitudes in optical depth due to the single mode imprint, which was the quantity we wanted to measure, and, secondly, an increase in the total opacity following the envelope of the single mode Fraunhofer interference pattern. As we were mainly interested in the development of the single mode pattern after shock breakout, i.e. in the RT growth phase, we only gathered a few data points before shock breakout, where the aluminium foil is compressed to its highest density. On analysis of the data, we decided that it was worth dedicating a Full radiography experiment to the measurement or the change in opacity due to shock compression, this time using a drive beam with a single smooth spot, omitting the single mode interference pattern. Great care was taken to take a temporal series of shots during the compression phase, i.e. before shock breakout. This experiment and its results are described below. As a full XUV-laser radiography experiment is rather complicated and restricted to a few wavelengths because of the limited availability of appropriate high quality XUV mirrors, an alternative method of measuring the change in opacity due to shock compression was tested. Instead of imaging the A] foil via XUV mirrors onto a CCD, a flatfield spectrometer was used to take the data. We give details of this experiment and compare its results with those acquired with XUV-laser radiography.
Author
Ultraviolet Spectra; Opacity; Aluminum; Shock Loads; Compressing; X Ray Sources; Imaging Techniques; Extreme Ultraviolet Radiation

20000033490 Cambridge Univ., Cavendish Lab., Cambridge, UK
Optical Source Model for the 23.2-23.6 nm Radiation from the Multielement Germanium Soft X-Ray Laser
Burge, R. E., Cambridge Univ., UK; Yuan, X.–C., Cambridge Univ., UK; Slark, G. E., Cambridge Univ., UK; Browne, M. T., Cambridge Univ., UK; Charalambous, P., Cambridge Univ., UK; Lewis, C. L. S., Queens Univ., UK; Cairns, G. F., Queens Univ., UK; MacPhee, A. G., Queens Univ., UK; Neely, D., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 46-48; In English; See also 20000033474; Copyright; Avail: Issuing Activity

We are concerned with the optical properties of the J = 0-l and 2-1 lasing spectral lines, particularly the 19.6 nm and 23.2/23.6nm lines, using planar slab targets in the collisionally pumped neonlike germanium XXIII soft X-ray laser (XRL). We consider here, for the partially coherent J = 2-1 unresolved spectral lines at 23.2 and 23.6nm without prepulse, a description for the source size (distribution of source intensity) in two dimensions from experimental data averaged over the time period of a single pulse of radiation. The spatial coherence properties of an XRL are usually referred to the horizontal and vertical planes.

The experimental results introduced below refer to three- and four-target arrangements We add to previous data results for spatial coherence in the vertical plane.
Author
Optical Properties; Germanium; X Ray Lasers; Radiation Sources; Light Emission; Coherent Radiation

20000033491 Queens Univ., School of Mathematics and Physics, Belfast, UK
Saturated X-Ray Lasers at 196 A and 73 A Pumped with CPA Travelling Wave Excitation
MacPhee, A. G., Queens Univ., UK; Lewis, C. L. S., Queens Univ., UK; Keenan, R., Queens Univ., UK; ORourke, R. M. N., Queens Univ., UK; Tallents, G. J., Essex Univ., UK; Pestehe, S. J., Essex Univ., UK; Strati, F., Essex Univ., UK; Pert, G. J., York Univ., UK; McCabe, S. P., York Univ., UK; Simms, P., York Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 49-51; In English; See also 20000033474; Copyright; Avail: Issuing Activity

The efficiency of pumping soft X-ray lasers based on a laser-produced plasma medium has increased by more than 3 orders of magnitude in the last decade through a combination of novel experimental design and detailed theoretical modelling guidance . Scaling to shorter wavelength operation has been achieved through the use of higher Z targets allowing the efficient operation of Ni-like, as well as Ne-like ion XRLs. Pre-formed plasmas and curved targets have been among the principle experimental technique, which have had a major impact on these recent achievements in the development of X-ray lasers. A new and significant advance in the field has been the demonstration of transient gain in neon-like ions at the Max Born Institute in Berlin. This technique has subsequently been developed and extended to nickel-like ions at the Rutherford Appleton Laboratory, at LLNL and at LULI. Here we report demonstration of a travelling wave pumping technique which enables us to achieve saturated output intensities at the shortest wavelength to date, pumped in the very efficient transient gain mode.
Author
X Ray Lasers; Penetration; Experiment Design; Plasmas (Physics); Wave Excitation

20000033492 Queens Univ., School of Mathematics and Physics, Belfast, UK
Preliminary Investigations into Non-Linear Optics with X-Ray Lasers
ORourke, R. M. N., Queens Univ., UK; Keenan, R., Queens Univ., UK; Lewis, C. L. S., Queens Univ., UK; MacPhee, A. G., Queens Univ., UK; Moore, B., Queens Univ., UK; Dobosz, S., Essex Univ., UK; Tallents, G., Essex Univ., UK; Djaoui, A., Rutherford Appleton Lab., UK; Neely, D., Rutherford Appleton Lab., UK; Wolfrum, E. W., Oxford Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 52-55; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

Following on feasibility studies into the subject, experimental exploration began in January 1999. The initial experiment, carried out in target area cast of Vulcan, was to exact preliminary tests on the viability or a four wave mixing process. This scheme involved the combination or two XRL photons at 23.12 nm from Ne-like Ni with one optical photon at 1.06 microns in a Na-like Ar plasma to give an output at near the second harmonic of the X-ray laser (XRL) input. This article aims to outline some of the uncertainties which faced us prior to the experimental run and the progress made into understanding the best way in which to approach the experiment in the future.
Author
Feasibility Analysis; Viability; Four-Wave Mixing

20000033493 Queens Univ., School of Mathematics and Physics, Belfast, UK
Five Beam Irradiance of a Single Sm X-Ray Laser
Keenan, R., Queens Univ., UK; ORourke, R. M. N., Queens Univ., UK; Lewis, C. L. S., Queens Univ., UK; Wolfrum, E., Oxford Univ., UK; Zhang, J., Oxford Univ., UK; Pestehe, S. J., Essex Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 56-57; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

The Ni-like Sm x-ray laser (7.3nm) has been shown to saturate at plasma medium lengths of approx. 18 mm using a double pulse configuration, where a prepulse produces a cold preformed plasma which increases energy absorption from the main heating pulse and reduces refraction. However, for lengths beyond l8 mm, into saturation mode, a double target arrangement had been used to compensate for refraction. The alignment of the double targets is critical for coupling of the small gain regions close to the target and precision surface displacement is required for maximum output. Also, the Sm laser has a narrow divergence so when imaging back past the target, as in radiography the beam is close to the axis and the double target creates a wide obstruction in the chamber centre for the beam to get past. For these reasons we have tried a single Sm target, 25 mm long, driven with 5

overlapped beams each 20 mm long. This length was chosen since 25 mm is well into saturation, where output increases linearly with length, but short enough that uniformity and an intensity of 5 x l0(exp 13) W/sq cm can easily be achieved.
Author
X Ray Lasers; Plasmas (Physics); Imaging Techniques; Energy Absorption; Beams (Radiation)

20000033494 Essex Univ., Dept. of Physics, Colchester, UK
Parametric Instabilities and Harmonic Generation at the Relativistic 1/4 Critical Density of Ultra-Intense Laser Light
Mason, P., Essex Univ., UK; Barr, H. C., Essex Univ., UK; Parr, D., Essex Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 58-59; In English; See also 20000033474; Copyright; Avail: Issuing Activity

At non-relativistic intensities the two plasmon decay instability (TPD) arises at the quarter critical density (n(sub c)/4). For a linear polarized laser driver, optimum coupling is in the plane of polarisation of the laser beam. At the same time, one of the TPD plasmons can participate in higher harmonic generation at half-harmonic frequencies omega = (N + 1/2)omega(sub 0). At non-relativistic intensities the process is parasitic to TPD. At relativistic intensities it arises as a Stimulated (”Raman”) harmonic generation (SRHG) process in its own right (and arises across all densities from quarter critical plasma up to the laser cut-off). The results below show the hybrid TPD/SRHG process which occurs at ultra-high intensities at the ”relativistic critical density” n(sub 0) = n(sub cr)/4 where n(sub cr) approx. = n(sub cr) gamma(sub q), gamma(sub q) = (1 +q(sup2)/2)(sup 1/2). The numerical approach to all electronic parametric instabilities as developed by Barr, Mason and Parr is used to obtain the results presented here.
Author
Harmonic Generations; Stability; Relativistic Electron Beams; Laser Beams

20000033495 Essex Univ., Dept. of Physics, Colchester, UK
Parametric Instabilities and Harmonic Generation in Overdense Plasma at the Cutoff for Ultra-Intense Laser Light
Parr, D. M., Essex Univ., UK; Barr, H. C., Essex Univ., UK; Mason, P., Essex Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 60-61; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Classically overdense plasma is accessible to ultra-intense laser light due to self-induced transparency caused by the relativistic electron mass increase. Here we examine the electron parametric instability of linearly polarized light at its cut-off, where the ’relativistic critical density’ n(sub cr) = n(sub c)G(sup 2)(q)gamma(sub q), q = eA(sub 0)/mc(sup 2) is the peak normalised vector potential of the laser light and G(0)=1, G(qmuch greater than 1) approx. = 1.07. At n(sub cr) the linearly polarized laser light is a non-linear anharmonic pure transverse oscillation (induced longitudinal motion is negated by self-consistent fields), with the electron velocity approaching a rectangular waveform when q much greater than 1. Such waveforms are unstable in a variety of ways: modulationally, to a second order two plasmon decay mechanism, and to stimulated harmonic generation. These derive from a combination of charge-displacement and relativistic mass increase modulations/fluctuations. A general and unified treatment applicable to all electronic parametric instabilities, described in last year’s Annual Report and there applied to underdense plasma, is used.
Author
Stability; Independent Variables; Harmonic Generations; Plasmas (Physics); Laser Outputs; Light Beams

20000033497 Essex Univ., Dept. of Physics, Colchester, UK
Atomic Number Scaling of Ni-Like Lasers
Eker, G., Essex Univ., UK; Tallents, G. J., Essex Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 64-65; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

One of the important objectives of X-ray laser development is to achieve a coherent, monochromatic, and saturated laser output at short wavelengths. Saturated soft X-ray amplification in Ne-like ions has been demonstrated at wavelengths between 24 nm to 15 nm. The required pumping laser energy increases rapidly with Ne-like ions as the wavelength becomes shorter towards the water window region (2.5 nm -4.4 nm). With Ni-like ions the pumping laser energy is reduced for a given X-ray laser wavelength as the quantum efficiency (the laser transition energy/the excitation energy) for Ni-like ions is higher than that for Ne-like ions of similar X-ray laser wavelength. With multi pulse pumping, the efficiency of soft X-ray lasers produced from laser plasma media has increased. Shorter wavelength lasing has been achieved using higher Z targets in Ni-like and Ne-like ions. Multi pulsing works well with approx. 100 ps pulses, where the gain is quasi-steady state. Collisional pumping into the upper lasing level is balanced by radiative decay. In this report, Ni-like X-ray lasers with atomic numbers between 47 (Ag) and 92 (U) and lasing wavelengths between 14 nm and 2.5 nm are examined. We calculate the gain coefficients and the required pumping conditions for the Ni-like ions as a function of atomic number using the 1.5D hydrodynamic with atomic physics code EHYBRID and the atomic data tabulated by Daido et al. The energies of lasing levels and the oscillator strengths of transitions have been calculated by Daido et al for Ni-like ions from Z=47 to 92. There are two 4d-4p J=0-l lasing transitions for Ni-like ions. The lasing transition

oscillator strengths arc approximately equal for dysprosium (Z=66), but become increasingly unequal at higher and lower Z so that the dominant lasing transition switches from the long wavelength line to the short wavelength line with increasing Z. Given excitation cross-sections as a function of incident electron energy, an excitation rate coefficient can be calculated for a Maxwellian electron velocity distribution.
Derived from text
Atomic Structure; Laser Outputs; Coherent Radiation; Monochromatic Radiation; Excitation; Nickel; Oscillator Strengths

20000033499 Imperial Coll. of Science, Technology and Medicine, Blackett Lab., London, UK
Fast and Anomalous Electron Transport in Intense Short Pulse Laser-Matter Interactions
Haines, M. G., Imperial Coll. of Science, Technology and Medicine, UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 68-69; In English; See also 20000033474; Copyright; Avail: Issuing Activity

When an intense short pulse laser is incident on dense matter the electromagnetic energy is converted with high efficiency to energetic electrons The subsequent transport of these fast electrons has been studied theoretically by three types of model a fully PIC code, a hybrid code (collisionless fast electron component in a resistive electron fluid background), and analytically in 1-D for a similar hybrid models In this report further analytic work will be presented, showing how the return cold electron current will excite an anomalous resistivity as in a related paper and the associated skin depth leads to an estimate of the net current and the self-generated magnetic field.
Author
Electron Transfer; Electromagnetic Interactions; Pulsed Lasers; Numerical Analysis

20000033502 Essex Univ., Dept. of Physics, Colchester, UK
Travelling Wave Effects on Short Pulse Pumped X-Ray Lasers
Strati, F., Essex Univ., UK; Tallents, G. J., Essex Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 73-76; In English; See also 20000033474; Copyright; Avail: Issuing Activity

There has been an increasing interest in transient collisional excitation of soft X-ray lasers. The advent of high intensity, short pulse (approx. 1 ps), lasers has enabled experimental investigation of the feasibility and characteristics of this approach. The first transient excitation demonstration was achieved at the Max Born Institute in Berlin with neon-like ions. The technique has subsequently been successfully developed and extended in a number of experimental investigations at the Rutherford Appleton Laboratory (RAL), at LLNL and at LULI. In a recent experiment a(RAL saturation has been achieved on the 196 A Ge neon-like and, for the first time, on the 73 A Sm nickel-like transitions using a traveling wave technique for the optical pulse pumping. The efficiency of the traveling wave optical pumping of the lasing medium has been investigated for the 196 A Ge neon-like X-ray laser by irradiating a solid target with different traveling wave velocities. The principal aim of this report is to review a simple semianalytical Amplified Spontaneous Emission (ASE) model, accounting for homogeneous broadening, in order to investigate the active medium length-scaling of the energy output through saturation and the effects of traveling wave pumping on general ASE devices, to which the soft X-ray lasers belong.
Author
Traveling Waves; Pulsed Lasers; X Ray Lasers; Procedures; Spontaneous Emission

20000033503 Reading Univ., J. J. Thomson Physical Lab., UK
Manipulation of Bond Hardening in H2(+) by Chirping of Intense Femtosecond Laser Pulses
Frasinski, L. J., Reading Univ., UK; Posthumus, J. H., Reading Univ., UK; Plumridge, J., Reading Univ., UK; Codling, K., Reading Univ., UK; Taday, P. F., Rutherford Appleton Lab., UK; Langley, A. J., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 79-81; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Intuition suggests that a sufficiently strong laser field can weaken molecular bonds and induce dissociation. This mechanism known as bond softening is uncontroversial and well understood in H2(+) (see, for example, Topical Review), The opposite effect, also called molecular stabilisation, vibrational trapping, creation of light-induced bound states or bond hardening has the same theoretical origin but the history of its experimental verification has been confusing, Two manifestations of bond hardening in H2(+) near one-photon and three-photon resonances were inferred from rather noisy data in the early 1990s. They were received with great interest, as at that time the stabilisation of the molecular bond was a candidate for a universal mechanism explaining the invariance of ion kinetic energies with changes of intensity and pulse duration. Later, it was established that this invariance is a signature of rapid, sequential ionisation at the critical internuclear distance. Since then there has been a surprising lack of clear-cut confirmation of the bond hardening effect. With more recent work casting doubt on the existence of light-induced bound

states the idea of bond hardening has become again only a remote theoretical possibility. Against this trend of scepticism, we present an experimental observation of bond hardening in H2(+).
Author
Chemical Bonds; Internuclear Properties; Joints (Junctions); Laser Outputs; Pulse Duration; Pulsed Lasers

20000033504 Ioannina Univ., Physics Dept., Greece
Multiply Charged Intact Ions of Polyatomic Cyclic Molecules Generated by Strong Laser Fields
Kosmidis, C., Ioannina Univ., Greece; Tzallas, P., Ioannina Univ., Greece; Ledingham, K. W. D., Glasgow Univ., UK; McCanny, T., Glasgow Univ., UK; Singhal, R. P., Glasgow Univ., UK; Taday, P. F., Rutherford Appleton Lab., UK; Langley, A. J., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 82-84; In English; See also 20000033474; Copyright; Avail: Issuing Activity

The interaction of strong laser Fields with atoms and molecules leads to the production of multiply charged species. The observation of highly charged atomic ions produced by intense laser beams has been reported a few years ago and has later been extended to molecular ions. Multiply charged molecular ions may offer significant advantages in quantitative analysis and structure determination, notably isomer distinction and peptide analysis. Recently, multiply charged intact ions induced by femtosecond (fs) lasers have been observed for some polyatomic molecules. This observation, in conjunction with the potential of femtosecond laser induced mass spectrometry discussed earlier may have an important bearing on analytical applications. The mechanism for the production of these species is not clear yet. Two main mechanisms have been proposed for the production of multiply charged atomic ions. According to the first mechanism, called stepwise ionization, initially only one electron is detached from the atom while the second electron is subsequently ejected from the singly charged ion. The second mechanism is a non-sequential one and is referred to as the simultaneous detachment of two electrons. Cornagia and Hering have reported non-sequential ionization for a number of small molecules. In the present work the interaction of some cyclic polyatomic molecules with strong laser beams (10(exp 15) 10(exp 16)W/sq cm) is studied. De Witt and Levis have concluded that ionization yield of the parent molecule is related to the molecular structure. The main aim of the present work, is to explore the role of molecular structure in multiply charged intact ion generation under strong laser irradiation and the influence of the frequency and the intensity of the laser beam. The molecules have been chosen in such a way as to investigate the influence, if any, of aromaticity for some homo-and heterocyclic compounds. It is important also to check the significance of the nature of the higher occupied molecular orbitals (MO).
Author
Polyatomic Molecules; Laser Beams; Laser Outputs; Quantitative Analysis; Molecular Structure; Molecular Ions

20000033505 Glasgow Univ., Dept. of Physics and Astronomy, UK
Uniform Molecular Analysis Using Femtosecond Laser Mass Spectrometry
Fang, X., Glasgow Univ., UK; Ledingham, K. W. D., Glasgow Univ., UK; Graham, P., Glasgow Univ., UK; Smith, D. J., Glasgow Univ., UK; McCanny, T., Glasgow Univ., UK; Singhal, R. P., Glasgow Univ., UK; Langley, A. J., Rutherford Appleton Lab., UK; Taday, P. F., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 85-88; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Laser mass spectrometry permits ultra-sensitive detection and analysis of atoms and molecules, and has become an important analytical tool in many areas. This technique is based on the analysis of ion information from irradiated atoms or molecules. Therefore the procedure and mechanism of ion production plays a key role in its analytical ability. Generally, preceding the ion detection by mass spectrometers and particularly by time of flight (TOF) mass spectrometers, a laser ionizes the atoms or molecules in samples either by resonance (including resonance enhanced) or by non-resonance ionisation. For elements such ionisation is a simple up-pumping of atomic levels to ionic states. However ionisation of molecules is often accompanied by and/or competes with molecular dissociation which leads to the production of fragments.
Derived from text
Molecular Dynamics; Mass Spectroscopy; Lasers; Fragments; Atomic Energy Levels

20000033508 Queens Univ., Belfast, UK
Dissociation and Dissociative Ionization of H2(+) Using a Crossed Femtosecond Laser and Ion Beam Technique
Williams, I. D., Queens Univ., UK; McKenna, P., Queens Univ., UK; Sanderson, J. H., University Coll., UK; Bryan, W. A., University Coll., UK; El–Zein, A., University Coll., UK; Newell, W. R., University Coll., UK; Taday, P. F., Rutherford Appleton Lab., UK; Divall, E., Rutherford Appleton Lab., UK; Langley, A. J., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 94; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Theoretical interpretations of the dissociation and dissociative ionisation or H2(+) in an intense femtosecond laser pulse quite reasonably all begin with the molecular ion H2(+), generally in a Franck-Condon vibrational distribution. In other words it is assumed that the initial ionization of the neutral H2 molecule by the leading edge of the laser pulse is totally independent of the subsequent dynamics of the He2(+) ion. Experimental studies however all begin with a neutral H2 molecule , and assume that the ionization process and presence of the ionized electron are not important. to test this very important assumption, we herein report on the first experimental study of a beam of H2(+) molecular ions in an intense femtosecond laser pulse. by producing a fast beam of H2(+) ions to interact with the laser pulse, the precursor H2 neutral state is avoided and furthermore fast product neutral H atoms can be detected as well as protons. This is the First time that neutral dissociation products have been detected in the study of molecules in strong laser fields.
Author
Dissociation; Hydrogen; Laser Beams; Numerical Analysis; Molecular Ions; Gas Ionization; Franck-Condon Principle

20000033534 Essex Univ., Dept. of Physics, Colchester, UK
Spectra in the Range 5 to 50 A from the X-Ray Source
Nottola, A., Essex Univ., UK; Tallents, G. J., Essex Univ., UK; Goodhead, D. T., Medical Research Council, UK; Hill, M. A., Medical Research Council, UK; Stevens, D. L., Medical Research Council, UK; Turcu, I. C. E., Rutherford Appleton Lab., UK; Hirst, G. J., Rutherford Appleton Lab., UK; Shaikh, W., Rutherford Appleton Lab., UK; Westhall, J., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 156-159; In English; See also 20000033474; Copyright; Avail: Issuing Activity

In order to characterize the Central Laser Facility (CLF) soft X-ray laser-plasma source For radiobiology experiments to be performed by the Radiation and Genome Stability Unit of the Medical Research Council, a series of spectroscopic measurements has been carried out on the X-ray source itself. The characterisation was directed to choose materials to be used as laser targets giving the most efficient energy emission in selected X-ray regions in the range 0.2-2 keV with the narrowest bandwidth possible, to be further Filtered in future experiments by means of X-ray optics or grazing incidence mirrors.
Author
X Ray Sources; Bandwidth; Characterization; Radiobiology; X Ray Lasers; Spectral Resolution

20000033536 Liverpool Univ., Laser Group, UK
Investigation of the Nd:YAG Laser Percussion Drilling Process Using High Speed Filming
French, P. W., Liverpool Univ., UK; Hand, D. P., Heriot-Watt Univ., UK; Peters, C., Lumonics Ltd., UK; Shannon, G. J., Liverpool Univ., UK; Byrd, P., Aerospace Group, UK; Steen, W. M., Liverpool Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 162-166; In English; See also 20000033474; Original contains color illustrations; Sponsored in part by Lumonics Ltd.; Copyright; Avail: Issuing Activity

Laser percussion drilling is a process that is of great interest to the aerospace industry. The speed of the drilling action makes it a prime candidate for drilling such components as combustion chambers which have between 40,000 to 50,000 holes. Other components such as turbine and guide vanes contain fewer holes, typically 50 to 200, but given the total numbers of components involved, percussion drilling still has the potential to provide significant cost-benefit. In a previous study using experimental design techniques we found that the dominant factors affecting the process are focal position, gas pressure, pulse shape and pulse energy. A high speed camera filming at speeds of 40,500 frames per second was therefore used to capture the drilling event with these factors set at different levels.
Author
YAG Lasers; Research; Percussion; Laser Drilling; Turbines

20000033537 Heriot-Watt Univ., Dept. of Physics, Edinburgh, UK
Laser Engineering for Manufacturing Applications: Phase 3, Stream A, 'Precision Laser Drilling'
Hand, D. P., Heriot-Watt Univ., UK; Rodden, W. S. O., Heriot-Watt Univ., UK; Jones, J. D. C., Heriot-Watt Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 167-168; In English; See also 20000033474; Copyright; Avail: Issuing Activity

As part of the long term Laser Engineering for Manufacturing Applications (LEMA) programme, funded by EPSRC, we are researching into the Precision Laser Drilling process; in particular how the efficient (in terms of cost per hole) Nd:YAG single-shot drilling process can be improved in terms of its reliability and repeatability. If sufficient improvements can be achieved, then the process has significant potential in an aerospace application; the generation of large arrays of small (50 microns diameter) holes in the 1 mm thick titanium and aluminium used in the leading edges of aircraft wings and tailfins. These hole arrays will have the effect of reducing turbulence around the wing, leading to potential fuel savings of at least 7%. At present, methods for doing this

by percussion drilling using excimer lasers are available, but this is a slow and hence relatively costly process. In order to improve the single-shot Nd:YAG drilling process, however, we need to better understand its dynamics. This can be partly achieved by the use of single-point optical measurements, but in order to obtain a more complete picture a full-field imaging technique is essential. The process is however too fast for standard digital cameras, with holes being formed in less than 100 micron sec. We therefore applied to the EPSRC Engineering Loan Pool to borrow a high-speed camera (Kodak Ektapro HS Motion Analyzer Model 4540, which operates at up to 40,500 frames per second). In order to reduce the glare due to plasma generation, however, it was essential to use an intense narrow-band illumination light source, together with a corresponding narrow-band filter in front of the camera. The most convenient light source to use was an Argon ion laser, and so in conjunction we obtained a Spectra-Physics 2025-05 (CWL1) laser from the Central Laser Facility.
Author
Excimer Lasers; Laser Drilling; Costs; Holes (Mechanics); Imaging Techniques; Laser Applications; Manufacturing; Reliability

20000033539 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK
Vulcan Computer Control System Upgrade
Pepler, D., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 176-178; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

The Vulcan high power Nd:glass laser facility at the Rutherford Appleton Laboratory has had since it's infancy (some 22 years previous) some form of computer control for operating the laser and for collecting, collating and archiving of the data obtained from the laser operations. The computer control has changed over the intervening years but initially the computer was a GEC 4080 'mini' computer which despite it's classification completely took up two 6' high 19" racks. to enable this computer to control the laser it was interfaced into a series of CAMAC crates placed around the laser system. The GEC 4080 was quite advanced for it's time and was able to run up to 256 concurrent processes but was quite restricted in the memory available both for RAM and for hard disc space. Two 20 MB Winchester discs were available which had to be backed up onto magnetic tape at least once a week. I he computer was programmed in the high-level assembly language BABBAGE that also had its restrictions. With the advent of the single board computer, the LSI 11, the target areas of Vulcan were computerized using the MicroPower PASCAL programming language again with these computers interfaced into CAMAC for target area control and communication with the GEC 4080. Using the experience gained from this and with the introduction of the personal computer (PC), the GEC 4080 was replaced by two networked PC's. This system was therefore required to address these and other issues as the fact that the facility downtime should be minimal.
Derived from text
Computers; High Level Languages; High Power Lasers; Large Scale Integration; Personal Computers; Improvement

20000033541 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK
Materials Processing with High Power Lasers
Pepler, D. A., Rutherford Appleton Lab., UK; Allott, R., Rutherford Appleton Lab., UK; Boba, A., Rutherford Appleton Lab., UK; Clarke, R., Rutherford Appleton Lab., UK; Collier, J. L., Rutherford Appleton Lab., UK; Danson, C. N., Rutherford Appleton Lab., UK; Hirst, G., Rutherford Appleton Lab., UK; Neely, D., Rutherford Appleton Lab., UK; Notley, M., Rutherford Appleton Lab., UK; Payne, M., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999; 2p; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

Materials processing such as the annealing of phosphor thin films deposited (via RF magnetron sputtering) on silicon wafers has traditionally been achieved using time consuming transfers through high temperature cycles in N2, O2 or H2 atmospheres. It should be possible however, to anneal a full-sized silicon wafer, at room temperature, using a single pulse (1 - 20 ns) of high energy ultra-violet laser light, provided that the laser beam is large enough and that the laser energy and beam quality is of a sufficiently high level. It will be shown in this paper that the output from the neodymium glass laser Vulcan can be converted from the fundamental near IR wavelength (1.053 microns) to the fourth harmonic (263 nm). With the use of diffractive optics in the form of phase plates, large focal spots (approx. 50 mm diameter) can be achieved with high beam quality. Previous work, on the laser annealing of phosphors on silicon wafers used the output from the Titania KrF laser at the CLF. This work enabled the annealing of small areas (approx.3sq mm) of ZnS:Mn thin films to be successfully achieved. This was sufficient to prove the technique but the requirement now is to scale up the irradiation to about 2 cm square. However the KrF laser is no longer available and so a new source of UV laser was sought.
Derived from text
Cycles; Hydrogen; Irradiation; Laser Annealing; Laser Beams; Near Infrared Radiation; Neodymium Lasers; Nitrogen; Oxygen; Phosphors; Thin Films

20000033542 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK

Characterisation of Vulcan's Tsunami Oscillator

Parkinson, M., Rutherford Appleton Lab., UK; Kidd, A. K., Rutherford Appleton Lab., UK; Collier, J. L., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 184-185; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

The Vulcan laser system relies heavily on the performance of the short pulse oscillators that feed the CPA chain. As part of a continuing diagnostic program installation of a number of beam diagnostic systems has begun. One such diagnostic system from the Coherent-Ealing company was used to analyse the performance of the Tsunami mode-locked Ti: Sapphire Laser. The Tsunami is a commercial Kerr Lens Modelocked (KLM) oscillator using Ti: Sapphire as the active medium. The 80 MHz cavity produces 120 fs pulses at 5 nJ per pulse. It is an integral part of Vulcan's 'Front End' system being the main oscillator that seeds the CPA chain.

Derived from text

Oscillators; Lasers; Tsunami Waves; Laser Cavities; Laser Beams; Performance Tests; Measuring Instruments; Pulsed Lasers

20000033543 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK

Development of a Multi-Terawatt, Femtosecond Laser Facility: Astra

Langley, A. J., Rutherford Appleton Lab., UK; Divall, E. J., Rutherford Appleton Lab., UK; Girard, N., Rutherford Appleton Lab., UK; Hooker, C. J., Rutherford Appleton Lab., UK; Hutchinson, M. H. R., Rutherford Appleton Lab., UK; Lecot, A., Rutherford Appleton Lab., UK; Marshall, D., Rutherford Appleton Lab., UK; Neely, D., Rutherford Appleton Lab., UK; Taday, P. F., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 186; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

The development of Astra will provide the research community with one of the world's most powerful and versatile femtosecond laser facilities. The project, which is set f . or completion by January 2000, brings together expertise which exists within the Central Laser Facility (CLF) in High Power Lasers (HPL) and within the Lasers for Science Facility (LSF) to develop a laser system which is capable of producing Ultra high intensities (approx. 10(exp19) W/sq cm at the repetition rate of 10 Hz. The multi-output laser will provide a range of energies and wavelengths into two experiment areas simultaneously. This will support all the CLF's new and existing femtosecond users within one facility, offering both an economy of scale by multi-user access and encouraging cross-fertilization between different research programmes. The combination of very high intensities, ultrashort pulse duration (less than 50 fs) and high repetition rate opens up new and important opportunities. For example, the generation of X-ray pulses of femtosecond duration will enable time-resolved studies with temporal resolutions of less than 100 fs of molecular and solid-state structures to be undertaken. The ability to study a broad range of chemical and biological processes on such short time-scales is of wide applicability and should significantly increase the number and range of users of the facility.

Derived from text

Research Facilities; X Rays; High Power Lasers; Construction

20000033544 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK

An F1 On-Axis Parabola Producing Focal Spots of Less than 10 Microns on Vulcan

Danson, C. N., Rutherford Appleton Lab., UK; Allott, R. M., Rutherford Appleton Lab., UK; Collier, J., Rutherford Appleton Lab., UK; Edwards, C. B., Rutherford Appleton Lab., UK; Neely, D., Rutherford Appleton Lab., UK; Norreys, P. A., Rutherford Appleton Lab., UK; Winstone, T. B., Rutherford Appleton Lab., UK; Child, N. S., Optical Surfaces Ltd., UK; Harris, W. P., Optical Surfaces Ltd., UK; Mathers, J. H., Optical Surfaces Ltd., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 183; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

The technique of Chirped Pulse Amplification (CPA) is now in common use on many laser systems and has resulted in massive increases in intensities delivered to target. A fundamental aspect of generating these intensities is the ability to focus the beam. It has been demonstrated that with the standard beam configuration Vulcan operates with approximately three times diffraction limited performance and with the commissioning of an in-house developed static corrector this performance can be improved to 1.5 times diffraction limited. With such a beam it is necessary to use the highest possible quality optic and shortest focal length to generate the smallest focal spot size and hence the highest possible irradiance on target.

Derived from text

Procedures; Technology Assessment; Amplification; Parabolas; Focusing; Beam Splitters

20000033545 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK

Astra Development Phase 1: A Femtosecond Terawatt Laser

Langley, A. J., Rutherford Appleton Lab., UK; Girard, N., Rutherford Appleton Lab., UK; Mohammed, I., Rutherford Appleton Lab., UK; Ross, I. N., Rutherford Appleton Lab., UK; Taday, P. F., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 187-189; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

During the 18 month period of the EPSRC funded development programme we have upgraded the intensity of the femtosecond laser facility at RAL by a factor of 500 to provide a laser capable of delivering a focused intensity of 10(exp 18)W/sq cm. The development took place over a period of 18 months between April 1997 and September 1998. During stage 1 of the development, a sub-terawatt single-amplifier system was built delivering 1 mJ, 50 fs pulses to user experiments. This system was used to carry out 22 weeks of user experiments between October 1997 and August 1998. Stage 2 of the project to upgrade to terawatt performance was carried out in two separate periods in March, June and July 1998. During October 1998 the TW laser was relocated in a new laboratory at RAL and, following the announcement of the grant it became part of the EPSRC funded programme to develop a multi-terawatt laser facility to be known as ASTRA. Terawatt experiment operations began on 16 November 1998.

Author

Research Facilities; Construction; Lasers

20000033546 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK

Astra Development Phase 2: Design Considerations for a Multi-Terawatt Amplifier

Hooker, C. J., Rutherford Appleton Lab., UK; Marshall, D., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 190-191; In English; See also 20000033474; Copyright; Avail: Issuing Activity

In order to achieve the 1-Joule pulse energies required for multi-terawatt operation, a third amplifier was needed at the end of the Astra laser chain. Preliminary Calculations based on the expected intensity showed that the length of the stretched Pulse would have to be increased, otherwise nonlinear effects would prevent effective recompression of the amplified Pulses. A new stretcher was designed to produce pulses of 600 ps, which was both the shortest acceptable duration and the longest achievable with readily available gratings. The design of this stretcher is not described in this article, which deals with the development of a Simulator for the laser chain and the analysis of parasitic modes in the crystal and methods of overcoming them.

Author

Lasers; Simulators; Pulse Radar; Nonlinearity; Fabrication

20000033549 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK

Production of Nickel Targets for X-Ray Laser Experiments

Prior, N. M., Rutherford Appleton Lab., UK; Stubbs, M. A., Rutherford Appleton Lab., UK; Stinson, T., Rutherford Appleton Lab., UK; Shepherd, D., Rutherford Appleton Lab., UK; Neely, D., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 196; In English; See also 20000033474; Copyright; Avail: Issuing Activity

The target preparation laboratory within the Central Laser Facility is responsible for the production of interaction targets used during Vulcan experiments. In recent years the efficiency of X-ray lasers has improved significantly and the wavelength range has been increased by using a broader range of different atomic number targets from titanium (Z=22) to tantalum (Z=73). The targets used in these experiments consist of a single stripe 100 pm wide, normal]), required to be around 0.6 microns thick with a top-hat profile, coated onto a flat glass substrate by thermal deposition. In this process, material is loaded into a tungsten filament, which is heated by a low voltage current source causing evaporation. The evaporated material travels in straight lines from the source and coats all exposed surfaces of the substrate. A mask made of two razor blades separated by the stripe width is placed over the substrate to produce a clean edged stripe. Razor blades have been found to be ideal for producing straight edges of the stripe to within 5- 10 microns. The thermal evaporation method is not appropriate for high boiling point materials such as nickel, as there is a physical limit to the current that can be passed through the tungsten filament An alternative method of coating such materials is the use of the magnetron sputtering plant. The sputter plant uses a potential

voltage applied across an argon plasma to dislocate ions of coating material and to transfer them to the substrate. Due to the presence of the argon buffer gas, the material can often ”seep” forming diffuse edges. The aim of this experiment was to investigate and compare way-, of optimizing the coating of nickel stripes using the sputtering technique to obtain top-hat coating profiles.
Author
X Ray Lasers; Tungsten; Titanium; Nickel; Experimentation; Wavelengths; Laser Outputs; Laser Targets; Coating

20000033552 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK
An Experimental Investigation of OPCPA on the Vulcan Laser
Ross, I. N., Rutherford Appleton Lab., UK; Collier, J. L., Rutherford Appleton Lab., UK; Matousek, P., Rutherford Appleton Lab., UK; Danson, C. N., Rutherford Appleton Lab., UK; Neely, D., Rutherford Appleton Lab., UK; Allott, R. M., Rutherford Appleton Lab., UK; Pepler, D. A., Rutherford Appleton Lab., UK; Hernandez–Gomez, C., Rutherford Appleton Lab., UK; Osvay, K., Attila Jozsef Univ., Hungary; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 201-203; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

Following new ideas by the authors, which showed that a combination of the two techniques of optical parametric amplification and chirped pulse amplification offers exciting prospects for a major enhancement to laser facilities, a programme was set up to develop this technique (called optical parametric chirped pulse amplification or OPCPA) and apply it to the CLF’s lasers. This report describes the second phase of this programme following earlier experiments at low power using millijoule lasers which verified the basic properties and performance of the scheme. The rationale for the experiment was to investigate a scheme as close as possible to a full design for the Vulcan laser without incurring large equipment costs. The resulting scheme was a two stage OPCPA, scaled to operate at the joule level. This enabled a study of the ability of the OPA amplifiers to give very high gain, efficiency and beam quality for chirped pulses, and to give pulses free of phase and spectral errors which might affect the ability to recompress them with good fidelity.
Author
Experimentation; Data Acquisition; Technology Assessment; Amplification; Light Amplifiers; Procedures

20000033556 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK
Upgrade of Vulcan to 1 Petawatt
Edwards, C. B., Rutherford Appleton Lab., UK; Hutchinson, M. H. R., Rutherford Appleton Lab., UK; Danson, C. N., Rutherford Appleton Lab., UK; Neely, D., Rutherford Appleton Lab., UK; Wyborn, B. E., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 175; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

The Central Laser Facility (CLF) has been awarded a grant to upgrade the Vulcan high power neodymium glass laser facility. Over the course of the 3 year project, the output of Vulcan’s ultrashort pulse beam will be increased to 500 J in a pulse of 500 fs duration giving a power on target of 1 Petawatt (10(exp 15 Watts). With the use of adaptive optics to correct wavefront errors, the Vulcan beam will be focussed to a near diffraction limited focal spot, producing irradiance on target of 10(exp 21) W/sq cm. This level of performance will open up new regimes of plasma physics to the UK scientific user community and their international collaborators including photon induced nuclear reactions, studies of relativistic effects in ultra high fields and new schemes for the acceleration of charged particles. In addition to funding from EPSRC, the upgrade is benefiting from components which have been made available by the U.S. Department of Energy following the closure of the NOVA laser at Lawrence Livermore National Laboratory in May ’99. This includes 20 cm disc amplifiers, large aperture beam delivery optics and a number of high energy density capacitors. In return, scientists from Livermore will receive access to beam time, either as sole investigators or in collaboration with the UK user community. The most visible sign of the upgrade will be the construction of a new target area on the east side of R1 adjoining TA East as shown below. This new building will be approximately equal in size to target areas East and West combined, slightly higher and equipped with a 5 ton crane to enable the major pieces of equipment to be moved quickly and safely. The size of the building is set by the length of the vacuum spatial filter beam expander and relay, and the size of the pulse compression system. The latter comprised a pair of diffraction gratings 92 cm in diameter with a separation fo 13 m and house in an ultra-clean vacuum chamber. At the time of writing of this report, planning permission has been obtained and it is hoped that building work will begin at the end of 1999.
Derived from text
Research Facilities; Vacuum Chambers; High Power Lasers; Construction; Charged Particles; Adaptive Optics

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.

20000032358 Florida Agricultural and Mechanical Univ., Lab. for Modern Fluid Physics, Tallahassee, FL USA
Turbulence Distortion of Combustion Energy Transfer Rates
Camulaire, Frantz, Florida Agricultural and Mechanical Univ., USA; DeSilva, U. P., Florida Agricultural and Mechanical Univ., USA; Mochena, T., Florida Agricultural and Mechanical Univ., USA; Johnson, J. A., III, Florida Agricultural and Mechanical Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 440-444; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Selective turbulence distortion allows an independent manipulation of emissions and efficiency in the internal combustion engine using additives. The main objective of this paper will be to determine the circumstance under which the selective distortion might be implemented. This paper presents Hot Wire Anemometry (HWA) measurements made in a motored IC engine sampled at 100KHz sampling rate. Several computational tools have been utilized to analyze the statistical characteristics of the evolution of turbulence. The power spectrum is used to display the frequency composition of the time variation of the dynamical variables and to derive the power law behavior whereby the spectral indices can be calculated based on the different slope values. Following Hinze (1975), the expected spectral power distribution of the in-cylinder flow field should exist in two characteristic regions. The first one, in which the flow exhibits large eddies, will exist mainly at low frequency (100 to 1,000 Hz). For the second one, in which the flow exhibits small eddies, the power spectral distribution will exist mainly in the region of high frequency (1,000 to 100,000 Hz).

Derived from text

Turbulence; Distortion; Combustion; Energy Transfer; Internal Combustion Engines

20000032610 Saitama Inst. of Tech., Saitama, Japan
Drilling in GFRP Using a Heated Drill
Kumagai, Shinji, Saitama Inst. of Tech., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 10-14; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In a machining process such as drilling holes in a composite material, softening of matrix due to cutting heat generally adds to the machining difficulty. However, trial made here was a reversed utilization of this matrix softening effect to improve machinability. In this report, holes were drilled in GFRP by softening matrix utilizing heat transferred from the heated drill which was heated by an external source of heated energy. Heating temperature of drill, surface roughness of drilled holes, resistance to cutting, and drilling efficiency were carefully investigated, and it was found that the machinability was im- proved when the drill was heated to the matrix deforming temperature. Also included is a description of the experimentally manufactured heating device.

Author

Glass Fiber Reinforced Plastics; Drilling; Machining; Softening; Heating; Drills

20000032743 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-36 : Turbo Pump Deinstalled and Being Inspected
Feb. 07, 1990; In English; Videotape: 2 min. 42 sec. playing time, in color, no sound except background noise
Report No.(s): NONP-NASA-VT-2000043338; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

STS-36 was the sixth shuttle mission dedicated to the Department of Defense. The mission was launched onboard the shuttle Atlantis, on Feb 28, 1990. This videotape opens with shots of the shuttle on the launch pad and shows the removal of a turbo pump, and visual and internal inspection of the pump.

CASI

Inspection; Turbine Pumps; Space Shuttle Orbiters

20000032791 Department of the Navy, Washington, DC USA
Tapered Resilient Sleeve Bearing Assembly
Plangetis, Gus F., Inventor; Sep. 14, 1999; 6p; In English
Patent Info.: Filed 3 Apr. 98,; US-Patent-Appl-SN-09,054,390; US-Patent-5,951,170

Report No.(s): AD-D019608; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A least two rigid segments of a tapered bearing sleeve are interconnected by deformable elastomeric sections for rotational support of a shaft or pin about a fixed axis established within a housing into which the bearing sleeve is inserted and held therein by an adjustment closure ring under axial pressure of a spring through which radial clearance between the sleeve segments and the shaft varied during transient loading of the shaft, is minimized to reduce vibrational noise and wear.

DTIC

Noise Reduction; Shafts (Machine Elements); Sleeves; Wear; Journal Bearings

20000032962 GenCorp Aerojet, Azusa, CA USA

Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Performance Verification Report, Antenna Drive Subsystem, METSAT AMSU-A2 (PN: 1331200-2, SN:109)

Haapala, C., GenCorp Aerojet, USA; Jul. 22, 1999; 82p; In English

Contract(s)/Grant(s): NAS5-32314

Report No.(s): AEROJET-11528; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This is the Performance Verification Report, Antenna Drive Subassembly, METSAT AMSU-A2 (P/N 1331200-2, S/N 109), for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).

Author

Advanced Microwave Sounding Unit; Earth Observing System (EOS); Remote Sensors; Satellite Sounding

20000032984 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Study on Variable Structure Control of Engine Air-Fuel Ratio

Handa, Yasuhiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 237-238; In Japanese; Copyright; Avail: Issuing Activity

In order to realize emission standards to be intensified in 2000, a highly accurate fuel injection control has been demanded for reducing exhaust emissions and improving fuel consumption rate in automobile engine. In this paper, we construct physical models of air-fuel ratio control systems which include manifold air dynamics, fuel puddle dynamics, stroke delay, transport delay and sensor dynamics. Then we design a fuel-injection controller which includes air mass estimation system, and present a tuning method of the controller parameters which can cope with changes of both the throttle angle and the engine speed.

Author

Fuel Injection; Fuel-Air Ratio; Control Systems Design; Controllers

20000033059 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on the Continuously Variable Transmission Based on Feedback Linearization

Hock, Yeoh Kian, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 241-242; In Japanese; Copyright; Avail: Issuing Activity

Reduction of the fuel-consumption of automobiles can be achieved by using the continuously variable transmissions(CVT). The classical way to control a CVT-based car is to use PID-type controllers which based on the first order linear approximation model. This paper introduces an exact linearization approach, that is feedback linearization to linearize a CVT-based drive-train. A known controller design method can be used to control this linearized model. Sliding mode controller is used in this paper.

Author

Controllers; Feedback; Linearization; Transmissions (Machine Elements); Mathematical Models

20000033148 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne Australia

Investigation of Asymmetrical Vibration Isolators for Maritime Machinery Applications

Dickens, John D.; Nov. 1999; 54p; In English

Report No.(s): AD-A373906; DSTO-RR-0168; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The development of a novel vibration isolator test facility is described. It is used to measure the dynamic properties of vibration isolators commonly used in maritime and industrial machinery applications. The vibration isolator test facility is capable of measuring the four pole parameters over the frequency range from 5 Hz to 2 kHz, static load range from 1 to 30 kN, and temperature range from 6 to 60 C. In order to demonstrate the usefulness of the facility, experimental data for three commercial asymmetrical vibration isolators used for maritime applications are presented. Their four pole parameters and effectiveness are compared.

DTIC

Vibration Isolators; Test Facilities

20000033269 NASA Marshall Space Flight Center, Huntsville, AL USA

Fretting Stresses in Single Crystal Superalloy Turbine Blade Attachments

Arakere, Nagaraj K., Florida Univ., USA; Swanson, Gregory, NASA Marshall Space Flight Center, USA; [2000]; 36p; In English; Joint Tribology Conference, 1-4 Oct. 2000, Seattle, WA, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): RTOP 260-40-03
Report No.(s): ASME-Trib-61; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Single crystal nickel base superalloy turbine blades are being utilized in rocket engine turbopumps and turbine engines because of their superior creep, stress rupture, melt resistance and thermomechanical fatigue capabilities over polycrystalline alloys. Currently the most widely used single crystal nickel base turbine blade superalloys are PWA 1480/1493 and PWA 1484. These alloys play an important role in commercial, military and space propulsion systems. High Cycle Fatigue (HCF) induced failures in aircraft gas turbine and rocket engine turbopump blades is a pervasive problem. Blade attachment regions are prone to fretting fatigue failures. Single crystal nickel base superalloy turbine blades are especially prone to fretting damage because the subsurface shear stresses induced by fretting action at the attachment regions can result in crystallographic initiation and crack growth along octahedral planes. Furthermore, crystallographic crack growth on octahedral planes under fretting induced mixed mode loading can be an order of magnitude faster than under pure mode I loading. This paper presents contact stress evaluation in the attachment region for single crystal turbine blades used in the NASA alternate Advanced High Pressure Fuel Turbo Pump (HPFTP/AT) for the Space Shuttle Main Engine (SSME). Single crystal materials have highly orthotropic properties making the position of the crystal lattice relative to the part geometry a significant factor in the overall analysis. Blades and the attachment region are modeled using a large-scale 3D finite element (FE) model capable of accounting for contact friction, material orthotrophy, and variation in primary and secondary crystal orientation. Contact stress analysis in the blade attachment regions is presented as a function of coefficient of friction and primary and secondary crystal orientation, Stress results are used to discuss fretting fatigue failure analysis of SSME blades. Attachment stresses are seen to reach peak values at locations where fretting cracks have been observed. Fretting stresses at the attachment region are seen to vary significantly as a function of crystal orientation. Attempts to adapt techniques used for estimating fatigue life in the airfoil region, for life calculations in the attachment region, are presented. An effective model for predicting crystallographic crack initiation under mixed mode loading is required for life prediction under fretting action.
Author

Fretting; Single Crystals; Stress Analysis; Turbine Blades; Mathematical Models; Turbine Engines; Heat Resistant Alloys

20000033617 NASA Marshall Space Flight Center, Huntsville, AL USA

The Plastic Flow Field in the Vicinity of the Pin-Tool During Friction Stir Welding

Bernstein, E. L., Alabama A & M Univ., USA; Nunes, A. C., Jr., NASA Marshall Space Flight Center, USA; [2000]; 18p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The plastic flow field in the vicinity of the pin-tool during Friction Stir Welding (FSW) needs to be understood if a theoretical understanding of the process is to be attained. The structure of welds does not exhibit the flow field itself, but consists in a residue of displacements left by the plastic flow field. The residue requires analysis to extract from it the instantaneous flow field around the pin-tool. A simplified merry-go-round model makes sense of some tracer experiments reported in the literature. A quantitative comparison is made of the displacements of copper wire markers with displacements computed from a hypothetical plastic flow field. The hypothetical plastic flow field consists in a circular rotation field about a translating pin tool with angular velocity varying with radius from the pin centerline. A sharply localized rotational field comprising slip on a surface around the tool agreed better with observations than a distributed slip field occupying a substantial volume around the tool. Both the tracer and the wire displacements support the ”rotating plug” model, originally invoked or thermal reasons, of the FSW process.
Author

Plastic Flow; Flow Distribution; Friction Welding

20000033679 NASA Lewis Research Center, Cleveland, OH USA

Effects of Planetary Speed-Reduction Ratio on Mean Service Life

Savage, M., Akron Univ., USA; Rubadeux, K. L., Hendrickson Co., USA; Coe, H. H., NASA Lewis Research Center, USA; Journal of Mechanical Design; Mar. 1998; Volume 120, pp. 113-118; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Planetary-gear transmissions are compact speed reductions which use parallel-load paths to transmit high power. The range of possible reduction ratios is bounded from below and above by limits on the relative size of the planet gears. For a single-plane planetary transmission, the speed-reduction ratio must be greater than two for planet gears to exist. As the ratio increases, so does the size of the planets relative to the sizes of the sun and ring. Which ratio is best for a planetary reduction can be resolved by

studying a series of optimal designs. In this series, each design is obtained by maximizing the service life for a spur-gear planetary with a fixed size, speed-reduction ratio, input speed, power and materials. The planetary-gear reduction service life is modeled as a function of the two-parameter Weibull distributed service lives of the ball bearings and spur gears in the reduction. Planet-bearing life strongly influences the optimal reduction lives which point to an optimal planetary reduction ratio in the neighborhood of four to five.
Author
Gears; Service Life; Speed Regulators; Transmissions (Machine Elements)

38
QUALITY ASSURANCE AND RELIABILITY

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

20000032573 National Inst. of Standards and Technology, Materials Reliability Div., Gaithersburg, MD USA
Materials Science and Engineering Laboratory Materials Reliability: 1999 Programs and Accomplishments
Fickett, F. R.; Siewert, T. A.; Jan. 2000; 108p; In English
Report No.(s): PB2000-101945; NISTIR-6434; No Copyright; Avail: National Technical Information Service (NTIS)
The Materials Reliability Division develops measurement technologies that enable the producers and users of materials to improve the quality and reliability of their products. Measurement technologies, and the associated materials science base, are developed for materials evaluation to assure reliable performance, for nondestructive evaluation to assure quality of finished materials and products, and for process control to improve the quality and consistency of materials. Within these broad areas of measurement technology, the division focused its resources in FY 1999 on the following three research themes: Microscale Measurements; Microstructure Sensing; and Process Sensing and Modeling.
NTIS
Materials Science; Reliability Analysis; Reliability Engineering

20000032634 Marley Organization, Inc., Ridgefield, CT USA
Directory of Professional/Trade Organization Laboratory Accreditation/Designation Programs
Hyer, C. W.; Dec. 1999; 142p; In English
Report No.(s): PB2000-100398; No Copyright; Avail: National Technical Information Service (NTIS)
This directory is a guide to laboratory accrediation and similar types of programs conducted by professional and trade organizations. These programs accredit or designate laboratories or other entities to assist private sector professional societies, trade associations, related certification bodies, their membership, as well as government agencies in carrying out their responsibilities. This accrediation or designation is based on a assessment of the capability of the laboratory to conduct the testing. However, the nature of the assessment varies considerably by organization and program. Entries in this directory are based on information provided by each organization and reflect the organization's view of its activities. Parties interested in laboratory accreditation are referred to NIST SP 808, Directory of Federal Government Laboratory Accreditation/Designation Programs, and NIST SP 815, Directory of State and Local Government Laboratory Accreditation/Designation Programs, which contain information on similar programs conducted at the federal, state, and local government levels.
NTIS
Certification; Qualifications; Laboratories

20000032870 Sikorsky Aircraft, Stratford, CT USA
Flaw Tolerant Safe-Life Methodology
Adams, D. O., Sikorsky Aircraft, USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 14 - 1 - 14 - 8; In English; See also 20000032859; Copyright Waived; Avail: CASI; A02, Hardcopy
Conventional safe-life methodology has been in general use in the helicopter industry for more than 40 years to substantiate fatigue-loaded dynamic components. However, it is seen to need improvement. One improvement is to reduce its sensitivity to the strength-reducing effects of flaws and defects that may occur in manufacturing and service use. Damage Tolerance methodology provides a means to accomplish this improvement but it is currently difficult to economically apply it to every fatigue mode on every component. Flaw Tolerant methodology is an available equal-choice option to Damage Tolerance for Transport Category civil rotorcraft, and it is offered here as a practical improvement to conventional safe life for military applications as

well. Flaw Tolerance, which is based on the characteristics of initiation of cracks from flaws, is described and illustrated by means of examples of successful applications to helicopter components.
Author
Damage; Helicopters; Rotary Wing Aircraft; Tolerances (Mechanics); Helicopter Design; Aircraft Reliability; Aircraft Structures; Design Analysis; Cracks

20000032871 Eurocopter France, Etablissement de Marignane, Marignane, France
Damage Tolerance Applied on Metallic Components
Marquet, Thierry, Eurocopter France, France; Struzik, Alain, Eurocopter France, France; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 15 - 1 - 15 - 14; In English; See also 20000032859; Copyright Waived; Avail: CASI; A03, Hardcopy

New requirements including damage tolerance were inserted in FAR 29.571, amendment 28 in 1989 to increase the safety level of helicopters. (" Flaw tolerance safe life" and "fail safe" - or a combination thereof, were proposed to fulfill the damage tolerance requirements. If unpractical, " safe life " evaluation was acceptable.) A working group called TOGAA was mandated by the US Senate to propose modifications to the FAA rules. Harmonised recommendations from rotorcraft manufacturers (RCWG) had been gathered in a "White Paper". The TOGAA commented this methodology and concluded in mid 1998, that the "flaw tolerant safe life" concept should be purged in FAR 29, and advocated the exclusive use of crack propagation for single and multiple load paths. This paper presents EUROCOPTER's statistical analyses of the root causes of accident in flight. EUROCOPTER's philosophy in reply to FAR & JAR 29-571 is detailed, showing a significant and measurable improvement over conventional "safe-life" methodology. This philosophy has already been applied to several current projects (EC 155, NH 90), and the RCWG simply wanted it to be left in the current rules.
Author
Damage; Tolerances (Mechanics); Statistical Analysis; Rotary Wing Aircraft; Helicopters; Crack Propagation; Metals; Aircraft Reliability; Helicopter Design; Design Analysis

20000033627 NASA Goddard Space Flight Center, Greenbelt, MD USA
Logic Design Pathology and Space Flight Electronics
Katz, Richard, NASA Goddard Space Flight Center, USA; Barto, Rod L., Spacecraft Digital Electronics, USA; Erickson, K., Jet Propulsion Lab., California Inst. of Tech., USA; [1997]; 27p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Logic design errors have been observed in space flight missions and the final stages of ground test. The technologies used by designers and their design/analysis methodologies will be analyzed. This will give insight to the root causes of the failures. These technologies include discrete integrated circuit based systems, systems based on field and mask programmable logic, and the use computer aided engineering (CAE) systems. State-of-the-art (SOTA) design tools and methodologies will be analyzed with respect to high-reliability spacecraft design and potential pitfalls are discussed. Case studies of faults from large expensive programs to "smaller, faster, cheaper" missions will be used to explore the fundamental reasons for logic design problems.
Author
Logic Design; Logic Programming; Computer Aided Design; Design Analysis; Spacecraft Design; Electronic Equipment

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.

20000032101 Old Dominion Univ., Dept. of Aerospace Engineering, Norfolk, VA USA
Structure Damage Simulations Accounting for Inertial Effects and Impact and Optimization of Grid-Stiffened Non-Circular Shells ***Final Report, 1 Jan. 1994 - 31 Oct. 1999***
Mei, Chuh, Old Dominion Univ., USA; Jaunky, Navin, Old Dominion Univ., USA; Nov. 08, 1999; 40p; In English
Contract(s)/Grant(s): NCC1-284; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this research project is to develop modelling and analysis strategy for the penetration of aluminium plates impacted by titanium impactors. Finite element analysis is used to study the penetration of aluminium plates impacted by titanium impactors in order to study the effect of such uncontained engine debris impacts on aircraft-like skin panels. LS-DYNA3D) is

used in the simulations to model the impactor, test fixture frame and target barrier plate. The effects of mesh refinement, contact modeling, and impactor initial velocity and orientation were studied. The research project also includes development of a design tool for optimum design of grid-stiffened non-circular shells or panels subjected to buckling.
Author
Aircraft Structures; Finite Element Method; Grid Generation (Mathematics); Impactors; Titanium; Impact Damage; Buckling; Models

20000032268 New Mexico Univ., Dept. of Civil Engineering, Albuquerque, NM USA
Finite Element Modeling of Crack Propagation-A Practical View
Valerio, Robert, New Mexico Univ., USA; Gerstle, Walter, New Mexico Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 165-170; In English; See also 20000032189
Report No.(s): 98URC031; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The finite element method (FEM) modeling of discrete crack propagation is an important unsolved problem in the practical analysis of mechanical and structural systems. Although academic software has been developed over the past twenty years for the purpose of FEM modeling of crack propagation, the software has been extremely limited in its capability. Essentially, only two-dimensional elasto-static crack propagation is currently possible. The first elasto-static three-dimensional crack propagation modeling software is just now becoming available. Commercial-grade software for this type of analysis is not readily available and is very expensive to maintain and operate. to perform practical linear elastic FEM analysis, three fundamental capabilities are required. The first capability is to represent a crack in a 2D or 3D body. The second capability is to automatically mesh the cracked geometry. The third capability is to compute stress-intensity factors along the crack front, and from these to predict a new geometry with a propagated crack (i.e. determine the direction and length of crack propagation). With these three capabilities in place, it should be possible to model crack propagation as a sequence of repeated steps. Some commercial software is now available with sophisticated attributes such as fully automatic meshing and command languages that allow the analyst to write scripts with sophisticated FEM analysis ”recipes”. The two primary goals of this paper are (1) to identify whether it is currently practical to use a commercial FEM code to perform crack propagation analysis; and (2) to identify the necessary attributes a FEM code must have to accomplish crack propagation analysis.
Author
Crack Propagation; Finite Element Method; Mathematical Models; Applications Programs (Computers); Elastostatics

20000032270 Clark-Atlanta Univ., Dept. of Engineering, GA USA
Influence of Material Distribution on Impact Resistance of Hybrid Composites
Abatan, Ayu, Clark-Atlanta Univ., USA; Hu, Hurang, Clark-Atlanta Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 171-176; In English; See also 20000032189
Contract(s)/Grant(s): NAS3-27785; NCC3-552
Report No.(s): 98URC032; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Impact events occur in a wide variety of circumstances. A typical example is a bullet impacting a target made of composite material. These impact events produce time-varying loads on a structure that can result in damage. As a first step to understanding the damage resistance issue in composite laminates, an accurate prediction of the transient response during an impact event is necessary. The analysis of dynamic loadings on laminated composite plates has undergone considerable development recently. Rayleigh-Ritz energy method was used to determine the impact response of laminated plates. The impact response of composite plates using shear deformation plate theory was analyzed. In recent work a closed-form solution was obtained for a rectangular plate with four edges simply supported subjected to a center impact load using classical plate theory. The problem was further investigated and the analysis results compared of both classical plate theory and shear deformation theory, and found that classical plate theory predicts very accurate results for the range of small deformations considered. In this study, the influence of cross sectional material distribution on the comparative impact responses of hybrid metal laminates subjected to low and medium velocity impacts is investigated. A simple linear model to evaluate the magnitude of the impact load is proposed first, and it establishes a relation between the impact velocity and the impact force. Then a closed-form solution for impact problem is presented. The results were compared with the finite element analysis results. For an 11 layer-hybrid laminate, the impact response

as a function of material distribution in cross-section is presented. With equal areal weight, the effect of the number of laminate layers on the impact resistance is also investigated. Finally, the significance of the presented results is discussed.
Derived from text
Impact Resistance; Hybrid Composites; Mathematical Models; Mechanical Properties; Elastic Deformation; Plates (Structural Members)

20000032293 Tennessee State Univ., NASA Center for Automated Space Science, Nashville,TN USA
Effect of Uncertainty of Identified Parameters on Structural Damage Detection
Davidson, Mario, Tennessee State Univ., USA; Lew, Jiann–Shiun, Tennessee State Univ., USA; Sathanthan, S., Tennessee State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 795-800; In English; See also 20000032189
Contract(s)/Grant(s): NCC5-228
Report No.(s): 98URC142; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
This paper presents a study of the effect of the uncertainty of identified parameters on the damage detection of structure. The identified parameters, which are obtained by applying system identification algorithms to analyze the time-domain response data, have uncertainty due to noise, environmental change, etc. The damage of some structural elements may have less effect on the identified parameters than noise or environmental change, so some damage situations cannot be distinguished under these circumstances. An algorithm is presented to determine whether the considered damage can be distinguished. A twenty-bay truss structure is used to demonstrate and verify the study.
Author
System Identification; Algorithms; Structural Analysis; Damage Assessment; Mathematical Models; Finite Element Method

20000032339 North Carolina Agricultural and Technical State Univ., Dept. of Electrical Engineering, Greensboro, NC USA
Real-Time Active Vibration Control Using Piezoelectric Actuators In Plate Structures
Shen, Yaxi, North Carolina Agricultural and Technical State Univ., USA; Homaifar, Abdollah, North Carolina Agricultural and Technical State Univ., USA; Bikdash, Marwan, North Carolina Agricultural and Technical State Univ., USA; Naser, Ahmed A., North Carolina Agricultural and Technical State Univ., USA; Feb. 22, 1998; 6p; In English; See also 20000032189
Contract(s)/Grant(s): NAGw-2924
Report No.(s): Rept-98-URC064; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
This work presents a control system testbed which is used for active vibration control. Software simulation and real-time experiment are realized at the same time using different control methodologies through dSPACE environment. Localized control with hybrid-fuzzy PD controller and rate-feedback controller are shown to attenuate vibration at resonance frequencies. The result confirmed that these two kinds of control methods are reliable in active damping of the vibration.
Author
Active Control; Vibration Damping; Real Time Operation; Test Stands; Control Systems Design; Feedback Control; Piezoelectricity; Actuators; Mathematical Models

20000032469 NASA Marshall Space Flight Center, Huntsville, AL USA
Double-Plate Penetration Equations
Hayashida, K. B., NASA Marshall Space Flight Center, USA; Robinson, J. H., NASA Marshall Space Flight Center, USA; February 2000; 40p; In English
Report No.(s): NASA/TM-2000-209907; NAS 1.15:209907; M-962; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report compares seven double-plate penetration predictor equations for accuracy and effectiveness of a shield design. Three of the seven are the Johnson Space Center original, modified, and new Cour-Palais equations. The other four are the Nysmith, Lundeberg-Stern-Bristow, Burch, and Wilkinson equations. These equations, except the Wilkinson equation, were derived from test results, with the velocities ranging up to 8 km/sec. Spreadsheet software calculated the projectile diameters for various velocities for the different equations. The results were plotted on projectile diameter versus velocity graphs for the expected orbital debris impact velocities ranging from 2 to 15 km/sec. The new Cour-Palais double-plate penetration equation was compared to the modified Cour-Palais single-plate penetration equation. Then the predictions from each of the seven double-plate penetration equations were compared to each other for a chosen shield design. Finally, these results from the equations were compared with test results performed at the NASA Marshall Space Flight Center. Because the different equations predict a wide range of projectile diameters at any given velocity, it is very difficult to choose the ”right” prediction equation for

shield configurations other than those exactly used in the equations' development. Although developed for various materials, the penetration equations alone cannot be relied upon to accurately predict the effectiveness of a shield without using hypervelocity impact tests to verify the design.
Author
Penetration; Meteoroids; Space Debris

20000032631 National Defence Research Establishment, Avd. foer Vapen och Skydd., Tumba, Sweden
Blunt-Nosed Projectile Perforation of Target Plates ***Topical Report***
Wijk, G.; Jun. 1999; 24p; In English
Report No.(s): PB2000-103071; FOA-R-99-01181-310-SE; No Copyright; Avail: National Technical Information Service (NTIS)

A new model is proposed to predict rigid, blunt-nosed projectile perforation of target plates for normal impact against the target surface. This is a logical extension of a recently suggested model for sharp-nosed projectiles. The main purpose is to use the model as a small but important part in large computer programs for assessment of effects and vulnerability of complex targets, for instance the program LIBRA. Such application requires a model that is analytic and simple. Another purpose is to obtain a way of determining the energy consumption when BAD (Behind Armour Debris) particles perforate witness plates or vulnerable (vital) components in complex targets. A few old experimental results which support the model are reported, but much more experimental work should follow.
NTIS
Computer Programs; Projectiles; Penetration; Models; Blunt Bodies; Targets

20000032861 Defence and Evaluation Research Agency, Farnborough, UK
The Development of a Robust Crack Growth Model for Rotorcraft Metallic Structures
Cook, R, Defence and Evaluation Research Agency, UK; Wood, P. C., Westland Helicopters Ltd., UK; Jenkins, S., Westland Helicopters Ltd., UK; Matthew, D., Westland Helicopters Ltd., UK; Irving, P., Cranfield Univ., UK; Austen, I., nCode International Ltd., UK; Buller, R., Westland Design Services Ltd., UK; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 3 - 1 - 3 - 11; In English; See also 20000032859; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

In the UK, helicopters have traditionally been designed using safe life principles. However, proposed changes to the airworthiness regulations require that, in the future, structures are qualified using flaw growth methods. Therefore, a robust crack growth model is required. A collaborative project has been undertaken by GKN Westland Helicopters, DERA, Cranfield University and nCode International to develop such a model and define the methodologies required for its implementation. The work was funded by the Department of Trade and Industry and the Ministry of Defence whose support is gratefully acknowledged. This report describes work carried out in the collaborative project and the recommendations formulated. The project consisted of six main areas of investigation namely the derivation of stress intensity factors, determination of typical flight load sequences, measurement of fracture mechanics material properties for use in models. measurement of crack growth data for model verification; evaluation and development of crack growth models, and definition of a helicopter damage tolerance methodology. The project considered two areas of helicopter design, these are: (1) a dynamic rotating component found in a rotorhead; and (2) a typical structural feature in the main load path lift frames. The two areas are fundamentally different and involve different materials and loading actions which may therefore, require different damage tolerance approaches. In this paper each of the six areas of investigation are described, with the main focus on the development and evaluation of crack growth models. The approach used for model development and evaluation was to increase gradually the complexity of the loaded structure. Initially simple compact tension coupons subjected to constant amplitude loading were studied and models were evaluated against test measurements. The complexity of the loading was increased to include discrete loading events, compressive loading events, and finally two representative flight load sequences, Asterix and Rotorix, which were developed during the project. The complexity of the components was also increased, to include part through thickness cracks and finally structural elements representative of features in a rotorhead mast and an area of a main lift frame. At each of these stages, the models were evaluated against experimental measurements. From the results of the investigation, an overall methodology was developed for damage tolerance assessments, although a number of areas require further investigation. The applications and limitations of the approach are presented and recommendations for further work made.
Derived from text
Crack Propagation; Mathematical Models; Metals; Rotary Wing Aircraft; Tolerances (Mechanics); Helicopter Design; Fracture Mechanics; Cracks; Aircraft Structures

20000032873 Department of the Air Force, Engineering Directorate, Wright-Patterson AFB, OH USA

Treatment of High-Cycle Vibratory Stress in Rotorcraft Damage Tolerance Design

Lincoln, John W., Department of the Air Force, USA; Yeh, Hsing C., Department of the Air Force, USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 18 - 1 - 18 - 10; In English; See also 20000032859; Copyright Waived; Avail: CASI; A02, Hardcopy

Fixed wing aircraft manufacturers have adopted the damage tolerance design philosophy with great success for both military and commercial aircraft. However, rotorcraft manufacturers currently still primarily use the classical safe life approach or a modification thereof. One reason for this is that, at this time, no clearly defined damage tolerance design criteria exist for rotorcraft structures because of the analysis and test problems associated with the high cycle loading environment. This paper describes a study performed by the USA Air Force (USAF) to assess the impact of the damage tolerance approach on the design of a rotorcraft component affected by high-cycle vibratory stresses. The assessment consisted of developing the stress spectrum for a critical rotor system location and performing fracture analyses to determine the potential for establishing inspection intervals based on the damage tolerance approach. They performed sensitivity studies to determine the maximum range truncation that would yield results with acceptable accuracy. They considered the influence of the small-crack effect in all fracture mechanics calculations. The resulting crack growth functions provided the basis for establishing whether an inspection program was viable for the component. They examined the effect of stress reduction measures such as shot peening to enhance the damage tolerance capability of highly stressed components. Therefore, the paper identifies the main issues related to the use of damage tolerance for rotorcraft, and additionally makes recommendations for rotorcraft design criteria.

Author

Helicopter Design; Design Analysis; Cracks; Rotary Wing Aircraft; Fracture Mechanics; Fracturing; Tolerances (Mechanics); Damage; Stress Cycles

20000033135 NASA Ames Research Center, Moffett Field, CA USA

MSC/NASTRAN Stress Analysis of Complete Models Subjected to Random and Quasi-Static Loads

Hampton, Roy W., NASA Ames Research Center, USA; January 2000; 36p; In English

Contract(s)/Grant(s): RTOP 297-10-02

Report No.(s): NASA/TM-2000-209585; NAS 1.15:209585; A-00V0007; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Space payloads, such as those which fly on the Space Shuttle in Spacelab, are designed to withstand dynamic loads which consist of combined acoustic random loads and quasi-static acceleration loads. Methods for computing the payload stresses due to these loads are well known and appear in texts and NASA documents, but typically involve approximations such as the Miles' equation, as well as possible adjustments based on "modal participation factors." Alternatively, an existing capability in MSC/NASTRAN may be used to output exact root mean square [rms] stresses due to the random loads for any specified elements in the Finite Element Model. However, it is time consuming to use this methodology to obtain the rms stresses for the complete structural model and then combine them with the quasi-static loading induced stresses. Special processing was developed as described here to perform the stress analysis of all elements in the model using existing MSC/NASTRAN and MSC/PATRAN and UNIX utilities. Fail-safe and buckling analyses applications are also described.

Author

Nastran; Stress Analysis; Euler Buckling; Fail-Safe Systems; Finite Element Method; Mathematical Models

20000033223 Kyushu Univ., Graduate School of Engineering, Fukuoka, Japan

Some Effects of Housing Roof Shapes on the Wind Loads

Kumamaru, Mamiko; Tsuru, Norio; Maeda, Junji; Miyake, Akiharu; Technology Reports of Kyushu University; January 2000; ISSN 0023-2718; Volume 73, No. 1, pp. 63-70; In Japanese; Copyright; Avail: Issuing Activity

Many wind disaster reports have said that the percentage suffering of gable roof houses by strong winds was higher than that of hipped houses. In the paper it is discussed some effects of housing roof shapes on the wind loads in uniform, pulsating and turbulent flows using wind tunnel testing. Generally the wind load of gable roof shape housing is 20% bigger than that of a hipped roof housing. However the existence of ridge tiles reduces the difference. A moderate size of eaves does not influence the drag too much. The same characteristics are seen in pulsating and turbulent flows. The difference between the wind damage of hipped roof houses and gable houses can be explained by the above results from the standpoint of the wind loads.

Author

Wind Tunnel Tests; Wind Effects; Unsteady Flow; Roofs; Damage; Structural Design Criteria; Ground Wind

20000033374 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

Flexibility Based Formulation for Nonlinear Analysis of Reinforced Concrete Frames Considering the Effects of Finite Length Inelastic Zones

Leu, Liang–Jeng, National Taiwan Univ., Taiwan, Province of China; Cheng, Ju–Chuan, National Taiwan Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; 2000; ISSN 0253-3839; Volume 23, No. 1, pp. 97-108; In English

Contract(s)/Grant(s): NSC-87-2211-E-002-032; Copyright; Avail: Issuing Activity

This paper is concerned with geometrically and materially non-linear analysis of planar reinforced concrete (RC) frames with a particular emphasis on how to model efficiently and accurately the effects of material nonlinearity. To this end, an inelastic stiffness matrix is developed using a flexibility formulation on the basis of cross sectional generalized stress-strain relationships. The derived stiffness matrix takes into account the effects of cracking of concrete and yielding of reinforcement that may occur within a finite-length zone located at the ends of a member. Its implementation is easy and efficient since the number of degrees of freedom is the same as that of the elastic stiffness matrix. Geometric nonlinearity is incorporated into the analysis through the use of the conventional geometric stiffness matrix. The accuracy and efficiency of the derived inelastic stiffness matrix are verified by several example problems.

Author

Composite Materials; Concretes; Flexibility; Nonlinearity; Reinforcement (Structures); Stress-Strain Relationships

20000033431 National Chung Hsing Univ., Dept. of Civil Engineering, Taichung, Taiwan, Province of China

Estimation of High Performance Concrete Strength by Pulse Velocity

Lin, Yiching, National Chung Hsing Univ., Taiwan, Province of China; Changfan, Hung, National Chung Hsing Univ., Taiwan, Province of China; Hsiao, Chiamen, National Chung Hsing Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Nov. 1997; ISSN 0253-3839; Volume 20, No. 6, pp. 661-668; In English

Contract(s)/Grant(s): NSC-86-2211-E-005-017; Copyright; Avail: Issuing Activity

Experimental studies were carried out to establish the correlation relationship between compressive strength and pulse velocity for high performance concrete and, further, to evaluate the feasibility of using the pulse velocity to estimate compressive strength. Cylinders (100 x 200 mm) made of high performance concrete with seven mixture proportions having variations in water/binder ratio and aggregate content were used as specimens in the studies. The influence of changing the curing temperature (10, 23, and 40 C) on the strength-velocity relationship was also investigated. Finally, 160 cylinders from another 45 various mixtures were used to evaluate the variability of the strength-velocity relationship. Results obtained from these studies show that the velocity increases within the first day much more rapidly than strength. A normalized comparison of strength development with pulse velocity development shows that monitoring the development of pulse velocity would be a good indicator of the development of concrete strength. It is also shown that changes in water-binder ratio and curing temperature do not alter the strength-velocity relationship. In addition, the use of pulse velocity to estimate compressive strength of high performance concrete is feasible mainly because the pulse velocity is not so sensitive to the change in aggregate content.

Author

Compressive Strength; Concretes; Aggregates; Binders (Materials); Concrete Structures

20000033693 NASA Lewis Research Center, Cleveland, OH USA

Recent Advances in the Method of Forces: Integrated Force Method of Structural Analysis

Patnaik, Surya N., Ohio Aerospace Inst., USA; Coroneos, Rula M., NASA Lewis Research Center, USA; Hopkins, Dale A., NASA Lewis Research Center, USA; Advances in Engineering Software; 1998; ISSN 0965-9978; Volume 29, No. 3, pp. 463-474; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Stress that can be induced in an elastic continuum can be determined directly through the simultaneous application of the equilibrium equations and the compatibility conditions. In the literature, this direct stress formulation is referred to as the integrated force method. This method, which uses forces as the primary unknowns, complements the popular equilibrium-based stiffness method, which considers displacements as the unknowns. The integrated force method produces accurate stress, displacement, and frequency results even for modest finite element models. This version of the force method should be developed as an alternative to the stiffness method because the latter method, which has been researched for the past several decades, may have entered its developmental plateau. Stress plays a primary role in the development of aerospace and other products, and its analysis is difficult. Therefore, it is advisable to use both methods to calculate stress and eliminate errors through comparison. This paper examines the role of the integrated force method in analysis, animation and design.

Author

Structural Analysis; Equilibrium Equations; Stress Analysis; Equilibrium Methods; Energy Methods

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.

20000032170 Rocky Mountain Research Station, Ogden, UT USA
Ecology and Conservation of the Cactus Ferruginous Pygmy-Owl in Arizona
Cartron, J. L. E.; Finch, D. M.; Jan. 2000; 82p; In English; Original contains color illustrations
Report No.(s): PB2000-103322; RMRS-GTR-43; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report is the result of a cooperative effort by the Rocky Mountain Research Station and the USDA Forest Service Region 3, with participation by the Arizona Gam and Fish Department and the Bureau of Land Management. It assesses the state of knowledge related to the conservation status of the cactus ferruginous pygmy-owl in Arizona. The population decline of this owl has been attributed to the loss of riparian areas before and after the turn of the 20th century. Currently, the cactus ferruginous pygmy-owl is chiefly found in southern Arizona in zeroriparian vegetation and well-structured upland desertscrub. The primary threat to the remaining pygmy-owl population appears to be continued habitat loss due to residential development. Important information gaps exist and prevent a full understanding of the current population status of the owl and its conservation needs.
NTIS
Arizona; Conservation; Ecology; Forests; Wildlife

20000032172 Geological Survey, Reston, VA USA
Atlas of Relations between Climatic Parameters and Distributions of Import Trees and Shrubs in North America: Hardwoods
Thompson, R. S.; Anderson, K. H.; Bartlein, P. J.; 2000; 436p; In English
Report No.(s): PB2000-103110; USGS/PP-1650-B; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

This atlas explores the continental-scale relations between the geographic ranges of woody plant species and climate in North America. A 25-km equal-area grid of modern climatic and bioclimatic parameters was constructed from instrumental weather records. The geographic distributions of sel3ected tree and shrub species were digitized, and the presence or absence of each species was determined for each cell on the 25-km grid, thus providing a basis for comparing climatic data and species' distributions. The relations between climate and plant distributions are explored in n form. The results of this effort are primarily intended for use in biogeographic, paleoclimatic, and global-change research.
NTIS
Climatology; North America; Trees (Plants); Taxonomy; Geological Surveys

20000032173 Geological Survey, Reston, VA USA
Atlas of Relations between Climatic Parameters and Distributions of Important Trees and Shrubs in North America: Introduction and Conifers
Thompson, R. S.; Anderson, K. H.; Bartlein, P. J.; 1999; 282p; In English
Report No.(s): PB2000-103109; USGS/PP-1650-A; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

This atlas explores the continental-scale relations between the geographic ranges of woody plant species and climate in North America. A 25-km equal-area grid of modern climatic and bioclimatic parameters was constructed from instrumental weather records. The geographic distributions of selected tree and shrub species were digitized, and the presence of absence of each species was determined for each cell on the 25-km grid, thus providing a basis for comparing climatic data and species' distributions. The relations between climate and plant distributions are explored in graphical and tabular form. The results of this effort are primarily intended for use in biogeographic, paleo-climatic, and global-change research.
NTIS
Climatology; Conifers; Trees (Plants); North America; Geographic Distribution; Taxonomy

20000032215 Florida International Univ., High Performance Database Research Center, Miami, FL USA
High Performance Database Management for Earth Sciences
Rishe, Naphtali, Florida International Univ., USA; Barton, David, Florida International Univ., USA; Urban, Frank, Florida International Univ., USA; Chekmasov, Maxim, Florida International Univ., USA; Martinez, Maria, Florida International Univ., USA; Alvarez, Elms, Florida International Univ., USA; Gutierrez, Martha, Florida International Univ., USA; Pardo, Philippe, Florida International Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 539-544; In English;

See also 20000032189
Contract(s)/Grant(s): DAAH04-96-1-0049; DAAH04-96-1-0278; DoI-CA-5280-4-9044; NATO-HTECH.LG-931449; NAGW-4080; NAG5-5095; NRA-97-MTPE-05; NSF CDA-97-11582; NSF IRI-94-09661; NSF HRD-97-07076; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The High Performance Database Research Center at Florida International University is completing the development of a highly parallel database system based on the semantic/object-oriented approach. This system provides exceptional usability and flexibility. It allows shorter application design and programming cycles and gives the user control via an intuitive information structure. It empowers the end-user to pose complex ad hoc decision support queries. Superior efficiency is provided through a high level of optimization, which is transparent to the user. Manifold reduction in storage size is allowed for many applications. This system allows for operability via internet browsers. The system will be used for the NASA Applications Center program to store remote sensing data, as well as for Earth Science applications.
Author
Data Base Management Systems; Earth Sciences; Data Bases; Remote Sensing; Information Management; Information Retrieval

20000032332 NASA Marshall Space Flight Center, Huntsville, AL USA
A New Image Processing and GIS Package
Rickman, D., NASA Marshall Space Flight Center, USA; Luvall, J. C., NASA Marshall Space Flight Center, USA; Cheng, T., Cheng (T.), USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 933-936; In English; See also 20000032189
Report No.(s): 98URC166; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

The image processing and GIS package ELAS was developed during the 1980's by NASA. It proved to be a popular, influential and powerful in the manipulation of digital imagery. Before the advent of PC's it was used by hundreds of institutions, mostly schools. It is the unquestioned, direct progenitor or two commercial GIS remote sensing packages, ERDAS and MapX and influenced others, such as PCI. Its power was demonstrated by its use for work far beyond its original purpose, having worked several different types of medical imagery, photomicrographs of rock, images of turtle flippers and numerous other esoteric imagery. Although development largely stopped in the early 1990's the package still offers as much or more power and flexibility than any other roughly comparable package, public or commercial. It is a huge body or code, representing more than a decade of work by full time, professional programmers. The current versions all have several deficiencies compared to current software standards and usage, notably its strictly command line interface. In order to support their research needs the authors are in the process of fundamentally changing ELAS, and in the process greatly increasing its power, utility, and ease of use. The new software is called ELAS II. This paper discusses the design of ELAS II.
Derived from text
Applications Programs (Computers); Image Processing; Geographic Information Systems; Software Engineering

20000032615 Rocky Mountain Research Station, Ogden, UT USA
Stream Channel Responses to Streamflow Diversion on Small Streams of the Snake River Drainage, Idaho
Bohn, C. C.; King, J. G.; Feb. 2000; 30p; In English
Report No.(s): PB2000-103349; RMRS-RP-20; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The effects of channels of small, low-head seasonal water diversions in the Snake River drainage were investigated. Channels below small diversions were compared to the channels immediately above the same diversions to determine if differences in flow conveyance, substrate sediment size distribution, or streamside vegetation density were present. Estimates of flow conveyance were greater above the diversions, as measured by the area between the edge of vegetation on both banks, and by frequent-flow indicators, which generally approximated bankfull state. No significant difference in substrate particle size or in channel roughness was found between channels above and below diversions. Although use histories of the diversions were not available, limited observations and conversations with users suggest that many of the diversion structures did not substantially divert high springtime flows so that passage of channel-forming flow probably occurred.
NTIS
Channel Flow; Drainage

20000032753 Rocky Mountain Research Station, Fort Collins, CO USA
North American Science Symposium: Toward a Unified Framework for Inventorying and Monitoring Forest Ecosystem Resources *Simposio Cientifico Noreamericano: Hacia un Planteamiento Unificado para Inventariar y Montiorear los Recursos de los Ecosistemas Forestales*

Dec. 1999; 554p; In English; In Spanish; North American Science Symposium: Toward a Unified Framework for Inventorying and Monitoring Forest Ecosystem Resources, 2-6 Nov. 1998, Guadalajara, Mexico; Original contains color illustrations
Report No.(s): PB2000-100631; RMRS-P-12; No Copyright; Avail: National Technical Information Service (NTIS); Abstract Only

The general objective of this Symposium was to build on the best science and technology available to assure that the data and information produced in future inventory and monitoring programs are comparable, quality assured, available, and adequate for their intended purposes, thereby providing a reliable framework for characterization, assessment, and management of forest ecosystems in North America. Central to the syntheses delivered in this Symposium was the conclusion that a fundamental improvement in approaches used for inventorying and monitoring ecosystem resources is required to meet current and future environmental uncertainties. Specific actions were proposed to address these challenges. These strategic actions are described in the last chapter of these proceedings.
NTIS
Forests; Ecosystems; Environmental Monitoring; Inventories; Resources Management; Biological Diversity; Information Management

20000032797 Royal Norwegian Council for Scientific and Industrial Research, Trondheim, Norway
Flexible hydrological modelling system developed using an object oriented methodology
Rinde, T.; Dec. 31, 1998; 200p; In English
Report No.(s): DE99-771609; NEI-NO-1128; ISBN 82-471-0257-9; No Copyright; Avail: Department of Energy Information Bridge

The report presents a software system called Process Integrating Network (PINE). The capabilities, working principles, programming technical design and principles of use of the system are described as are some practical applications. PINE is a simulation tool for modelling of hydrological and hydrologically related phenomena. The system is based on object oriented programming principles and was specially designed to provide freedom in the choice of model structures and algorithms for process descriptions. It supports full freedom with regards to spatial distribution and temporal resolution. Geographical information systems (GIS) may be integrated with PINE in order to provide full spatial distribution in system parametrization, process simulation and visualisation of simulation results. Simulation models are developed by linking components for process description together in a structure. The system can handle compound working media such as water with chemical or biological constituents. Non-hydrological routines may then be included to describe the responses of such constituents. Features such as extensibility and reuse of program components are emphasised in the program design. Separation between process topology, process descriptions and process data facilitates simple and consistent implementation of components for process description. Such components may be automatically prototyped and their response functions may be implemented without knowledge of other parts of the program system and without the need to program import or export routines or a user interface. Model extension is thus a rapid process that does not require extensive programming skills. Components for process descriptions may further be placed in separate program libraries, which can be included in the program as required. The program system can thus be very compact while it still has a large number of process algorithms available. The system can run on both PC and UNIX platforms.
NTIS
Hydrology Models; Pollution Monitoring

43
EARTH RESOURCES AND REMOTE SENSING

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

20000032191 NASA Marshall Space Flight Center, Huntsville, AL USA
Modeling the Effect of Vegetation on Passive Microwave Remote Sensing of Soil Moisture
Liu, Y. P., Alabama A & M Univ., USA; Inguva, R., Wyoming Univ., USA; Crosson, W. L., NASA Marshall Space Flight Center, USA; Coleman, T. L., Alabama A & M Univ., USA; Laymon, C., NASA Marshall Space Flight Center, USA; Fahsi, A., Alabama A & M Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 1-5; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

The effect of vegetation on passive microwave remote sensing of soil moisture is studied. The radiative transfer modeling work of Njoku and Kong is applied to a stratified medium of which the upper layer is treated as a layer of vegetation. An effective dielectric constant for this vegetation layer is computed using estimates of the dielectric constant of individual components of the vegetation layer. The horizontally-polarized brightness temperature is then computed as a function of the incidence angle. Model predictions are used to compare with the data obtained in the Huntsville '96, remote sensing of soil moisture experiment, and with predictions obtained using a correction procedure of Jackson and Schmugge.
Author
Vegetation; Soil Moisture; Mathematical Models; Microwave Imagery; Remote Sensing

20000032193 Michigan Technological Univ., Houghton, MI USA
Effects of Grass Vegetation on Land Surface Brightness Temperature: Testing of the Numerical Solution of a Forward Radiative Transfer Model ***Topical Report***
Ruark, M. D., Michigan Technological Univ., USA; Liu, Y. P., Alabama A & M Univ., USA; Inguva, R., Wyoming Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 6-10; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

The effects of grass vegetation on L-band passive microwave determination of brightness temperature at land surface are studied, using the numerical code of a forward radiative transfer model. This model, based on soil moisture and temperature profiles, first predicts the brightness temperature at a bare soil surface, then adjusts the brightness temperature using a correction for vegetative cover on soil surface. This correction, characterized by a vegetation water content and a correction parameter, attempts to compensate for changes which occur in radiative transfer when vegetation is present. Data from the HSCaRS Huntsville '96 experiment, specifically the measured brightness temperatures of plots with a smooth bare soil surface and a grass-covered soil surface, is used for comparison with the model predictions. Additionally, the sensitivity of the model prediction to soil moisture and the sensitivity of the vegetation correction to the vegetation water content and correction parameter is examined.
Author
Vegetation; Grasses; Brightness Temperature; Earth Surface; Moisture Content; Soil Moisture; Temperature Profiles

20000032225 NASA Marshall Space Flight Center, Huntsville, AL USA
Southern Great Plains 1997 hydrology experiment: The spatial and temporal distribution of soil moisture within a quarter section pasture field
Tsegaye, T., Alabama A & M Univ., USA; Coleman, T., Alabama A & M Univ., USA; Tadesse, W., Alabama A & M Univ., USA; Rajbhandari, N., Alabama A & M Univ., USA; Senwo, Z., Alabama A & M Univ., USA; Crosson, W., NASA Marshall Space Flight Center, USA; Surrency, J., Alabama A & M Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volume 2 and 3, pp. 76-82; In English; See also 20000032189
Contract(s)/Grant(s): NCCW-84; NCC8-140; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Understanding the spatial and temporal distribution of soil moisture near the soil surface is important to relate ground truth data to remotely sensed data using an electronically scanned thinned array radiometer (ESTAR). The research was conducted at the A-ARM EF site in the Little Washita Watershed in Chickasha Oklahoma. Soil moisture was measured on a 100 x 100-m grid on a quarter section (0.8 km by 0.8 km) size field where the DOE A-ARM SWATS is located. This site has several drainage channels and small ponds. The site is under four different land use practices, namely active pastureland, non-grazed pastureland covered with thick grass, forest area covered with trees, and a single residential area. Soil moisture was measured with a Time Domain Reflectometry (TDR) Delta-T 6-cm theta-probe and gravimetric soil moisture (GSM) technique for the top 6 cm of the soil depth. A fourth order polynomial equation was fitted to each probe calibration curve. The correlation between TDR and GSM measurement technique ranges from 0.81 to 0.91. Comparison of the spatial and temporal distribution of soil moisture measured by the TDR and GSM techniques showed very strong similarities. Such TDR probes can be used successfully to replace the GSM techniques to measure soil moisture content rapidly and accurately with site specific calibration.
Author
Soil Moisture; Remote Sensing; Temporal Distribution; Spatial Distribution; Optical Measurement; Hydrology; Ground Truth; Grasslands; Soil Science

20000032228 Puerto Rico Univ., Tropical Center for Earth and Space Studies, Mayaguez, Puerto Rico

Dimension Reduction in AVIRIS and LANDSAT Images using Subset Selection Methods

Pagan, Francisco, Puerto Rico Univ., Puerto Rico; Fernandez, Gianna, Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 589-594; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Observations from hyperspectral sensors lead to high dimensional data sets having hundreds of narrow spectral bands. A major challenge in handling such data sets is the removal of redundant information and to keep that information relevant to the application at hand. The standard approach to deal with such redundancy is the use of principal component analysis. In this approach the original hyperspectral image is transformed by means of linear combinations into a set of uncorrelated or orthogonal ”images”. A well known fact for multispectral and hyperspectral images is the fact that most of the spatial information content is summarized by the first few principal components. A disadvantage of this approach is the inherent transformation of the original hyperspectral image (physical meaningful spectral data) into linear combinations of bands with, in many instances, little or no physical relation with the spectral information content on the original image. Therefore, it is of interest to look at methodologies that reduce the hyperspectral data set dimensionality with no transformation of the data with the same performance as principal components. In this paper, we will show the application of subset selection methods for the reduction of dimensionality in hyperspectral images and discuss potential applications to band selection and lossy compression. Subset selection is the problem of determining the most linearly independent columns in a matrix. The reduction of dimensionality of the hyperspectral data set is achieved by exploring its near linear dependency structure. The linear dependency structure of the hyperspectral data set can be derived using the singular value decomposition (SVD). The information contained in the SVD allows us to identify the most independent bands in the hyperspectral image. It is shown previously that the canonical correlation between the principal components and the bands selected using the subset selection procedure will be close to 100% if the matrix associated with the hyperspectral data set is near rank deficient. Numerical examples using AVIRIS and LANDSAT images are used to illustrate the potential applicability of the technique, we will show how by using the SVD subset selection method of an AVIRIS image (224 bands) we can reduce the data set down to 7 bands that have a canonical correlation of 99.9% with the principal components. Also, due to the simplicity of handling, we will use data from the LANDSAT multi spectral sensor to illustrate the concepts of subset selection and its combinatorial nature. In this case, results show that for the example at hand we can summarize all information in 1 principal component. Visual interpretation illustrates that the band selected with the subset selection method has most of the spatial structure present in the first principal component. In this case, the selected band has a 98% of cm-relation with the first principal component.

Author

Data Reduction; Combinatorial Analysis; Satellite Imagery; Principal Components Analysis; Data Acquisition; LANDSAT Satellites; Images; Data Processing

20000032229 Pennsylvania State Univ., University Park, PA USA

Correlation Analysis of Soil Moisture and Soil Temperature under Vegetated Plots

Steinfield, S., Pennsylvania State Univ., USA; Tsegaye, T., Alabama A & M Univ., USA; Fahsi, A., Alabama A & M Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 83-88; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Understanding soil properties is crucial to creating alternative techniques to better comprehend crop growth, micro-topography, and global change. Results showed that soil surface temperature, GSM and Theta(v) varied substantially from one location to another but minimally under different vegetation types. A Pearson correlation revealed a strong negative correlation (-0.82 to -0.99) between soil temperature and Theta(v) when average positional values were used, but only a weak (-0.07 to -0.41) negative correlation when all data points were considered. Correlation between temperature and GSM was also negative. However, when using only the average positional values, these positions were positively correlated for the alfalfa and tall fescue plots and moderately-negatively correlated for the com plot. Since data for this experiment is based on one field and one data collection. Further investigation is needed to confirm the results and make conclusive statements about the correlation between surface soil temperature and GSM.

Author

Soil Moisture; Crop Growth; Data Acquisition; Soil Science; Surface Temperature

20000032232 Alabama A & M Univ., Center for Hydrology, Soil Climatology, and Remote Sensing, Normal, AL USA

Effect of land-use practice on soil moisture variability for soils covered with dense forest vegetation of Puerto Rico

Tsegaye, T., Alabama A & M Univ., USA; Coleman, T., Alabama A & M Univ., USA; Senwo, Z., Alabama A & M Univ., USA; Shaffer, D., Puerto Rico Univ., Puerto Rico; Zou, X., Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 28, 1998; Volumes 2 and 3, pp. 95-100; In English; See also 20000032189

Contract(s)/Grant(s): NCCW-84; NCC8-140; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Little is known about the landuse management effect on soil moisture and soil pH distribution on a landscape covered with dense tropical forest vegetation. This study was conducted at three locations where the history of the landuse management is different. Soil moisture was measured using a 6-cm three-rod Time Domain Reflectometery (TDR) probe. Disturbed soil samples were taken from the top 5-cm at the up, mid, and foothill landscape position from the same spots where soil moisture was measured. The results showed that soil moisture varies with landscape position and depth at all three locations. Soil pH and moisture variability were found to be affected by the change in landuse management and landscape position. Soil moisture distribution usually expected to be relatively higher in the foothill (P3) area of these forests than the uphill (P1) position. However, our results indicated that in the Luquillo and Guanica site the surface soil moisture was significantly higher for P1 than P3 position. These suggest that the surface and subsurface drainage in these two sites may have been poor due to the nature of soil formation and type.

Author

Land Use; Soil Moisture; Variability; Soil Sampling; Soils

20000032260 Texas Univ., Dept. of Geological Sciences, El Paso, TX USA

Geologic Mapping of the Cd. Chihuahua, Mexico, area from Satellite Imagery

Perez, A. E., Texas Univ., USA; Rodriguez, J. A., Texas Univ., USA; Pingitore, N. E., Texas Univ., USA; Keller, G. R., Texas Univ., USA; Penn, B. S., Texas Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 698-702; In English; See also 20000032189

Report No.(s): 98URC126; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

The City of Chihuahua in Northern Mexico has been experiencing a water shortage in the last decade due to the great demand of its growing population. About a quarter of the municipal water is supplied by the Tabalaopa-Aldama aquifer located to the North-East of the city. The Tabalaopa Valley has been used for hundreds of years as agricultural land that is irrigated with intermittent irrigation from the Chuviscar River. Because of the scarcity of water and the expense of chemical fertilizers some of the crops are irrigated with untreated sewage water from Chihuahua City. Although this poses no direct health threat given that the crops are for animal consumption only, the danger lies in the possible contamination of the underlying water. Percolation of the contaminated waters and the proximity of the water table present a conflict between the need of the farmers and the health of the community. The area is of great hydrologic interest because of its potable water potential as well as its agricultural resources. One of the first steps in addressing the problem is to better understand the geology of the area. Outlining the rock types present is the focus of this study. by integrating the preexisting geologic maps as well as TM satellite imagery we intend to redefine the geologic map in greater detail.

Derived from text

Geological Surveys; Satellite Imagery; Mexico; Thematic Mapping; Hydrology; Agriculture

20000032263 Prairie View Agricultural and Mechanical Coll., Texas Gulf Coast Environmental Data Center, TX USA

Spectral Characterization of Water Stress Impact on Some Agricultural Crops, 1, Conceptual Model

Shakir, Safwat H., Prairie View Agricultural and Mechanical Coll., USA; Girmay–Gwahid, B., Prairie View Agricultural and Mechanical Coll., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 709-714; In English; See also 20000032189

Report No.(s): 98URC128; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Potential crop growth and yield are usually not achieved because of constraints imposed by the plant environment. Water is an essential plant growth factor. Its reduced amount in the plant affects the plant photosynthesis which is in turn limits yield potential. Therefore adequate soil moisture has a large influence on plant growth. i.e., it promotes root growth and an abundant leaf area, increases the number of branches per plant. A number of plant traits are related with water stress particularly to drought resistance such as by stomatal resistance, osmotic adjustment, leaf orientation, size and rolling. In detecting stress on plants the response of the components of the plant canopy are important particularly for spectral identification. Studies have shown that the

visible (red) and near infrared portion of the spectrum give indications of the vegetation condition in terms of biomass, greeness and leaf area index. A combination of spectral bands has given a method of characterization. These include the greeness vegetation index (GVI), Normalized Difference Vegetation Index (NDVI), Ratio index (NIR/R). Later a Transformed Vegetation Index (TVI) was used to avoid working with negative ratio values. Prepedicular Vegetation Index (PVI) was also developed that account for soil background variations. The spectral vegetation indices, particularly the NDVI, are most often used to observe vegetation pattern and dynamics from satellite sensors. At local scale, various plant parameters such as LAI (Leaf Area Index), biomass production, and percent cover are related to NDVI. Although NDVI has shown to minimize view angle effects relative to variations in the red and NIR bands, it remains sensitive to atmosphere, soil, and view sun angle conditions limiting its qualitative capabilities to characterize the vegetation surface. Atmospheric influences lower the NDVI of vegetated areas whereas dark or wet soil backgrounds raise the NDVI for a given canopy. In partially vegetated surfaces illuminated from small solar zenith angles have lower NDVI values due to a higher proportion of sunlit soil. At larger solar zenith angles, the percent of direct flux reaching the soil biomass is small, and the scattering properties of the vegetation dominate, resulting in higher vegetation index values. Observed spectral patterns involving constant vegetation amounts with different soil backgrounds could not be explained nor predicted by either the ratio or orthogonal greeness measures. Greenness measures were found to strongly depend on soil brightness. Soil-induced greeness changes became greater with increasing amounts of vegetation up to 60% green cover. The results suggest that soil and plant spectra interactively mix in a non-additive, partially correlated manner to produce composite canopy spectra. In this present paper, we will introduce a new conceptual model to evaluate the crop stress or vegetation based on combinations of very narrow bands in NIR and MIR region.
Derived from text
Characterization; Plant Stress; Water; Agriculture; Crop Growth; Spectral Bands; Remote Sensing

20000032265 Agricultural Research Service, Remote Sensing Research Unit, Weslaco, TX USA
Using Videographic Remote Sensing and Spatial Information Technologies for Detecting and Mapping Plant Species and Insect Infestations
Everitt, J. H., Agricultural Research Service, USA; Escobar, D. E., Agricultural Research Service, USA; Fletcher, R. S., Agricultural Research Service, USA; Davis, M. R., Agricultural Research Service, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 715-727; In English; See also 20000032189
Report No.(s): 98URC129; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche; C01, CD-ROM
This paper presents an overview on the application of aerial videography with global positioning system (GPS) and geographic information system (GIS) technologies for natural resource management. Applications demonstrated include detecting and mapping: (1) saltcedar (Tamarix chinensis Lour.) infestations in a riparian area; (2) black mangrove [Avicennia germinans (L.) L.] populations in a coastal region; and (3) citrus blackfly (Aleurocanthus wodumi Asby) and harvester ant (Pogonomyex barbatus F. Smith) infestations in agricultural areas and grazing lands, respectively. Video imagery (color-infrared and normal color) could be used to detect insect and plant infestations/populations. The integration of a GPS with the video imagery permitted latitude and longitude coordinates of insect and plant infestations/populations to be recorded on each image. The GPS coordinates were entered into a GIS to map insect and plant infestations/populations on a regional scale. The integration of videography, GPS, and GIS are valuable tools that can enable resource managers to develop maps showing the distribution of insect and plant infestations/populations over large areas. The digital video imagery can serve as a permanent geographically located image data base for monitoring future contraction or spread of insect and plant infestations/populations over time.
Author
Remote Sensing; Video Data; Insects; Infestation; Global Positioning System; Geographic Information Systems; Thematic Mapping

20000032278 Alabama A & M Univ., Center for Hydrology Soil Climatology and Remote Sensing, Normal, AL USA
Optical Sensing of Soil Moisture with Optical Fibers using Infrared Reflectance and Raman Scattering Techniques
Jackson, A., Alabama A & M Univ., USA; Reddy, B. R., Alabama A & M Univ., USA; Coleman, T. L., Alabama A & M Univ., USA; Belisle, W., Alabama A & M Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 203-208; In English; See also 20000032189
Report No.(s): 98URC038; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
Raman and infrared reflectance techniques are used to measure soil moisture. A bifurcated fiber was used for launching light to the soil surface and collect reflected light. Raman scattering measurement revealed a systematic variation of the signal in a depth profile measurement of peat. Infrared reflectance at 1.4 and 1.9 micrometers was found to be suitable to detect soil moisture

content. A low power Argon ion laser beam was used in the Raman scattering experiments. A tungsten-halogen lamp was used as light source in the infrared reflectance measurements.
Author
Infrared Radiation; Optical Fibers; Soil Moisture; Spectral Reflectance; Raman Spectra; Argon Lasers

20000032285 NASA Stennis Space Center, Bay Saint Louis, MS USA
Use of Earth Observing Satellite Data for the Development of "Learning Exercises" for College-Level Science Courses
Joyce, Armond T., NASA Stennis Space Center, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 780-783; In English; See also 20000032189
Report No.(s): 98URC139; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

This paper is based on experiences being gained through a project entitled "The Mississippi Community College Pilot Project". The project was labeled "pilot" because it is thought that lessons learned during the implementation of this project may aid similar endeavors in other states. The objective of the project is to provide curriculum enrichment and associated faculty enhancement through the use of earth observations data in biological and physical sciences courses. The premise underlying the objective is that information from earth observations from satellite and aircraft platforms provides an effective means of illustrating and explaining science topics/phenomena in a new and/or different perspective. It is also thought that the use of data acquired from space may also serve to captivate the students interest and/or inquisitiveness about the particular science issue.
Derived from text
Learning; Data Acquisition; Science; Earth Observations (From Space); Computer Programs

20000032323 NASA Marshall Space Flight Center, Huntsville, AL USA
A Conceptual Approach to Assimilating Remote Sensing Data to Improve Soil Moisture Profile Estimates in a Surface Flux/Hydrology Model, Part 1, Overview
Crosson, William L., NASA Marshall Space Flight Center, USA; Laymon, Charles A., NASA Marshall Space Flight Center, USA; Inguva, Ramarao, Science and Technology Consultants, USA; Schamschula, Marius, Alabama A & M Univ., USA; Caulfield, John, Fisk Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 322-327; In English; See also 20000032189
Report No.(s): 98URC059; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Knowledge of the amount of water in the soil is of great importance to many earth science disciplines. Soil moisture is a key variable in controlling the exchange of water and energy between the land surface and the atmosphere. Thus, soil moisture information is valuable in a wide range of applications including weather and climate, runoff potential and flood control, early warning of droughts, irrigation, crop yield forecasting, soil erosion, reservoir management, geotechnical engineering, and water quality. Despite the importance of soil moisture information, widespread and continuous measurements of soil moisture are not possible today. Although many earth surface conditions can be measured from satellites, we still cannot adequately measure soil moisture from space. Research in soil moisture remote sensing began in the mid 1970s shortly after the surge in satellite development. Recent advances in remote sensing have shown that soil moisture can be measured, at least qualitatively, by several methods. Quantitative measurements of moisture in the soil surface layer have been most successful using both passive and active microwave remote sensing, although complications arise from surface roughness and vegetation type and density. Early attempts to measure soil moisture from space-borne microwave instruments were hindered by what is now considered sub-optimal wavelengths (shorter than 5 cm) and the coarse spatial resolution of the measurements. L-band frequencies between 1 and 3 GHz (10-30 cm) have been deemed optimal for detection of soil moisture in the upper few centimeters of soil. The Electronically Steered Thinned Array Radiometer (ESTAR), an aircraft-based instrument operating a 1,4 GHz, has shown great promise for soil moisture determination. Initiatives are underway to develop a similar instrument for space. Existing space-borne synthetic aperture radars (SARS) operating at C- and L-band have also shown some potential to detect surface wetness. The advantage of radar is its much higher resolution than passive microwave systems, but it is currently hampered by surface roughness effects and the lack of a good algorithm based on a single frequency and single polarization. In addition, its repeat frequency is generally low (about 40 days). In the meantime, two new radiometers offer some hope for remote sensing of soil moisture from space. The Tropical Rainfall Measuring Mission (TRMM) Microwave Imager (TMI), launched in November 1997, possesses a 10.65 GHz channel and the Advanced Microwave Scanning Radiometer (AMSR) on both the ADEOS-11 and Earth Observing System AM-1 platforms to be launched in 1999 possesses a 6.9 GHz channel. Aside from issues about interference from vegetation, the coarse resolution of these data will provide considerable challenges pertaining to their application. The resolution of TMI is about 45 km and that of AMSR is about 70 km. These resolutions are grossly inconsistent with the scale of soil moisture processes and the

spatial variability of factors that control soil moisture. Scale disparities such as these are forcing us to rethink how we assimilate data of various scales in hydrologic models. of particular interest is how to assimilate soil moisture data by reconciling the scale disparity between what we can expect from present and future remote sensing measurements of soil moisture and modeling soil moisture processes. It is because of this disparity between the resolution of space-based sensors and the scale of data needed for capturing the spatial variability of soil moisture and related properties that remote sensing of soil moisture has not met with more widespread success. Within a single footprint of current sensors at the wavelengths optimal for this application, in most cases there is enormous heterogeneity in soil moisture created by differences in landcover, soils and topography, as well as variability in antecedent precipitation. It is difficult to interpret the meaning of 'mean' soil moisture under such conditions and even more difficult to apply such a value. Because of the non-linear relationships between near-surface soil moisture and other variables of interest, such as surface energy fluxes and runoff, mean soil moisture has little applicability at such large scales. It is for these reasons that the use of remote sensing in conjunction with a hydrologic model appears to be of benefit in capturing the complete spatial and temporal structure of soil moisture. This paper is Part I of a four-part series describing a method for intermittently assimilating remotely-sensed soil moisture information to improve performance of a distributed land surface hydrology model. The method, summarized in section II, involves the following components, each of which is detailed in the indicated section of the paper or subsequent papers in this series: Forward radiative transfer model methods (section II and Part IV); Use of a Kalman filter to assimilate remotely-sensed soil moisture estimates with the model profile (section II and Part IV); Application of a soil hydrology model to capture the continuous evolution of the soil moisture profile within and below the root zone (section III); Statistical aggregation techniques (section IV and Part II); Disaggregation techniques using a neural network approach (section IV and Part III); and Maximum likelihood and Bayesian algorithms for inversely solving for the soil moisture profile in the upper few cm (Part IV).
Derived from text
Soil Moisture; Remote Sensing; Satellite-Borne Instruments; Hydrology Models; Earth Observing System (EOS); Data Processing; Surface Energy; Earth Surface

20000032325 Alabama A & M Univ., Dept. of Plant, Soil and Animal Science, Normal, AL USA
Meteorological and Watershed Factors Affect the Runoff and Peak Flow Reduction Capacities of Forested Filter Zones
Rajbhanadri, Narayan B., Alabama A & M Univ., USA; Gregory, James, North Carolina State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 900-904; In English; See also 20000032189
Report No.(s): 98URC160; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM
Runoff is the key hydrologic process affecting the stability of land in the riparian watershed system. Maintenance of a forested filter zone (FFZ) is recognized as an effective way of reducing the velocity of surface runoff from an upland area (Barker and Gregory, 1989, and Shultz, 1995). Because the sediment carrying capacity of surface runoff is proportional to the fifth power of velocity, a small decrease in flow velocity can cause a significant increase in sediment deposition (Alberts et al., 1981). Rajbhandari et al., (1996) reported that sediment deposition was significantly increased where drainage density of small ephemeral channels in a FFZ was low. They further reported that the deposition was remarkable when the infiltration of field runoff in the FFZ was increased by dispersing flow across contour. Dispersal of surface runoff utilizes all the hydrologic attributes of a filter zone or riparian zone. In a FFZ, litter fall increases hydraulic roughness, the deposition processes, and infiltration capacity. Forest debris along the slope contours significantly reduces flow velocity and enhances water detention storage. In addition, dense ground cover and understory vegetation increase turbulent flow to substantially reduce flow velocity and enhance infiltration and detention storage. Extensive root development of trees enhances soil structure and porosity for deep percolation of water. Nevertheless, these attributes change with seasons. In this paper, we describe differences in total surface stormflow (including A horizon interflow) and peak flow rate across FFZ's adjacent to agricultural fields with regards to meteorological, runoff, and watershed factors. The meteorological factors tested were the two seasons - growing season and dormant season. Comparing two modes of runoff, dispersed flow and concentrated flow, were the hydrologic factors. The watershed factors included drainage density, vegetation cover, and soil moisture content.
Author
Meteorological Parameters; Forests; Sediments; Turbulent Flow; Vegetation; Watersheds; Flow Measurement; Agriculture; Topography

20000032326 Central State Univ., International Center for Water Resources Management, Wilberforce, OH USA
Assessment of Atrazine Movement in a Corn Plot with Respect to the Hydrologic Responses of Decatur Soil
Nibs, Elvis, Central State Univ., USA; Rajbhandari, Narayan, Alabama A & M Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education;

Feb. 22, 1998; Volumes 2 and 3, pp. 905-909; In English; See also 20000032189
Report No.(s): 98URC161; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Application of Pesticides is common in agricultural practices because of their ability to control disease vectors and pests that adversely affect the production and quality of food. One harmful factor of such a practice has been the severe environmental stress to many river basins. Some recent studies have shown that subsurface flow can carry detectable levels of pesticides to contaminate river basin and ground water (Buhler et al., 1994). Atrazine [2-chloro-4ethyl amino-6 isoproilamino-5-triazine] is one of the widely used pesticide for corn (Zea mays L.) culture and is one of the most commonly detected pesticides in stream water and ground water in the USA (USDA, 1990). Rajbhandari (1996) identified that Atrazine was sensitive to most of the soil types in the coastal plain during corn planting period in North Carolina. In this paper, we try to assess Atrazine movement in the corn field at the upland region in Alabama, USA, with respect to some hydrologic parameters and to find out if substantial amounts can contaminate ground water.

Author

Agriculture; Ground Water; Soils; Hydrology; Corn; Coastal Plains

20000032327 NASA Marshall Space Flight Center, Huntsville, AL USA

A Conceptual Approach to Assimilating Remote Sensing Data to Improve Soil Moisture Profile Estimates in a Surface Flux/Hydrology Model, 2, Aggregation

Schamschula, Marius, Alabama A & M Univ., USA; Crosson, William L., NASA Marshall Space Flight Center, USA; Inguva, Ramarao, Science and Technology Consultants, USA; Yates, Thomas, Oakwood Coll., USA; Laymen, Charles A., NASA Marshall Space Flight Center, USA; Caulfield, John, Fisk Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 328-330; In English; See also 20000032189
Report No.(s): 98URC060; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

This is a follow up on the preceding presentation by Crosson. The grid size for remote microwave measurements is much coarser than the hydrological model computational grids. to validate the hydrological models with measurements we propose mechanisms to aggregate the hydrological model outputs for soil moisture to allow comparison with measurements. Weighted neighborhood averaging methods are proposed to facilitate the comparison. We will also discuss such complications as misalignment, rotation and other distortions introduced by a generalized sensor image.

Author

Hydrology Models; Soil Moisture; Remote Sensing; Computerized Simulation; Computational Grids; Data Processing

20000032328 Alabama A & M Univ., Center for Hydrology, Soil Climatology and Remote Sensing, Normal, AL USA

Integration of GIS, Geostatistics, and 3-D Technology to Assess the Spatial Distribution of Soil Moisture

Betts, M., Alabama A & M Univ., USA; Tsegaye, T., Alabama A & M Univ., USA; Tadesse, W., Alabama A & M Univ., USA; Coleman, T. L., Alabama A & M Univ., USA; Fahsi, A., Alabama A & M Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 910-915; In English; See also 20000032189
Contract(s)/Grant(s): NCCW-84; NCC8-140
Report No.(s): 98URC162; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The spatial and temporal distribution of near surface soil moisture is of fundamental importance to many physical, biological, biogeochemical, and hydrological processes. However, knowledge of these space-time dynamics and the processes which control them remains unclear. The integration of geographic information systems (GIS) and geostatistics together promise a simple mechanism to evaluate and display the spatial and temporal distribution of this vital hydrologic and physical variable. Therefore, this research demonstrates the use of geostatistics and GIS to predict and display soil moisture distribution under vegetated and non-vegetated plots. The research was conducted at the Winfred Thomas Agricultural Experiment Station (WTAES), Hazel Green, Alabama. Soil moisture measurement were done on a 10 by 10 m grid from tall fescue grass (GR), alfalfa (AA), bare rough (BR), and bare smooth (BS) plots. Results indicated that variance associated with soil moisture was higher for vegetated plots than non-vegetated plots. The presence of vegetation in general contributed to the spatial variability of soil moisture. Integration of geostatistics and GIS can improve the productivity of farm lands and the precision of farming.

Author

Soil Moisture; Remote Sensing; Geographic Information Systems; Agriculture; Farm Crops; Moisture Content; Topography; Spatial Distribution

20000032336 NASA Marshall Space Flight Center, Huntsville, AL USA

A Conceptual Approach to Assimilating Remote Sensing Data to Improve Soil Moisture Profile Estimates in a Surface Flux/Hydrology Model, 3, Disaggregation

Caulfield, John, Fisk Univ., USA; Crosson, William L., NASA Marshall Space Flight Center, USA; Inguva, Ramarao, Science and Technology Consultants, USA; Laymon, Charles A., NASA Marshall Space Flight Center, USA; Schamschula, Marius, Alabama A & M Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 331-333; In English; See also 20000032189

Report No.(s): 98URC061; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

This is a followup on the preceding presentation by Crosson and Schamschula. The grid size for remote microwave measurements is much coarser than the hydrological model computational grids. to validate the hydrological models with measurements we propose mechanisms to disaggregate the microwave measurements to allow comparison with outputs from the hydrological models. Weighted interpolation and Bayesian methods are proposed to facilitate the comparison. While remote measurements occur at a large scale, they reflect underlying small-scale features. We can give continuing estimates of the small scale features by correcting the simple 0th-order, starting with each small-scale model with each large-scale measurement using a straightforward method based on Kalman filtering.

Author

Remote Sensing; Hydrology Models; Soil Moisture; Kalman Filters; Computational Grids; Bayes Theorem

20000032337 Institute for Global Change Research and Education, Huntsville, AL USA

Estimation of Soil Moisture Profile using a Simple Hydrology Model and Passive Microwave Remote Sensing

Soman, Vishwas V., Institute for Global Change Research and Education, USA; Crosson, William L., Institute for Global Change Research and Education, USA; Laymon, Charles, Institute for Global Change Research and Education, USA; Tsegaye, Teferi, Alabama A & M Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 334-338; In English; See also 20000032189

Contract(s)/Grant(s): NCCW-84; USRA-SUB95-164

Report No.(s): 98URC062; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Soil moisture is an important component of analysis in many Earth science disciplines. Soil moisture information can be obtained either by using microwave remote sensing or by using a hydrologic model. In this study, we combined these two approaches to increase the accuracy of profile soil moisture estimation. A hydrologic model was used to analyze the errors in the estimation of soil moisture using the data collected during Huntsville '96 microwave remote sensing experiment in Huntsville, Alabama. Root mean square errors (RMSE) in soil moisture estimation increase by 22% with increase in the model input interval from 6 hr to 12 hr for the grass-covered plot. RMSEs were reduced for given model time step by 20-50% when model soil moisture estimates were updated using remotely-sensed data. This methodology has a potential to be employed in soil moisture estimation using rainfall data collected by a space-borne sensor, such as the Tropical Rainfall Measuring Mission (TRMM) satellite, if remotely-sensed data are available to update the model estimates.

Author

Soil Moisture; Remote Sensing; Hydrology Models; Error Analysis

20000032342 NASA Goddard Space Flight Center, Greenbelt, MD USA

Analysis of Information Content in High-Spectral Resolution Sounders using Subset Selection Analysis

Velez–Reyes, Miguel, Puerto Rico Univ., Puerto Rico; Joiner, Joanna, NASA Goddard Space Flight Center, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 354-359; In English; See also 20000032189

Contract(s)/Grant(s): NCCW-0088; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

In this paper, we summarize the results of the sensitivity analysis and data reduction carried out to determine the information content of AIRS and IASI channels. The analysis and data reduction was based on the use of subset selection techniques developed in the linear algebra and statistical community to study linear dependencies in high dimensional data sets. We applied the subset selection method to study dependency among channels by studying the dependency among their weighting functions. Also, we applied the technique to study the information provided by the different levels in which the atmosphere is discretized for retrievals

and analysis. Results from the method correlate well with intuition in many respects and point out to possible modifications for band selection in sensor design and number and location of levels in the analysis process.
Derived from text
Sensitivity; Data Reduction; Selection; High Resolution; Sounding

20000032349 NASA Goddard Space Flight Center, Greenbelt, MD USA
Development of a Coupled Hydrological/Sediment Yield Model for a Watershed at Regional Level
Rajbhandaril, Narayan, Alabama A & M Univ., USA; Crosson, William, NASA Goddard Space Flight Center, USA; Tsegaye, Teferi, Alabama A & M Univ., USA; Coleman, Tommy, Alabama A & M Univ., USA; Liu, Yaping, Alabama A & M Univ., USA; Soman, Vishwas, NASA Goddard Space Flight Center, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 388-393; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Development of a hydrologic model for the study of environmental conservation requires a comprehensive understanding of individual-storm affecting hydrologic and sedimentologic processes. The hydrologic models that we are currently coupling are the Simulator for Hydrology and Energy Exchange at the Land Surface (SHEELS) and the Distributed Runoff Model (DRUM). SHEELS runs continuously to estimate surface energy fluxes and sub-surface soil water fluxes, while DRUM operates during and following precipitation events to predict surface runoff and peak flow through channel routing. The lateral re-distribution of surface water determined by DRUM is passed to SHEELS, which then adjusts soil water contents throughout the profile. The model SHEELS is well documented in Smith et al. (1993) and Laymen and Crosson (1995). The model DRUM is well documented in Vieux et al. (1990) and Vieux and Gauer (1994). The coupled hydrologic model, SHEELS/DRUM, does not simulate sedimentologic processes. The simulation of the sedimentologic process is important for environmental conservation planning and management. Therefore, we attempted to develop a conceptual frame work for coupling a sediment yield model with SHEELS/DRUM to estimate individual-storm sediment yield from a watershed at a regional level. The sediment yield model that will be used for this study is the Universal Soil Loss Equation (USLE) with some modifications to enable the model to predict individual-storm sediment yield. The predicted sediment yield does not include wind erosion and erosion caused by irrigation and snow melt. Units used for this study are those given by Foster et al. (1981) for SI units.
Derived from text
Hydrology Models; Hydrological Cycle; Drainage; Water Flow; Sediments; Watersheds

20000032350 Maryland Univ., College Park, MD USA
Change Detection Analysis in Urban and Suburban Areas Using LANDSAT Thematic Mapper data: Case of Huntsville, Alabama
Kuan, Dana, Maryland Univ., USA; Fahsi, A., Alabama Agricultural and Mechanical Coll., USA; Steinfeld S., Pennsylvania State Univ., USA; Coleman, T., Alabama Agricultural and Mechanical Coll., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 394-399; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Two LANDSAT Thematic Mapper (TM) images, from July 1984 and July 1992, were used to identify land use/cover changes in the urban and suburban fringe of the city of Huntsville, Alabama. Image difference was the technique used to quantify the change between the two dates. The eight-year period showed a 16% change, mainly from agricultural lands to urban areas generated by the settlement of industrial, commercial, and residential areas. Visual analysis of the change map (i.e., difference image) supported this phenomenon by showing that most changes were occurring in the vicinity of the major roads and highways across the city.
Author
Change Detection; Land Use

20000032651 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
Search and Target Acquisition *Recherche et Acquisition d'Objectifs*
March 2000; 241p; In English, 21-23 Jun. 1999, Utrecht, Netherlands; See also 20000032652 through 20000032676
Report No.(s): RTO-MP-45; AC/323(SCI)TP/19; ISBN 92-837-1035-5; Copyright Waived; Avail: CASI; A11, Hardcopy; A03, Microfiche; C01, CD-ROM

This volume contains the Technical Evaluation Report, the Keynote Address, and the 26 unclassified papers, presented at the Workshop on Search and Target Acquisition, that was organised by the Systems Concepts and Integration (SCI) Panel 12 (the

former RSG-2), on ”Camouflage, Concealment and Deception Evaluation Techniques”, and that was held in Utreacht, the Netherlands, from 21-23 June 1999. The paper presented covered the following headings: search performance predictions, target acquisition mechanisms, and simulation issues
Derived from text
Conferences; Camouflage; Target Acquisition; Simulation; Detection; Performance Prediction; Tracking (Position)

20000032652 Georgia Tech Research Inst., Electro-Optics, Environment and Materials Lab., Atlanta, GA USA
Lessons Learned in Developing and Validating Models of Visual Search and Target Acquisition
Doll, Theodore J., Georgia Tech Research Inst., USA; Home, Richard, Defence Evaluation Research Agency, UK; Search and Target Acquisition; March 2000, pp. 1-1 - 1-8; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

Some shortcomings of past and current approaches for modeling human visual search and target acquisition (STA) are discussed. The effects of complex pattern perception, visual attention, learning, and cognition on STA performance are particularly emphasized. The importance of these processes is explained and approaches are suggested for modeling them. Guidelines are also provided for testing and validating models of visual search and target acquisition. These guidelines take into account the roles of pattern perception, visual attention, learning, and cognition in STA performance. The present paper also presents and compares alternative approaches to field testing for the purpose of model validation.
Author
Target Acquisition; Tracking (Position); Cognition; Detection; Target Recognition; Signature Analysis

20000032653 Granada Univ., Dept. de Ciencias de la Computacion e I.A., Spain
Visual Distinctness Determined by Partially Invariant Features
Garcia, J. A., Granada Univ., Spain; Fdez–Valdivia, J., Granada Univ., Spain; Fdez–Vidal, Xose R., Santiago Univ., Spain; Rodriguez–Sanchez, Rosa, Jaen Univ., Spain; Search and Target Acquisition; March 2000, pp. 2-1 - 2-12; In English; See also 20000032651
Contract(s)/Grant(s): CICYT-TIC97-1150; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper describes a system for the automatically learned partitioning of ”visual patterns” in digital images, based on a sophisticated, band-pass, filtering operation, with fixed scale and orientation sensitivity. The ”visual patterns” are defined as the features which have the highest degree of alignment in the statistical structure across different frequency bands. Here we show a computational visual distinctness measure computed from the image representational model based on visual patterns. It is applied to quantify the visual distinctness of targets in complex natural scenes. We also investigate the relation between the computational distinctness measure and the visual target distinctness measured by human observers.
Author
Images; Statistical Analysis; Detection; Target Acquisition; Viewing; Bandpass Filters; Tracking Filters; Optical Tracking

20000032654 California Inst. of Tech., Computation and Neural Systems Program, Pasadena, CA USA
Target Detection Using Saliency-Based Attention
Itti, Laurent, California Inst. of Tech., USA; Koch, Christof, California Inst. of Tech., USA; Search and Target Acquisition; March 2000, pp. 3-1 - 3-10; In English; See also 20000032651; Sponsored in part by HIMH; Copyright Waived; Avail: CASI; A02, Hardcopy

Most models of visual search, whether involving overt eye movements or covert shifts of attention, are based on the concept of a ”saliency map”, that is, an explicit two-dimensional map that encodes the saliency or conspicuity of objects in the visual environment. Competition among neurons in this map gives rise to a single winning location that corresponds to the next attended target. Inhibiting this location automatically allows the system to attend to the next most salient location. We describe a detailed computer implementation of such a scheme, focusing on the problem of combining information across modalities, here orientation, intensity and color information, in a purely stimulus-driven manner. We have successfully applied this model to a wide range of target detection tasks, using synthetic and natural stimuli. Performance has however remained difficult to objectively evaluate on natural scenes, because no objective reference was available for comparison. We here present predicted search times for our model on the Search2 database of rural scenes containing a military vehicle. Overall, we found a poor correlation between human and model search times. Further analysis however revealed that in 314 of the images, the model appeared to detect the target faster than humans (for comparison, we calibrated the model’s arbitrary internal time frame such that no more than 2-4 image locations were visited per second). It hence seems that this model, which had originally been designed not to find small, hidden

military vehicles, but rather to find the few most obviously conspicuous objects in an image, performed as an efficient target detector on the Search2 dataset.
Author
Target Acquisition; Mathematical Models; Image Processing; Optical Tracking; Target Recognition; Computer Techniques

20000032655 Army Communications-Electronics Command, Night Vision and Electronic Sensors Directorate, Fort Belvoir, VA USA
Applying the Law of Comparative Judgement to Target Signature Evaluation
McManamey, James R., Army Communications-Electronics Command, USA; Search and Target Acquisition; March 2000, pp. 4-1 - 4-8; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

The Law of Comparative Judgement (LCJ) is a psychophysical tool that can be used to scale complex phenomena that lack easily identified physical parameters. Target signatures represent such phenomena. In a demonstration exercise, a ”search difficulty” value was found using the LCJ. These LCJ scale values were compared to search times and probabilities of detection from a search experiment run in the Netherlands. The scale values were not linearly related to search time and probability of detection, but correlated very well with the logarithm of mean search time (r = 0.936) and the cube of the number of correct responses (r = 0.954). A chi-squared goodness-of-fit test gave 94.6% confidence in the fit of the LCJ scale to the experimental data. While the LCJ results in a scale with no natural zero point and arbitrary units, this tool can be used to construct a standard scale. This paper illustrates how a standard clutter scale might be constructed using the LCJ. The LCJ could be a valuable tool in target signature evaluation either when used in conjunction with scaling equations that permit conversion to familiar quantities such as mean search time and probability of detection, by providing relative ”search difficulty” values, or by making possible a psychophysically meaningful clutter scale.
Author
Target Acquisition; Clutter; Detection; Optical Tracking; Performance Prediction; Signature Analysis; Scene Analysis

20000032656 Danish Defence Research Establishment, Copenhagen, Denmark
CAMEVA: A Methodology for Estimation of Target Detectability
Birkemark, Christian M., Danish Defence Research Establishment, Denmark; Search and Target Acquisition; March 2000, pp. 5-1 - 5-8; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper will present a methodology for computerized evaluation of camouflage effectiveness. The methodology is implemented in software at Danish Defence Research Establishment (DDRE) under the acronym CAMEVA. Basic input is a single image comprising a highly resolved static target as well as a proper amount of representative background. Separate target and background images can also be handled. Target and background regions are manually selected using the computer’s standard pointing device (i.e. the mouse). From the input data, CAMEVA predicts the target detectability as a function of the target distance. The detectability estimate is based on statistical distributions of features extracted from the imagery, establishing a multidimensional feature space. In the feature space, the Bhattacharyaa distance measure is applied as an estimator of the separability between the target and the background. The intention is that the extracted features should resemble those applied during the human perception process. Typically, contrast and various measures of edge strength are applied. The Bhattacharyaa distance establishes a relative separability, while the absolute detection range is obtained by deriving a relation between the Bhattacharyaa distance and the estimated target resolution, at range. Thus by introducing parameters of the sensor, typically the human unaided eye, detectability as a function of the range is obtained. The methodology will not reflect individual observer performance but is aimed at providing an estimate of the optimal detection performance, given the selected set of features. During the choice of features and of sensor parameters, other perception mechanisms, than the human observer performance, can be modelled with this methodology. The paper will discuss theoretical and practical aspects of CAMEVA. Validation and application examples, including results on the NATO RTO/SCI-012 SEARCH-l and SEARCH-2 datasets, will be presented together with other data.
Author
Camouflage; Computer Programs; Target Acquisition; Optical Tracking; Target Recognition; Statistical Analysis; Computerized Simulation

20000032657 Prince Edward Island Univ., Charlottetown, Prince Edward Island Canada
Evaluation of Target Acquisition Difficulty Using Recognition Distance to Measure Required Retinal Area
Nilsson, Thomy, Prince Edward Island Univ., Canada; Search and Target Acquisition; March 2000, pp. 6-1 - 6-12; In English; See also 20000032651; Copyright Waived; Avail: CASI; A03, Hardcopy

The psychophysical method of limits was used to measure the distance at which observers could distinguish military vehicles photographed in natural landscapes. Obtained from the TNO-TM Search-2 dataset, these pictures either were rear-projected 35 mm slides or were presented on a computer monitor. Based on the rational that more difficult vehicle targets would require more visual pathways for recognition, difficulty of acquisition was defined in terms of the relative retinal area required for recognition. Relative retinal area was derived from the inverse square of the recognition distance of a particular vehicle relative to the distance of the vehicle that could be seen furthest away. Results are compared with data on the time required to find the vehicles in these pictures. These comparisons indicate that: (1) the two methods are complementary with respect to distinguishing different degrees of acquisition difficulty; (2) recognition distance thresholds can be a suitable means of defining standards for the effectiveness of vital graphic information.
Author
Target Acquisition; Optical Tracking; Target Recognition; Performance Prediction; Distance; Position (Location)

20000032658 Ben Gurion Univ. of the Negev, Dept. of Electrical and Computer Engineering, Beersheva, Israel
Evaluating TNO Human Target Detection Experimental Results Agreement With Various Image Metrics
Aviram, G., Ben Gurion Univ. of the Negev, Israel; Rotman, S. R., Ben Gurion Univ. of the Negev, Israel; Search and Target Acquisition; March 2000, pp. 7-1 - 7-6; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

An evaluation of the agreement between experimental results of human target detection performance, as obtained by TNO - Human Factors Research Institute, and various image metrics is addressed in this paper. Image metrics, such as local target from background distinctness metrics (DOYLE and TARGET), a global image complexity metric (POE), and a textural global / local co-occurrence matrix metric (ICON), are presented and applied to the TNO image database. Good agreement, denoted by relatively high correlation levels, is found between the experimental results (search rates and probabilities of detection) and both DOYLE and TARGET local image metrics values. On the other hand, a relatively low correlation level is obtained between the experimental results and the POE global image metric values. Correlation values obtained using the global / local ICON metric are between these extremes, as expected. These results emphasize the dominance of the target to background distinctness perceptual cue and the appropriateness of the local metrics to this kind of imagery. Furthermore. they can be used to formulate empirical classification rules that can be used to evaluate and predict human detection performance in similar cases.
Author
Target Acquisition; Human Performance; Target Recognition; Optical Tracking; Psychophysiology

20000032659 Army Communications-Electronics Command, Fort Belvoir, VA USA
Image Based Contrast-to-Clutter Modeling of Detection
Wilson, David L., Army Communications-Electronics Command, USA; Search and Target Acquisition; March 2000, pp. 8-1 - 8-5; In English; See also 20000032651; Copyright Waived; Avail: CASI; A01, Hardcopy

Using image-based metrics, contrast-to-clutter modeling is applied to the Search-2 visible image set and perception experiment data. to calculate the contrast metric, a new image is generated from the original image by replacing the target with an ”expected background” using the local background surrounding the target and the natural horizontal correlation present in most surface-to-surface scenes. The contrast metric is obtained from the difference of this new image and the original image. Via a simple mathematical formula, the ratio of the contrast measure to a clutter metric is used to predict performance.
Author
Clutter; Image Analysis; Image Contrast; Mathematical Models; Target Acquisition; Performance Prediction; Imagery; Target Recognition

20000032660 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, Germany
Efficient Methods for Validating Target Acquisition Models
Hecker, R., Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Search and Target Acquisition; March 2000, pp. 9-1 - 9-6; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

On the basis of target acquisition fundamentals the camouflage assessment model CAMAELEON is presented and especially demands, principles and methods for validating the model. by indirect varying the distance to a target using zoom techniques of telescopes effective methods for validating the model have been developed in the visual range as well as in the infrared range. The paper presents the results of validation studies in the visual range and results of CAMAELEON model calculations with the SEARCH DATA image set made available by the TNO Human Factors Research Institute. The results are discussed on the basis

of the underlying principles of the CAMAELEON model and the SEARCH DATA evaluations especially of visual lobe. Further investigations on the development of CAMAELEON are presented on the basis of the gathered experiences.
Author
Mathematical Models; Target Acquisition; Camouflage; Position (Location); Target Recognition; Optical Tracking; Visual Perception

20000032661 National Defence Research Establishment, Div. of Command and Control Warfare Technology, Linkoeping, Sweden
Assessing Camouflage Methods Using Textural Features
Nyberg, Sten, National Defence Research Establishment, Sweden; Schutte, Klamer, Physics and Electronics Lab. TNO, Netherlands; Search and Target Acquisition; March 2000, pp. 10-1 - 10-10; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

Developments in the area of signature suppression make it progressively more difficult to recognize targets. In order to obtain a sufficient low degree of false alarms it is necessary to observe spatial and spectral properties. There is a genuine need to use spatial properties when analyzing the difference between a target area and a background area. This is more relevant today since modern signature suppression techniques have focused on the reduction of distinct features, like hot spots in the infrared band. The approach is to apply texture descriptors to characterize the background and also more or less camouflaged targets. In addition, other descriptors are used to characterize man made objects. It is necessary to focus on features which discriminate targets from the background, and this demands a more precise description of the background and the targets than usual. The underlying assumption is that an area with more or less observable targets has different statistical properties from other areas. Statistical properties together with detected target specific features like straight lines, edges, corners or perhaps reflections from a window have to be combined with methods used in data fusion. Experiments with a computer program that estimates the statistical differences between targets and background are described. These differences are computed using a number of different distance measures. 44 images from the Search-2 image data set are used and mean search time and number of hits are predicted using textural features. The long term goal is to find methods for assessing signature suppression methods, especially in the infrared wavelength area.
Author
Camouflage; Computer Programs; Optical Tracking; Target Recognition; Statistical Distributions; Target Acquisition; Performance Prediction; Textures; Visual Perception

20000032662 NASA Ames Research Center, Moffett Field, CA USA
Image Discrimination Models for Object Detection in Natural Backgrounds
Ahumada, A. J., Jr., NASA Ames Research Center, USA; Search and Target Acquisition; March 2000, pp. 11-1 - 11-3; In English; See also 20000032651
Contract(s)/Grant(s): RTOP 548-50-12; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper reviews work accomplished and in progress at NASA Ames relating to visual target detection. The focus is on image discrimination models, starting with Watson's pioneering development of a simple spatial model and progressing through this model's descendents and extensions. The application of image discrimination models to target detection will be described and results reviewed for Rohaly's vehicle target data and the Search 2 data. The paper concludes with a description of work we have done to model the process by which observers learn target templates and methods for elucidating those templates.
Author
Target Acquisition; Mathematical Models; Optical Tracking; Target Recognition; Discrimination; Image Processing; Visual Perception

20000032663 Turing Associates, Inc., Ann Arbor, MI USA
A Contrast Metric for 3-D Vehicles in Natural Lighting
Witus, G., Turing Associates, Inc., USA; Gerhart, G., Army Tank-Automotive and Armaments Command, USA; Search and Target Acquisition; March 2000, pp. 12-1 - 12-10; In English; See also 20000032651
Contract(s)/Grant(s): DAAE07-97-C-X101; Copyright Waived; Avail: CASI; A02, Hardcopy

Ground vehicles in natural lighting tend to have significant and systematic variation in luminance over the presented area. This arises, in large part, from the vehicle surfaces having different orientations and shadowing relative to the source of illumination and the position of the observer. These systematic differences create the appearance of a structured 3-D object. 3-D appearance is an important factor in search, figure-ground segregation and object recognition. This paper presents a contrast metric based on the 3-D structure of the vehicle, and an analysis of search performance for the Search-2 imagery. The analysis

employs the traditional P-infinity-times-negative-exponential model of search time distribution. P-infinity and mean search time are modeled as functions of the target signature. The signature metric is one over the product of vehicle size and contrast. The value of the metric is measured by the ability to account for variance in observed search performance. The 3-D structure contrast metric performs better than RSS contrast, and both perform dramatically better than the area- weighted average contrast. Target height performs better than either target area or square root of area. The signature metric accounts for over 80% of the variance in probability of detection and 75% of the variance in search time as measured in the TNO perception tests. When false alarm effects are discounted, the metric accounts for 89% of the variance in probability of detection and 95% of the variance in search time. The predictive power of the signature metric when it is calibrated to half the data and evaluated against the other half, is 90% of the explanatory power.
Author
Three Dimensional Bodies; Target Recognition; Optical Tracking; Luminance; Imagery; Mathematical Models; Surface Vehicles; Target Acquisition; Visual Perception; Image Contrast

20000032664 British Aerospace Aircraft Group, Bristol, UK
The Sources of Variability in the Search Process
Cooke, K., British Aerospace Aircraft Group, UK; Search and Target Acquisition; March 2000, pp. 14-1 - 14-12; In English; See also 20000032651; Copyright Waived; Avail: CASI; A03, Hardcopy

Modelling of camouflage concealment and detection, needs to consider the terrain in which a target will appear. A variety of capabilities for evaluating target signatures through to the human response now exists. The modelling approach adopted at British Aerospace research centre for many years has been a statistical one. Although image analysis techniques have been explored it has been cost effective for our purposes to stay with the statistical model ORACLE. A complex problem in modelling human visual performance is to find an adequate relationship between recognition thresholds across the visual field and simple target descriptions. The ORACLE model represents recognition as the resolution of a fraction of the target perimeter. The fractional perimeter concept has been applied further to representing average observer performance in structured scenes. Modelling of the SEARCH 2 data 2 was found to need a similar distribution of fractional perimeter values to a previous UK field trial. The use of a statistical lobe model for analysing search and recognition can be supported for generic information.
Author
Human Performance; Mathematical Models; Visual Perception; Optical Tracking; Target Recognition; Camouflage; Visual Observation

20000032665 Texas Univ., Dept. of Psychology, Austin, TX USA
Image Structure Models of Texture and Contour Visibility
Geisler, Wilson S., Texas Univ., USA; Thornton, Thomas, Texas Univ., USA; Gallogly, Donald P., Texas Univ., USA; Perry, Jeffrey S., Texas Univ., USA; Search and Target Acquisition; March 2000, pp. 15-1 - 15-8; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

The perceptual mechanisms underlying texture and contour grouping/segregation play a dominant role in determining the visibility of targets in complex backgrounds. In most quantitative models of texture segregation the image is initially processed by channels selective along certain fundamental stimulus dimensions such as spatial frequency and orientation. These channels generally contain a nonlinearity, such as full-wave rectification, so that they signal the local contrast energy within the bandpass of the channel. Another stage of linear filtering, followed by a simple edge finding or thresholding mechanism, is then applied to the channel outputs to find the texture boundaries or regions. Although these channel-energy models have been successful in predicting texture segregation and discrimination performance for some classes of stimuli, there are large classes of stimuli that are readily segregated by human observers but which cannot be segregated by channel energy. The evidence suggests that more sophisticated models incorporating perceptual organization mechanisms will be required to predict human texture and contour segregation performance. This paper describes new experimental evidence, and a working model which, in principle, can account for a wider range of human segregation and grouping capabilities. The premise of the model is that the visual system typically extracts rich descriptions of local image structure, and that it uses these descriptions for subsequent segregation and grouping. The model contains physiologically-based low level mechanisms for extracting primitives, matching mechanisms for detecting structural similarity, and grouping mechanisms for binding structural parts into wholes. Quantitative predictions of the model for contour segregation performance are presented.
Author
Mathematical Models; Visibility; Textures; Human Performance; Target Recognition; Contours; Visual Perception; Visual Observation

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Comparing Human Target Detection With Multidimensional Matched Filtering Methods

Krebs, W. K., Naval Postgraduate School, USA; Scribner, D. A., Naval Research Lab., USA; McCarley, J. S., Naval Postgraduate School, USA; Ogawa, J. S., Naval Postgraduate School, USA; Sinai, M. J., Naval Postgraduate School, USA; Search and Target Acquisition; March 2000, pp. 16-1 - 16-7; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

Recent technological advances in sensor manufacturing enable the use of separate spectral bands; e.g., MWIR and LWIR, to generate spatially registered imagery. Human factors experiments can be used to test whether a sensor can improve operator performance for detecting or recognizing a target. Although human factors experiments are of tremendous value, these tests are time consuming and resource intensive. In order to reduce costs associated with collecting behavioral data, an alternative approach is discussed. We propose using signal detection theory, to compliment and reduce the amount of classical human performance testing. As a test case we have studied whether multi-spectral sensors are significantly better than single band sensors. Scribner, Satyshur, and Kruer (1993) demonstrated that a two-dimensional matched filter (spatial) optimized for a specific target and background power spectra, can be used to estimate an observer's ability to detect the target embedded in a cluttered background. Three different background images were used with, and without, a target present. False alarm and target detection probabilities were computed and results were plotted on a Receiver Operating Characteristic (ROC) curve. The matched filter ROC curves were then compared to behavioral ROC curves. Results showed that the matched filter ROC curves were similar to behavioral ROC curves with color fusion and long-wave infrared showing the highest sensitivity and mid-wave and short-wave infrared scenes were significantly less sensitive. These results indicate that the matched filter analysis may be used to model human behavior. Author

Operator Performance; Target Acquisition; Matched Filters; Signal Detection; Visual Perception; Visual Tasks; Target Recognition; Visual Observation; Imagery

20000032667 Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD USA

Detection of Low-Contrast Moving Targets

Mazz, John P., Army Materiel Systems Analysis Activity, USA; Kistner, Regina W., Army Materiel Systems Analysis Activity, USA; Pibil, William T., Army Materiel Systems Analysis Activity, USA; Search and Target Acquisition; March 2000, pp. 17-1 - 17-5; In English; See also 20000032651; Copyright Waived; Avail: CASI; A01, Hardcopy

The U.S. Army Materiel Systems Analysis Activity (USAMSAA) designed a perception experiment to assess the influence of target angular velocity on the detectability of low to moderate contrast targets. The Moving Target Experiment II (MTE II) was designed to be representative of search with the unaided eye. Target angular velocity, range, contrast, and background were varied. Targets with near-equal contrast at identical range and angular velocity yielded widely different probabilities of detection. However, within a specific background region, contrast had a significant impact. This localized impact of target contrast indicates that further improvements in search and target acquisition modeling requires the evaluation of scene-content's impact on target detection (i.e., what about the scene leads an observer to the vicinity of the target.) For low-contrast targets, scene content has even greater impact on detection. The U.S. Army's standard methodology for representing search and target acquisition in combat models is the ACQUIRE model, Current implementations of ACQUIRE utilize the "two-thirds rule" to represent the detection of all moving targets regardless of angular velocity. The n50 for the detection of moving targets is simply 213 of the n50 used to represent the detection of stationary targets, Results of the MTE II and other experiments indicate that the appropriate ratio of moving-to-stationary n50 decreases as a function of angular velocity. A ratio of 2/3 equates to an angular velocity of 1 milli-radian/sec and a ratio of 113 equates to an angular velocity of 3.3 milli-radians/sec.
Author

Target Recognition; Moving Target Indicators; Visual Perception; Optical Tracking; Image Contrast; Mathematical Models; Visual Observation; Visual Acuity

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Validation and Verification of a Visual Model for Central and Peripheral Vision

Peli, Eli, Harvard Medical School, USA; Geri, George A., Raytheon Training and Services Co., USA; Search and Target Acquisition; March 2000, pp. 18-1 - 18-10; In English; See also 20000032651

Contract(s)/Grant(s): F41624-97-D-5000; NIH-EY-05957; NIH-EY-10285; Copyright Waived; Avail: CASI; A02, Hardcopy

Many computational visual models use the contrast sensitivity function (CSF) to represent certain visual characteristics of the observer. In addition, these models are often implemented using a multi-scale, band-limited representation of image contrast. The purpose of the present study was to evaluate a previously described visual model (Peli, JOSA A, 7, 2030, 1990) by comparing the appearance of an image viewed at various distances with simulations of that image corresponding to the same distances generated with the model. Among the unique characteristics of this model are that it applies a threshold (i.e. nonlinear) CSF and

a locally normalized, band-limited contrast. Since CSFs can vary substantially depending both on the stimuli and the testing method used to measure them, the model was evaluated using several CSFs. The model was also evaluated for both central images, extending to 2 deg. eccentricity, and peripheral images, extending from 8 deg. to 32 deg. eccentricity. Changes in the images with eccentricity were modeled by a single parameter. For the central (2 deg.) stimuli, the CSF obtained with 1-octave Gabor stimuli and a contrast detection task provided better simulations than the other CSFs tested. In addition, data obtained using both lower and higher contrast versions of the same images verified the CSF over a wide range of frequencies and indicated that the model was sensitive to small variations in the chosen CSF. For the peripheral (6.4-32 deg.) stimuli, the same l-octave, detection CSF was found to provide the best simulation. In general, the model suggested by Peli (1990) performed well for both the central and peripheral visual targets, suggesting that the use of a nonlinear CSF and locally normalized contrast are valid. Further, the performance of the model for the peripheral stimuli suggests that, at least for the simple discrimination task used here, differences in image detail across wide-field images can be modeled using a single eccentricity-dependent parameter in addition to the foveal CSF.
Author
Mathematical Models; Simulation; Visual Perception; Peripheral Vision; Target Recognition; Visual Discrimination

20000032669 Physics and Electronics Lab. TNO, The Hague, Netherlands
Modelling of Target Acquisition Within Combat Simulation and Wargames
Vink, Jan, Physics and Electronics Lab. TNO, Netherlands; Search and Target Acquisition; March 2000, pp. 19-1 - 19-3; In English; See also 20000032651; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper describes the target acquisition process from the perspective of modelling target acquisition as a part of modelling combat. Exchanging fire obviously is very important in combat. Conditions for direct fire are line-of-sight (LOS) and some kind of perception of the intended target. LOS is deterministic and can be calculated if there is a good digital representation of the terrain. But perception is considered a stochastic process with probabilities depending on the current situation. In most stochastic combat simulation programmes and wargames there is a module that models detection and perception. Because of the dynamic character of combat situations for observing are changing rapidly. The models are calculating situations every x seconds (typical 5 - 30). Within such a timeframe occurrences of events and the effects of these events are calculated. Illustrative events are new observations, firings, etc. The target acquisition module is responsible for an actual list of observations. Each time-frame the list is updated: old observations are checked (observers or targets can be killed or moved) and new observations can be added. Because of the dynamic character only calculations are made for the coming time-frame. For each observer and each potential target an observation probability is calculated and comparison with a random number determines if the considered observer/target will lead to a new observation. Input for this module are elements of the situation at hand and characteristics of observer (such as the sensor used) and target (such as its dimensions). This paper addresses some of the limitations and problems of the current implementation of the target acquisition module.
Author
Mathematical Models; War Games; Target Acquisition; Simulation; Combat; Line of Sight; Target Recognition

20000032673 Defence Clothing and Textiles Agency, Science and Technology Div., Colchester, UK
Methods for Deriving Optimum Colours for Camouflage Patterns
Mitchell, K. D., Defence Clothing and Textiles Agency, UK; Staples, C. R., Defence Clothing and Textiles Agency, UK; Search and Target Acquisition; March 2000, pp. 23-1 - 23-4; In English; See also 20000032651; Copyright Waived; Avail: CASI; A01, Hardcopy

The majority of camouflage patterns have been designed subjectively with only the colour aspect conforming to certain constraints such as average colour and luminance. Given the power of modern computing it should be possible to design scenario specific camouflage from calibrated colour imagery. The Defence Clothing and Textiles Agency is at present working on such a system. This capability will allow us to design and test patterns in a digital environment before field trials are carried out. This system will allow us to design patterns for specific scenarios such as coniferous treelines, deciduous treelines, summer, winter etc. It should also lead to highly effective patterns, as early validation can be carried out using a target detection model followed by photosimulation using a digital implantation technique. Once validated in the digital environment, a field trial using live observers can be carried out. In the design of a pattern, there are two major factors to take into account: the multi-level structure of a background and the many colours present. A method of designing scenario specific patterns needs to reduce the many hundreds of colours to a workable number of colour centres, usually between three and six. There is also the need to assess the structure present and produce a structure for the pattern, which should be multi-level to allow the pattern to be effective at various

ranges. In this paper, we will review the results obtained from the initial study on reduction of the number of colours and colour centre choice.
Author
Camouflage; Target Acquisition; Color; Target Recognition; Imagery; Mathematical Models

20000032755 NASA Goddard Space Flight Center, Greenbelt, MD USA
Atmospheric Science Measurements by the EOS Geoscience Laser Altimeter System
Spinhirne, James, NASA Goddard Space Flight Center, USA; [1999]; 2p; In English; Optical Remote Sensing of the Atmosphere, 21-25 Jun. 1999, Santa Barbara, CA, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Scheduled for Launch in July 2001, the Geoscience Laser Altimeter System (GLAS) is to be the first satellite instrument to provide full global lidar profiling of clouds and aerosol in the earth's atmosphere. GLAS is an EOS program instrument that is on its own satellite, now called the Ice, Cloud and land Elevation Satellite. The instrument is both a surface laser ranging system and an atmospheric profiling lidar. A most important surface measurement for the instrument is to study the change in the mass balance of the polar ice sheets by measuring the change in regional altitudes to an accuracy of 1.5 cm per year. The strategy to combine the surface measurement with a Cloud and aerosol lidar profiling mission is based on the compatibility of the altimetry instrument requirements with those for the required lidar measurements. The primary atmospheric science goal of the GLAS cloud and aerosol measurement is to determine the radiative forcing and vertically resolved atmospheric heating rate due to cloud and aerosol by directly observing the vertical structure and magnitude of cloud and aerosol parameters that are important for the radiative balance of the earth-atmosphere system, but which are ambiguous or impossible to obtain from existing or planned passive remote sensors. A further goal is to directly measure the height of atmospheric transition layers (inversions) which are important for dynamics and mixing, the planetary boundary layer and lifting condensation level.
Derived from text
Atmospheric Physics; Geophysics; Laser Altimeters; Earth Observing System (EOS); Clouds (Meteorology); Aerosols; Remote Sensors

20000032808 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Use of Multi-Source Satellite and Geospatial Data to Study the Effect of Urbanization of Primary Productivity in the USA
Imhoff, M. L., NASA Goddard Space Flight Center, USA; Tucker, C. J., NASA Goddard Space Flight Center, USA; Lawrence, W. T., NASA Goddard Space Flight Center, USA; Stutzer, D., NASA Goddard Space Flight Center, USA; Rusin, Robert, NASA Goddard Space Flight Center, USA; [2000]; 26p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Data from two different satellites, a digital land cover map, and digital census data were analyzed and combined in a geographic information system to study the effect of urbanization on photosynthetic vegetation productivity in the USA. Results show that urbanization can have a measurable but variable impact on the primary productivity of the land surface. Annual productivity can be reduced by as much as 20 days in some areas, but in resource limited regions, photosynthetic production can be enhanced by human activity. Overall, urban development reduces the productivity of the land surface and those areas with the highest productivity are directly in the path of urban sprawl.
Author
Urban Development; Land Use; Productivity; USA

20000032809 NASA Goddard Space Flight Center, Greenbelt, MD USA
Southern Africa Validation of NASA's Earth Observing System (SAVE EOS)
Privette, Jeffrey L., NASA Goddard Space Flight Center, USA; [2000]; 4p; In English; 28th; Remote Sensing, 27-31 Mar. 2000, Cape Town, South Africa; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Southern Africa Validation of EOS (SAVE) is 4-year, multidisciplinary effort to validate operational and experimental products from Terra-the flagship satellite of NASA's Earth Observing System (EOS). At test sites from Zambia to South Africa, we are measuring soil, vegetation and atmospheric parameters over a range of ecosystems for comparison with products from Terra, LANDSAT 7, AVHRR and SeaWiFS. The data are also employed to parameterize and improve vegetation process models. Fixed-point and mobile "transect" sampling are used to collect the ground data. These are extrapolated over larger areas with fine-resolution multispectral imagery. We describe the sites, infrastructure, and measurement strategies developed underSAVE, as well as initial results from our participation in the first Intensive Field Campaign of SAFARI 2000. We also describe SAVE's role in the Kalahari Transect Campaign (February/March 2000) in Zambia and Botswana.
Author
Soil Science; Vegetation; Africa; Zambia; Botswana; Kalahari Basin (Africa); Republic of South Africa

20000032956 NASA Goddard Space Flight Center, Greenbelt, MD USA

Surface Soil Moisture Retrieval Using SSM/I and Its Comparison with ESTAR: A Case Study Over a Grassland Region

Jackson, T., USDA-ARS Hydrology Lab., USA; Hsu, A. Y., Science Systems and Applications, Inc., USA; ONeill, P. E., NASA Goddard Space Flight Center, USA; [1999]; 34p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study extends a previous investigation on estimating surface soil moisture using the Special Sensor Microwave/Imager (SSM/I) over a grassland region. Although SSM/I is not optimal for soil moisture retrieval, it can under some conditions provide information. Rigorous analyses over land have been difficult due to the lack of good validation data sets. A scientific objective of the Southern Great Plains 1997 (SGP97) Hydrology Experiment was to investigate whether the retrieval algorithms for surface soil moisture developed at higher spatial resolution using truck-and aircraft-based passive microwave sensors can be extended to the coarser resolutions expected from satellite platform. With the data collected for the SGP97, the objective of this study is to compare the surface soil moisture estimated from the SSM/I data with those retrieved from the L-band Electronically Scanned Thinned Array Radiometer (ESTAR) data, the core sensor for the experiment, using the same retrieval algorithm. The results indicated that an error of estimate of 7.81% could be achieved with SSM/I data as contrasted to 2.82% with ESTAR data over three intensive sampling areas of different vegetation regimes. It confirms the results of previous study that SSM/I data can be used to retrieve surface soil moisture information at a regional scale under certain conditions.

Author

Grasslands; Microwave Imagery; Microwave Sensors; Radiometers; Remote Sensing; Soil Moisture

20000033004 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

On-Line Learning Algorithms

Tajika, Ichiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 165-168; In Japanese; Copyright; Avail: Issuing Activity

In this paper, we investigate some subjects concerning the mechanism of learning process based on the two kinds of learning models, the PAC learning model and the on-line prediction model. First, we provide a framework in which we use the mutual information between a target concept and a hypothesis to measure the accuracy of a hypothesis. Using this measure, we introduce a notion of mutual information gaining (MI-gaining) algorithms and explore their relation to PAC-learning algorithms. Furthermore, we give a boosting scheme that transforms a weak MI-gaining algorithm into a strong MI-gaining algorithm. Secondly, we extend an on-line prediction model, in which an algorithm predicts a binary value by combining the predictions of several prediction strategies, by introducing the notion of the confidence parameter for prediction. That is, both the prediction algorithm and experts are required to make bets on their predictions. We give an efficient on-line prediction algorithm that, achieves almost the same performance as the best expert. Thirdly, we generalize the on-line portfolio selection model, in which an algorithm invests several stocks each trading day and competes with the best investment strategy that maintains a fixed investment proportions on the whole trading days, to the one where investment strategies partition the whole trading days into several segments and switch investment proportions for each segment. We give an efficient on-line investment algorithm that achieves almost the same performance as the best investment strategy.

Author

On-Line Systems; Machine Learning; Algorithms; Performance Prediction; Mathematical Models

20000033365 NASA Goddard Space Flight Center, Greenbelt, MD USA

Characteristics of Forests in Western Sayani Mountains, Siberia from SAR Data

Ranson, K. Jon, NASA Goddard Space Flight Center, USA; Sun, Guoqing, Maryland Univ., USA; Kharuk, V. I., Sukachev Inst. of Forest, Russia; Kovacs, Katalin, Maryland Univ., USA; [1998]; 25p; In English

Contract(s)/Grant(s): NAG5-3548; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper investigated the possibility of using spaceborne radar data to map forest types and logging in the mountainous Western Sayani area in Siberia. L and C band HH, HV, and VV polarized images from the Shuttle Imaging Radar-C instrument were used in the study. Techniques to reduce topographic effects in the radar images were investigated. These included radiometric correction using illumination angle inferred from a digital elevation model, and reducing apparent effects of topography through band ratios. Forest classification was performed after terrain correction utilizing typical supervised techniques and principal component analyses. An ancillary data set of local elevations was also used to improve the forest classification. Map accuracy for each technique was estimated for training sites based on Russian forestry maps, satellite imagery and field measurements. The results indicate that it is necessary to correct for topography when attempting to classify forests in mountainous terrain. Radiometric correction based on a DEM (Digital Elevation Model) improved classification results but required reducing the SAR

(Synthetic Aperture Radar) resolution to match the DEM. Using ratios of SAR channels that include cross-polarization improved classification and
Author
Synthetic Aperture Radar; Forests; Mountains; Radar Data; Siberia

44
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.

20000032169 National Inst. of Standards and Technology, (BFRL), Gaithersburg, MD USA
Water-to-Water Heat Pump Using Hydrocarbon and Hydrofluorocarbon Zeotropic Mixtures with and Without an Internal Heat Exchanger
Payne, W. V.; Silk, E. A.; Domanski, P. A.; Jan. 2000; 90p; In English
Report No.(s): PB2000-103324; NISTIR-6449; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This investigation overviews the results of an experimental study pertaining to flammable refrigerant alternatives in water-to-water heat pumps for building and home applications. The system studied used a secondary heat transfer loop to communicate with the indoor space. The present study emphasizes the performance of R32/290, R22, R290, and R22-REF (direct expansion case) in the cooling and heating modes. The vapor compression cycle used an internal heat exchanger added between the liquid and vapor lines. Fluid performance as a function of thermophysical properties and heat transfer characteristics are addressed for each cycle configuration.
NTIS
Heat Pumps; Heat Exchangers; Hydrocarbons; Water; Fluorocarbons; Mixtures

20000032796 Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas, Madrid, Spain
Preparation and Characterisation of Amorphous-silicon Photovoltaic Devices Having Microcrystalline Emitters
Gutierrez, M.; Gandia, J.; Carabe, J.; Dec. 31, 1999; 23p; In Spanish; In English
Report No.(s): DE99-772173; CIEMAT-901; No Copyright; Avail: Department of Energy Information Bridge
The present work summarises the essential aspects of the research carried out so far at CIEMAT on amorphous-silicon solar cells. The experience accumulated on the preparation and characterisation of amorphous and microcrystalline silicon has allowed to start from intrinsic (absorbent) and p- and n-type (emitters) materials not only having excellent optoelectronic properties, but enjoying certain technological advantages with respect to those developed by other groups. Among these are absorbent-layer growth rates between 5 and 10 times as fast as conventional ones and microcrystalline emitters prepared without using hydrogen. The preparation of amorphous-silicon cells has required the solution of a number of problems, such as those related to pinholes, edge leak currents and diffusion of metals into the semiconductor. Once such constraints have been overcome, it has been demonstrated not only that the amorphous-silicon technology developed at CIEMAT is valid for making solar cells, but also that the quality of the semiconductor material is good for the application according to the partial results obtained. The development of thin-film laser-scribing technology is considered essential. Additionally it has been concluded that cross contamination, originated by the fact of using a single-chamber reactor, is the basic factor limiting the quality of the cells developed at CIEMAT. The present research activity is highly focused on the solution of this problem.
NTIS
Amorphous Silicon; Crystallinity; Microcrystals; Emitters; Photovoltaic Conversion

20000032814 Ballistic Missile Defense Organization, Washington, DC USA
BMDO Photovoltaics Program Overview
Caveny, Leonard H., Ballistic Missile Defense Organization, USA; Allen, Douglas M., Schafer (W. J.) Associates, Inc., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 13-21; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Concentrator solar arrays provide significant benefits to future BMDO missions: (1) low cost; (2) lightweight; and (3)radiation resistant. BMDO approach is to develop flight test modules and arrays to demonstrate technology maturity. Space concentrator arrays will provide significant cost and mass advantages to a range of commercial satellite programs.
Author
Concentrators; Solar Arrays; Photovoltaic Conversion; Quantitative Analysis

20000032815 Department of the Air Force, Kirtland AFB, NM USA
Air Force Activities in Space Photovoltaic Power System Technology
Gaffney, Kelly, Department of the Air Force, USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 23-30; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The paper discusses the following: life cycle cost and development of photovoltaics devices, solar cells power technologies as both cost and weight reduction tools, technology transition path for tandem cells and advanced arrays. Also discusses the development of advanced thin-film cell, and flight test solar cell assessment.
CASI
Life Cycle Costs; Photovoltaic Conversion; Weight Reduction; Solar Cells

20000032816 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
Europe's Space Photovoltaics Programme
Bogus, Klaus P., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 35-39; In English; See also 20000032812; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Europe has had a very successful record in the field of space photovoltaics and has achieved a competitive position in the world market. For a large variety of European spacecraft systems photovoltaic solar generators are the exclusive source of electrical power and additionally, Europe has succeeded in exporting solar arrays across the Atlantic (e.g. IUE, Hubble Space Telescope, CTS - Hermes and INTELSAT). The main purpose of the space photovoltaic technology development programme is to maintain the high standard of European solar array technology by carefully modernizing the existing concepts in a step-wise approach. The smooth introduction of new technologies into flight programmes is achieved by close cooperation between technologists and project engineers. The close coupling of the technology programme to the European mission scenario for the next 10 years is perfectly in line with the approach described above and leads to a fast application cycle of new technologies. A disadvantage of this approach is the resulting low priority for globally attractive new technologies which are not directly required in the ESA mission scenario with R's limited scope.
Author
Solar Arrays; Photovoltaic Conversion; Standardization; European Space Agency; Technology Utilization; Technology Transfer

20000032817 Research Triangle Inst., Research Triangle Park, NC USA
High-Efficiency, Deep-Junction, Epitaxial InP Solar Cells on (100) and (111)B InP Substrates
Venkatasubramanian, R., Research Triangle Inst., USA; Timmons, M. L., Research Triangle Inst., USA; Hutchby, J. A., Research Triangle Inst., USA; Walters, R., Naval Research Lab., USA; Summers, G., Naval Research Lab., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 43-51; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We report on the development and performance of deep-junction (approx. 0.25 microns), graded-emitter-doped, n(+) - p InP solar cells grown by metallorganic chemical vapor deposition (MOCVD). A novel, diffusion-transport process for obtaining lightly-doped p-type base regions of the solar cell is described. The I-V data and external quantum-efficiency response of these cells are presented. The best active-area AMO efficiency for these deep-junction cells on (100)-oriented InP substrates is 16.8%, with a J(sub SC) of 31.8 mA/sq cm, a V(sub OC) of 0.843 V, and a fill-factor of 0.85. by comparison, the best cell efficiency on the (111)B-oriented InP substrates was 15.0%. These efficiency values for deep-junction cells are encouraging and compare favourably with performance of thin-emitter (0.03 microns) epitaxial cells as well as that of deep-emitter diffused cells. The cell performance and breakdown voltage characteristics of a batch of 20 cells on each of the orientation are presented, indicating the superior breakdown voltage properties and other characteristics of InP cells on the (111)B orientation. Spectral response, dark I-V data, and photoluminescence (PL) measurements on the InP cells are presented with an analysis on the variation in J(sub SC) and V(sub OC) of the cells. It is observed, under open-circuit conditions, that lower-V(sub OC)oc cells exhibit higher band-edge PL

intensity for both the (100) and (111)B orientations. This anomalous behaviour suggests that radiative recombination in the heavily-doped n(+) - InP emitter may be detrimental to achieving higher V(sub OC) in n(+) - p InP solar cells.
Author
Solar Cells; Product Development; Fabrication; Performance Tests; Indium Phosphates; Metalorganic Chemical Vapor Deposition

20000032818 Houston Univ., TX USA
Chemical Beam Epitaxy for High Efficiency Photovoltaic Devices
Bensaoula, A., Houston Univ., USA; Freundlich, A., Houston Univ., USA; Vilela, M. F., Houston Univ., USA; Medelci, N., Houston Univ., USA; Renaud, P., Houston Univ., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 53-61; In English; See also 20000032812; Sponsored in part by IST, Inc.
Contract(s)/Grant(s): 93-03652-260; 93-003652-236; 91-03652-243; 93-003652-224; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

InP-based multijunction tandem solar cells show great promise for high conversion efficiency (eta) and high radiation resistance. InP and its related ternary and quaternary compound semiconductor's such as InGaAs and InGaAsP offer desirable combinations of energy bandgap values which are very suitable for multijunction tandem solar cell applications. The monolithically integrated InP/In(0.53)Ga(0.47)As tandem solar cells are expected to reach efficiencies above 30%. Wanlass et al. have reported AMO efficiencies as high as 20.1% for two terminal cells fabricated using atmospheric-pressure metalorganic vapor phase epitaxy (APMOVPE). The main limitations in their technique are first related to the degradation of the intercell ohmic contact (IOC), in this case the ln(0.53)Ga(0.47)As tunnel junction during the growth of the top InP subcell structure, and second to the current matching, often limited by the ln(0.53)Ga(0.47As bottom subcell. Chemical beam epitaxy (CBE) has been shown to allow the growth of high quality materials with reproducible complex compositional and doping profiles. The main advantage of CBE compared to metalorganic chemical vapor deposition (MOCVD), the most popular technique for InP-based photovoltaic device fabrication, is the ability to grow high purity epilayers at much lower temperatures (450 C - 530 C). In a recent report (Yamaguchi et al) have shown that cost-wise CBE is a breakthrough technology for photovoltaic (PV) solar energy applications. Through the research effort undertaken in our laboratory, we have seen a rapid progress in the energy conversion efficiency of InP-based solar cells fabricated using chemical beam epitaxy. This communication summarizes our recent results on PV devices and demonstrates the strength of this new technology.
Author
Photovoltaic Conversion; Energy Technology; Energy Conversion Efficiency; Indium Gallium Arsenides; Metalorganic Chemical Vapor Deposition; Solar Cells; Vapor Phase Epitaxy

20000032819 NASA Lewis Research Center, Cleveland, OH USA
Status of Diffused Junction p(+)n InP Solar Cells for Space Applications
Faur, Mircea, Cleveland State Univ., USA; Faur, Maria, NYMA, Inc., USA; Flood, D. J., NASA Lewis Research Center, USA; Brinker, D. J., NASA Lewis Research Center, USA; Goradia, C., Cleveland State Univ., USA; Fatemi, N. S., NYMA, Inc., USA; Jenkins, P. P., NYMA, Inc., USA; Wilt, D. M., NASA Lewis Research Center, USA; Bailey, S., NASA Lewis Research Center, USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 63-79; In English; See also 20000032812; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Recently, we have succeeded in fabricating diffused junction p(+)n(Cd,S) InP solar cells with measured AMO, 25 C open circuit voltage (V(sub OC)) of 887.6 mV, which, to the best of our knowledge, is higher than previously reported V(sub OC) values for any InP homojunction solar cells. The experiment-based projected achievable efficiency of these cells using LEC grown substrates is 21.3%. The maximum AMO, 25 C efficiency recorded to date on bare cells is, however, only 13.2%. This is because of large external and internal losses due to non-optimized front grid design, antireflection (AR) coating and emitter thickness. This paper summarizes recent advances in the technology of fabrication of p(+)n InP diffused structures and solar cells, resulted from a study undertaken in an effort to increase the cell efficiency. The topics discussed in this paper include advances in: 1) the formation of thin p(+) InP:Cd emitter layers, 2) electroplated front contacts, 3) surface passivation and 4) the design of a new native oxide/AI203/MgF2 three layer AR coating using a chemically-grown P-rich passivating oxide as a first layer. Based on the high radiation resistance and the excellent post-irradiation annealing and recovery demonstrated in the early tests done to date, as well as the projected high efficiency and low-cost high-volume fabricability, these cells show a very good potential for space photovoltaic applications.
Author
P-N Junctions; Cadmium Sulfides; Indium Phosphides; Diffusion; Technology Utilization; Homojunctions; Fabrication; Antireflection Coatings

20000032820 AstroPower, Inc., Newark, DE USA

High Quality InP-on-Si For Solar Cell Applications

Shellenbarger, Zane A., AstroPower, Inc., USA; Goodwin, Thomas A., AstroPower, Inc., USA; Collins, Sandra R., AstroPower, Inc., USA; DiNetta, Louis C., AstroPower, Inc., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 81-89; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

InP on Si solar cells combine the low-cost and high-strength of Si with the high efficiency and radiation tolerance of InP. The main obstacle in the growth of single crystal InP-on-Si is the high residual strain and high dislocation density of the heteroepitaxial InP films. The dislocations result from the large differences in lattice constant and thermal expansion mismatch of InP and Si. Adjusting the size and geometry of the growth area is one possible method of addressing this problem. In this work, we conducted a material quality study of liquid phase epitaxy overgrowth layers on selective area InP grown by a proprietary vapor phase epitaxy technique on Si. The relationship between growth area and dislocation density was quantified using etch pit density measurements. Material quality of the InP on Si improved with both reduced growth area and increased aspect ratio (length/width) of the selective area. Areas with etch pit density as low as 1.6 x 10(exp 4)/sq cm were obtained. Assuming dislocation density is an order of magnitude greater than etch pit density, solar cells made with this material could achieve the maximum theoretical efficiency of 23% at AMO. Etch pit density dependence on the orientation of the selective areas on the substrate was also studied.
Author

Indium Phosphates; Solar Cells; Vapor Phase Epitaxy; Radiation Tolerance; Low Cost; Liquid Phase Epitaxy

20000032821 Spire Corp., Bedford, MA USA

P/N InP Solar Cells on Ge Wafers

Wojtczuk, Steven, Spire Corp., USA; Vernon, Stanley, Spire Corp., USA; Burke, Edward A., Burke (Edward A.), USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 91-98; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Indium phosphide (InP) P-on-N one-sun solar cells were epitaxially grown using a metalorganic chemical vapor deposition process on germanium (Ge) wafers. The motivation for this work is to replace expensive InP wafers, which are fragile and must be thick and therefore heavy, with less expensive Ge wafers, which are stronger, allowing use of thinner, lighter weight wafers. An intermediate In(x)Ga(l-x)P grading layer starting as In(0.49)Ga(0.5l)P at the GaAs-coated Ge wafer surface and ending as InP at the top of the grading layer (backside of the InP cell) was used to attempt to bend some of the threading dislocations generated by lattice-mismatch between the Ge wafer and InP cell so they would be harmlessly confined in this grading layer. The best InP/Ge cell was independently measured by NASA-Lewis with a one-sun 250 C AMO efficiency of 9.1%, open-circuit voltage of 790 mV, fill-factor of 70%, and short-circuit photocurrent 22.6 mA/sq cm. We believe this is the first published report of an InP cell grown on a Ge wafer. Why get excited over a 9% InP/Ge cell? If we look at the cell weight and efficiency, a 9% InP cell on an 8 mil Ge wafer has about the same cell power density, 118 W/kg (BOL), as the best InP cell ever made, a 19% InP cell on a 18 mil InP wafer, because of the lighter Ge wafer weight. As cell panel materials become lighter, the cell weight becomes more important, and the advantage of lightweight cells to the panel power density becomes more important. In addition, although InP/Ge cells have a low beginning-of-life (BOL) efficiency due to dislocation defects, the InP/Ge cells are very radiation hard (end-of-life power similar to beginning-of-life). We have irradiated an InP/Ge cell with alpha particles to an equivalent fluence of 1.6 x 10(exp 16) 1 MeV electrons/sq cm and the efficiency is still 83% of its BOL value. At this fluence level, the power output of these InP/Ge cells match the GaAs/Ge cell data tabulated in the JPL handbook. Data are presented indicating InP/Ge has more power output than GaAs/Ge cells at fluences in excess of this value.
Author

P-N Junctions; Indium Phosphides; Solar Cells; Epitaxy; Metalorganic Chemical Vapor Deposition; Gallium Arsenides

20000032822 International Solar Electric Technology, Inglewood, CA USA

Status of Flexible CIS Research at ISET

Basol, B. M., International Solar Electric Technology, USA; Kapur, V. K., International Solar Electric Technology, USA; Minnick, A., International Solar Electric Technology, USA; Halani, A., International Solar Electric Technology, USA; Leidholm, C. R., International Solar Electric Technology, USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 101-106; In English; See also 20000032812
Contract(s)/Grant(s): NAS3-26615; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Great advances have been made in polycrystalline thin film terrestrial solar cell technologies since early 1980's when the first promising laboratory devices with high efficiencies were demonstrated. These cells were fabricated on polycrystalline CdTe and CuInSe2 (CIS) layers and they had AM1.5 conversion efficiencies of around 10%. During the last decade, the polycrystalline thin

film solar cell efficiencies have improved to over 15% range and the stability data obtained from these devices has been very encouraging. As the efficiency and the stability of the polycrystalline thin film solar cells have improved through the years, these devices have become more and more attractive for space applications where a reliable power source with high specific power is needed. Cells and modules fabricated on foil substrates also appeal to some specific terrestrial markets where flexibility is either required or preferred. CIS and related compound thin film solar cells have already demonstrated terrestrial conversion efficiencies of over 16% (the highest efficiency reported is 16.4% by NREL for a Cu (In,Ga) Se2 device). Preliminary tests also indicated that the radiation tolerance of CIS thin film cells was superior to that of single crystalline devices under high energy electron and proton irradiation. Besides their radiation resistance and promise of high efficiency, CIS thin film devices also offer to the space power market a high specific power and low cost. If these devices could be fabricated on light-weight substrates and if they could be monolithically integrated to form modules, they would become very competitive with the existing single crystal technologies even if their beginning-of-life efficiencies were lower than those of the single crystalline cells. The typical substrate for a high efficiency terrestrial CIS solar cell is a 0.3 cm thick soda lime glass sheet. The main thrust of our effort in this program was the fabrication of these devices on thin metal foil substrates using the selenization method.
Author
Copper Selenides; Indium Compounds; Polycrystals; Thin Films; Solar Cells; Technology Assessment; Technology Utilization; Fabrication

20000032823 AstroPower, Inc., Newark, DE USA
Development of a Lightweight, Light-Trapped, Thin GaAs Solar Cell for Spacecraft Applications
Hannon, Margaret H., AstroPower, Inc., USA; DiNetta, Louis C., AstroPower, Inc., USA; Dashiell, Michael W., AstroPower, Inc., USA; Cummings, John R., AstroPower, Inc., USA; Barnett, Allen M., AstroPower, Inc., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 107-114; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper describes ultra-lightweight, high performance, thin, light trapping GaAs solar cells for advanced space power systems. The device designs can achieve 24.5% efficiency at AMO and 1X conditions, corresponding to a power density of 330 W/sq m. A significant breakthrough lies in the potential for a specific power of 2906 W/kg because the entire device is less than 1.5 microns thick. This represents a 440% improvement over conventional 4-mil silicon solar cells. In addition to being lightweight, this thin device design can result in increased radiation tolerance. The attachment of the cover glass support to the front surface has been demonstrated by both silicone and electrostatic bonding techniques. Device parameters of 1.002 volts open-circuit voltage, 80% fill factor, and a short-circuit current of 24.3 mA/sq cm have been obtained. This demonstrates a conversion efficiency of 14.4% resulting in a specific power of 2240 W/kg. Additionally, this new technology offers an alternative approach for enabling multi-bandgap solar cells and high output space solar power devices. The thin device structure can be applied to any III-V based solar cell application, yielding both an increase in specific power and radiation tolerance.
Author
Product Development; Fabrication; Technology Utilization; Gallium Arsenides; Energy Gaps (Solid State); Weight (Mass); Slender Bodies

20000032824 Martin Marietta Corp., Denver, CO USA
Advances in Polycrystalline Thin-Film Photovoltaics
Lanning, Bruce R., Martin Marietta Corp., USA; Armstrong, Joseph H., Martin Marietta Corp., USA; Misra, Mohan S., Martin Marietta Corp., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 115-123; In English; See also 20000032812
Contract(s)/Grant(s): IR/D Proj. D-17R; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Polycrystalline, thin-film photovoltaics represent one of the few (if not the only) renewable power sources which has the potential to satisfy the demanding technical requirements for future space applications. The demand in space is for deployable, flexible arrays with high power-to-weight ratios and long-term stability (15-20 years). In addition, there is also the demand that these arrays be produced by scalable, low-cost, high yield, processes. An approach to significantly reduce costs and increase reliability is to interconnect individual cells series via monolithic integration. Both CIS and CdTe semiconductor films are optimum absorber materials for thin-film n-p heterojunction solar cells, having band gaps between 0.9 - 1.5 ev and demonstrated small area efficiencies, with cadmium sulfide window layers, above 16.5%. Both CIS and CdTe polycrystalline thin-film cells have been produced on a laboratory scale by a variety of physical and chemical deposition methods, including evaporation, sputtering, and electrodeposition. Translating laboratory processes which yield these high efficiency, small area cells into the design of a manufacturing process capable of producing 1 sq ft modules however, requires a quantitative understanding of each individual step in the process and its (each step) effect on overall module performance. With a proper quantification and

understanding of material transport and reactivity for each individual step, a manufacturing process can be designed that is not ”reactor-specffic” and can be controlled intelligently with the design parameters of the process. Development of a thin-film, manufacturing process depends not only on the scalability of the process but on the overall fixed and operating costs, the environmental compatibility (i.e., material utilization/waste minimization with minimal health and safety risks), and the reproducibility/stability of the process. For this reason, the selection of deposition processes at MMC was influenced by: 1) cost; 2) environmental compatibility; and 3) reproducibility/stability of the process. In the development of CdTe and CIS devices at MMC therefore, CdTe films are being deposited by electrodeposition and CIS films are being deposited by DC, cylindrical magnetron sputtering. Both of these processes are scalable, low-cost processes with relatively minimal environmental impact and a discussion of the development of these processes is presented in this paper. The objective of this paper is to present an overview of the current efforts at MMC to develop large-scale manufacturing processes for both CIS and CdTe thin-film polycrystalline modules. CIS cells/modules are fabricated in a ’substrate configuration’ by physical vapor deposition techniques and CdTe cells/modules are fabricated in a ’superstrate configuration’ by wet chemical methods. Both laser and mechanical scribing operations are used to monolithically integrate (series interconnect) the individual cells into modules. Results will be presented at the cell and module development levels with a brief description of the test methods used to qualify these devices for space applications. The approach and development efforts are directed toward large-scale manufacturability of established thin-film, polycrystalline processing methods for large area modules with less emphasis on maximizing small area efficiencies.
Author
Technology Assessment; Polycrystals; Thin Films; Photovoltaic Conversion; Design Analysis; Fabrication; Semiconductors (Materials); Technology Utilization; Cadmium Tellurides

20000032825 TRW Space Technology Labs., Redondo Beach, CA USA
Amorphous Silicon Thin Films: The Ultimate Lightweight Space Solar Cell
Vendura, G. J., Jr., TRW Space Technology Labs., USA; Kruer, M. A., TRW Space Technology Labs., USA; Schurig, H. H., TRW Space Technology Labs., USA; Bianchi, M. A., TRW Space Technology Labs., USA; Roth, J. A., TRW Space Technology Labs., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 125-134; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Progress is reported with respect to the development of thin film amorphous (alpha-Si) terrestrial solar cells for space applications. Such devices promise to result in very lightweight, low cost, flexible arrays with superior end of life (EOL) performance. Each alpha-Si cell consists of a tandem arrangement of three very thin p-i-n junctions vapor deposited between film electrodes. The thickness of this entire stack is approximately 2.0 microns, resulting in a device of negligible weight, but one that must be mechanically supported for handling and fabrication into arrays. The stack is therefore presently deposited onto a large area (12 by 13 in.), rigid, glass superstrate, 40 mil thick, and preliminary space qualification testing of modules so configured is underway. At the same time, a more advanced version is under development in which the thin film stack is transferred from the glass onto a thin (2.0 mil) polymer substrate to create large arrays that are truly flexible and significantly lighter than either the glassed alpha-Si version or present conventional crystalline technologies. In this paper the key processes for such effective transfer are described. In addition, both glassed (rigid) and unglassed (flexible) alpha-Si cells are studied when integrated with various advanced structures to form lightweight systems. EOL predictions are generated for the case of a 1 000 W array in a standard, 10 year geosynchronous (GEO) orbit. Specific powers (W/kg), power densities (W/sq m) and total array costs ($/sq ft) are compared.
Author
Amorphous Silicon; Technology Utilization; Fabrication; Product Development; Thin Films; Performance Tests

20000032826 NASA Lewis Research Center, Cleveland, OH USA
Modeling of High Efficiency Solar Cells Under Laser Pulse for Power Beaming Applications
Jain, Raj K., NASA Lewis Research Center, USA; Landis, Geoffrey A., NYMA, Inc., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 135-140; In English; See also 20000032812
Contract(s)/Grant(s): NAG3-1466; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Solar cells may be used as receivers for laser power beaming. To understand the behavior of solar cells when illuminated by a pulsed laser, the time response of gallium arsenide and silicon solar cells to pulsed monochromatic input has been modeled using a finite element solar cell model.
Author
Solar Cells; Pulsed Lasers; Mathematical Models; Laser Power Beaming

20000032827 Houston Univ., TX USA

Calculation of Near Optimum Design of InP/In(0.53)Ga(0.47)As Monolithic Tandem Solar Cells

Renaud, P., Houston Univ., USA; Vilela, M. F., Houston Univ., USA; Freundlich, A., Houston Univ., USA; Medelci, N., Houston Univ., USA; Bensaoula, A., Houston Univ., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 141-146; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

An analysis of InP/InGaAs tandem solar cell structures has been undertaken to allow for maximum AMO conversion efficiencies (space applications) while still taking into account both the theoretical and technological limitations. The dependence of intrinsic and extrinsic parameters such as diffusion lengths and generation-recombination (GR) lifetimes on N/P and P/N devices performances are clearly demonstrated. We also, report for the first time the improvement attainable through the use of a new patterned tunnel junction as the inter cell ohmic interconnect. Such a design minimizes the light absorption in the interconnect region and leads to a noticeable increase in the cell efficiency. Our computations predict 27% AMO efficiency for N/P tandems with ideality factor gamma = 2 (GR lifetimes approx. = 1 microns), and 36% for gamma = 1 (GR lifetimes approx. = 100 microns). The method of optimization and the values of the physical and optical parameters are discussed.
Author

Indium Phosphides; Computation; Technology Utilization; Indium Gallium Arsenides; Solar Cells

20000032828 NASA Lewis Research Center, Cleveland, OH USA

Performance, Defect Behavior and Carrier Enhancement in Low Energy, Proton Irradiated p(+)nn(+) InP Solar Cells

Weinberg, I., NASA Lewis Research Center, USA; Rybicki, G. C., NASA Lewis Research Center, USA; Vargas–Aburto, C., Kent State Univ., USA; Jain, R. K., Toledo Univ., USA; Scheiman, D., NYMA, Inc., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 149-158; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

InP p(+)nn(+) cells, processed by MOCVD, were irradiated by 0.2 MeV protons and their performance and defect behavior observed to a maximum fluence of 10(exp 13)/sq cm. Their radiation induced degradation, over this fluence range, was considerably+less than observed for similarly irradiated, diffused junction n p InP cells. Significant degradation occurred in both the cell's emitter and base regions the least degradation occurring in the depletion region. A significant increase in series resistance occurs at the highest fluenc.e. Two majority carrier defect levels, E7 and E10, are observed by DLTS with activation energies at (E(sub C) - 0.39)eV and (E(sub C) - 0.74)eV respectively. The relative concentration of these defects differs considerably from that observed after 1 MeV electron irradiation. An increased carrier concentration in the cell's n-region was observed at the highest proton fluence, the change in carrier concentration being insignificant at the lower fluences. In agreement with previous results, for 1 and 1.5 MeV electron irradiated InP p(+)n junctions, the defect level E10 is attributed to a complex between zinc, diffused into the n-region from the zinc doped emitter, and a radiation induced defect. The latter is assumed to be either a phosphorus vacancy or interstitial. The increased, or enhanced carrier concentration is attributed to this complex acting as a donor.
Author

Performance Prediction; Defects; Indium Phosphides; Solar Cells; Protons; Irradiation; Majority Carriers; Doped Crystals; Carrier Density (Solid State)

20000032829 Naval Research Lab., Washington, DC USA

Electron-Irradiated Two-Terminal, Monolithic InP/Ga(0.47)In(0.53)As Tandem Solar Cells and Annealing of Radiation Damage

Cotal, H. L., Naval Research Lab., USA; Walters, R. J., Naval Research Lab., USA; Summers, G. P., Naval Research Lab., USA; Messenger, S. R., Synthetic Fuels Associates, Inc., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 159-166; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Radiation damage results from two-terminal monolithic InP/Ga(0.47) In(0.53)As tandem solar cells subject to 1 MeV electron irradiation are presented. Efficiencies greater than 22 % have been measured by the National Renewable Energy Laboratory from 2 x 2 sq cm cells at 1 sun, AMO (25 C). The short circuit current density, open circuit voltage and fill factor are found to tolerate the same amount of radiation at low fluences. At high fluence levels, slight differences are observed. Decreasing the base dopant level of the Ga(0.47)In(0.53)As bottom cell improved the radiation resistance of J(sub sc) dramatically. This in turn, extended the series current flow through the subcells substantially up to a fluence of 3 x 10(exp 15)/sq cm compared to 3 x 10(exp 14)/sq cm, as observed previously. The degradation of the maximum power output from the tandem device is comparable to that from shallow homojunction (SHJ) InP solar cells, and the mechanisms responsible for such degradation is explained in

terms of the radiation response of the component cells. Annealing studies revealed that the recovery of the tandem cell response is mostly dictated by the annealing characteristics exhibited by SHJ InP solar cells.
Author
Indium Phosphides; Solar Cells; Gallium Arsenides; Radiation Damage; Electron Irradiation; Annealing

20000032830 Synthetic Fuels Associates, Inc., Landover, MD USA
Radiation Effects on p(+)n InP Junctions Grown by MOCVD
Messenger, S. R., Synthetic Fuels Associates, Inc., USA; Walters, R. J., Naval Research Lab., USA; Panunto, M. J., Maryland Univ. Baltimore County, USA; Summers, G. P., Naval Research Lab., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 167-180; In English; See also 20000032812; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The superior radiation resistance of InP over other solar cell materials such as Si or GaAs has prompted the development of InP cells for space applications. The early research on radiation effects in InP was performed by Yamaguchi and co-workers who showed that, in diffused p-InP junctions, radiation-induced defects were readily annealed both thermally and by injection, which was accompanied by significant cell recovery. More recent research efforts have been made using p-InP grown by metalorganic chemical vapor deposition (MOCVD). While similar deep level transient spectroscopy (DLTS) results were found for radiation induced defects in these cells and in diffused junctions, significant differences existed in the annealing characteristics. After injection annealing at room temperature, Yamaguchi noticed an almost complete recovery of the photovoltaic parameters, while the MOCVD samples showed only minimal annealing. In searching for an explanation of the different annealing behavior of diffused junctions and those grown by MOCVD, several possibilities have been considered. One possibility is the difference in the emitter structure. The diffused junctions have S-doped graded emitters with widths of approx. 0.3 microns,while the MOCVD emitters are often doped with Si and have widths of approx. 300 A (0.03 microns). The difference in the emitter thickness can have important effects. e.g. a larger fraction of the total photocurrent is generated in the n-type material for thicker emitters. Therefore the properties of the n-InP material may explain the difference in the observed overall annealing behavior of the cells.
Author
Radiation Effects; Indium Phosphides; P-N Junctions; Annealing; Gallium Arsenides; Technology Utilization

20000032831 National Renewable Energy Lab., Golden, CO USA
Design of High-Efficiency, Radiation-Hard, GaInP/GaAs Solar Cells
Kurtz, Sarah R., National Renewable Energy Lab., USA; Bertness, K. A., National Renewable Energy Lab., USA; Kibbler, A. E., National Renewable Energy Lab., USA; Kramer, C., National Renewable Energy Lab., USA; Olson, J. M., National Renewable Energy Lab., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 181-186; In English; See also 20000032812
Contract(s)/Grant(s): DE-AC02-83CH-10093; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Record air mass zero efficiency values are reported for Ga(0.5)In(0.5)P/GaAs devices before and after Irradiation by 10(exp 15)sq cm 1 MeV electrons. The two-terminal, two-junction devices are grown monolithically with a high-conductance, GaAs tunnel-junction interconnect and an area of 0.25 sq cm. A device optimized for beginning-of-life (BOL) performance achieved BOL 25.7% (25.4%) efficiency, while devices optimized for end-of-life (EOL) performance achieved EOL efficiencies of 19.6% (19.8% and 20.0%). (The efficiencies noted in parentheses were measured at NASA Lewis) The effects of the thickness of the top cell and the doping level of the bottom cell were investigated in this study. A range of top-cell thicknesses and bottom-cell doping levels gave respectably high (greater than 18%) EOL efficiencies.
Author
Design Analysis; Efficiency; Gallium Arsenides; Gallium Phosphides; Indium Phosphides; Solar Cells

20000032832 Wayne State Univ., Detroit, MI USA
Investigation of the Stability and 1.0 MeV Proton Radiation Resistance of Commercially Produced Hydrogenated Amorphous Silicon Alloy Solar Cells
Lord, Kenneth R., II, Wayne State Univ., USA; Walters, Michael R., Wayne State Univ., USA; Woodyard, James R., Wayne State Univ., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 187-196; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The radiation resistance of commercial solar cells fabricated from hydrogenated amorphous silicon alloys is reported. A number of different device structures were irradiated with 1.0 MeV protons. The cells were insensitive to proton fluences below 1E12 sq cm. The parameters of the irradiated cells were restored with annealing at 200 C. The annealing time was dependent on proton fluence. Annealing devices for one hour restores cell parameters for fluences below 1E14 sq cm fluences above 1E14 sq

cm require longer annealing times. A parametric fitting model was used to characterize current mechanisms observed In dark I-V measurements. The current mechanism were explored with irradiation fluence, and voltage and light soaking times. The thermal generation current density and quality factor increased with proton fluence. Device simulation shows the degradation in cell characteristics may be explained by the reduction of the electric field in the intrinsic layer.
Author
Research; Stability; Protons; Irradiation; Radiation Tolerance; Solar Cells; Amorphous Silicon; Fabrication

20000032833 Naval Research Lab., Washington, DC USA
The Use of Displacement Damage Dose to Correlate Degradation in Solar Cells Exposed to Different Radiations
Summers, Geoffrey P., Naval Research Lab., USA; Burke, Edward A., Synthetic Fuels Associates, Inc., USA; Shapiro, Philip, Synthetic Fuels Associates, Inc., USA; Statler, Richard, Synthetic Fuels Associates, Inc., USA; Messenger, Scott R., Synthetic Fuels Associates, Inc., USA; Walters, Robert J., Naval Research Lab., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 197-201; In English; See also 20000032812; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

It has been found useful in the past to use the concept of 'equivalent fluence" to compare the radiation response of different solar cell technologies. Results are usually given in terms of an equivalent 1 MeV electron or an equivalent 10 MeV proton fluence. to specify cell response in a complex space-radiation environment in terms of an equivalent fluence, R is necessary to measure damage coefficients for a number of representative electron and proton energies. However, at the last Photovoltaic Specialist Conference we showed that nonionizing energy loss (NIEL) could be used to correlate damage coefficients for protons, using measurements for GaAs as an example. This correlation means that damage coefficients for all proton energies except near threshold can be predicted from a measurement made at one particular energy. NIEL is the exact equivalent for displacement damage of linear energy transfer (LET) for ionization energy loss. The use of NIEL in this way leads naturally to the concept of IO MeV equivalent proton fluence. The situation for electron damage is more complex, however. In this paper ft is shown that the concept of displacement damage dose gives a more general way of unifying damage coefficients. It follows that 1 MeV electron equivalent fluence is a special case of a more general quantity for unifying electron damage coefficients which we call the effective l MeV electron equivalent dose.
Author
Damage; Displacement; Solar Cells; Dosage; Linear Energy Transfer (LET); Ionization; Extraterrestrial Radiation

20000032835 Optical Coating Lab., Inc., Santa Rosa, CA USA
Qualification Test Results for Blue-Red Reflecting Solar Cell Covers
Beauchamp, W. T., Optical Coating Lab., Inc., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 213-222; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Recent market forces and design innovations have spurred the development of solar cell covers that significantly reduce the solar absorptance for a cell array. GaAs cells using Ge as the substrate host material, can have a significantly higher output if the solar absorbtance of the cell array is reduced. New optical coating design techniques have allowed the construction of covers that reflect the ultraviolet energy (below 350 nm) and the near infrared energy (above 900 nm) resulting in the beneficial reduction in absorbtance. Recent modeling suggests three or more percent output increase due to the lowered temperature with such a device. Within the last several months we have completed the testing of production samples of these now covers in a qualification series that included the usual environmental effects associated with the routine testing of solar cell covers and the combined effects of protons, electrons and solar UV as would be encountered in space. For the combined effects testing the samples were exposed to 300 sun days equivalent UV, 5 x 10(exp 14)/sq cm of 0.5 MeV protons and 10(exp 15)/sq cm of 1.0 MeV electrons. Measurements of the reflectance, transmission, emittance and other appropriate parameters were made before and after the testing. As measured by the average transmission over the cell operating band, the change in transmission for the samples was less than or about equal to 1%. The details of the testing and the results in terms of transmission, reflectance and emittance are discussed in the paper.
Author
Performance Tests; Solar Cells; Coatings; Reflectance; Emittance; Gallium Arsenides

20000032836 Systems Science and Software, San Diego, CA USA
Parasitic Current Collection by Solar Arrays in LEO
Davis, Victoria A., Systems Science and Software, USA; Gardner, Barbara M., Systems Science and Software, USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 227-235; In English; See

also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Solar cells at potentials positive with respect to a surrounding plasma collect electrons. Current is collected by the exposed high voltage surfaces: the interconnects and the sides of the solar cells. This current is a drain on the array power that can be significant for high-voltage arrays. In addition, this current influences the current balance that determines the floating potential of the spacecraft. One of the objectives of the Air Force (PL/GPS) PASP Plus experiment is an improved understanding of parasitic current collection. As part of the PASP Plus program, we are using computer modeling to improve our understanding of the physical processes that control parasitic current collection.

Author

Computerized Simulation; Electric Current; Solar Cells; Plasmas (Physics); Electrons

20000032837 NASA Lewis Research Center, Cleveland, OH USA

Final Results of the Advanced Photovoltaic Experiment

Brinker, David J., NASA Lewis Research Center, USA; Hickey, John R., Eppley Lab., Inc., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 239-246; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Advanced Photovoltaic Experiment was designed to generate laboratory reference standards as well as to explore the durability of a wide variety of space solar cells. In addition to the cells, it was equipped with an absolute cavity radiometer to measure solar intensity, a spectroradiometer to measure the spectral content of this radiation and a sun angle sensor. Data from the solar cells and various sensors was obtained on a daily basis during the first eleven months of the 69 month flight. In this paper we compare pre-flight and post-flight laboratory measurements with on-orbit calibration data. Pre-flight and post-flight calibration data of the cavity radiometer as well as on-orbit data demonstrated the accuracy and durability of the Eppley Labs. instrument flown on APEX.

Author

Photovoltages; Experiment Design; Solar Cells; Durability; Calibrating; Data Processing

20000032838 NASA Lewis Research Center, Cleveland, OH USA

Preliminary Results from the Flight of the Solar Array Module Plasma Interactions Experiment (SAMPIE)

Ferguson, Dale C., NASA Lewis Research Center, USA; Hillard, G. Barry, NASA Lewis Research Center, USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 247-256; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

SAMPIE, the Solar Array Module Plasma Interactions Experiment, flew in the Space Shuttle Columbia payload bay as part of the OAST-2 mission on STS-62, March, 1994. SAMPIE biased samples of solar arrays and space power materials to varying potentials with respect to the surrounding space plasma, and recorded the plasma currents collected and the arcs which occurred, along with a set of plasma diagnostics data. A large set of high quality data was obtained on the behavior of solar arrays and space power materials in the space environment. This paper is the first report on the data SAMPIE telemetered to the ground during the mission. It will be seen that the flight data promise to help determine arcing thresholds, snapover potentials and floating potentials for arrays and spacecraft in LEO.

Author

Solar Arrays; Flight Recorders; Plasma Interactions; Experimentation; Space Plasmas; Plasma Diagnostics

20000032839 Air Force Systems Command, Wright-Patterson AFB, OH USA

Photovoltaic Electric Power Applied to Unmanned Aerial Vehicles (UAV)

Geis, Jack, Air Force Systems Command, USA; Arnold, Jack H., Rockwell International Corp., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 257-268; In English; See also 20000032812; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Photovoltaic Electric-Powered Flight is receiving a great deal of attention in the context of the USA' Unmanned Aerial Vehicle (UAV) program. This paper addresses some of the enabling technical areas, and their potential solutions. of particular interest are the long-duration, high- altitude class of UAVs whose mission it is to achieve altitudes between 60,000 and 100,000 feet, and to remain at those altitudes for prolonged periods performing various mapping and surveillance activities. Addressed herein are studies which reveal the need for extremely light-weight and efficient solar cells, high-efficiency electric motor-driven propeller modules, and power management and distribution control elements. Since the potential payloads vary dramatically in their power consumption and duty cycles, a typical load profile has been selected to provide commonality for the propulsion power comparisons. Also, since missions vary widely with respect to ground coverage requirements, from repeated orbiting over a localized target, to long-distance routes over irregular terrain, we have also averaged the power requirements for on-board G&C

power, as well as ground control and communication link utilization. In the context of the national technology reinvestment program, wherever possible we modeled components and materials which have been qualified for space and defense applications, yet are compatible with civilian UAV activities. These include, but are not limited to solar cell developments, electric storage technology for diurnal operation, local and ground communications, power management and distribution, and control servo design. and finally, the results of tests are presented. These cells were also used for modeling the flight characteristics of UAV aircraft.
Author
Photovoltaic Conversion; Communication Networks; High Altitude; Solar Cells; Surveillance; Technology Utilization; Pilotless Aircraft

20000032840 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
Post-Flight Investigation Programmes of Recently Retrieved Solar Generators
Gerlach, Lothar, European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 269-283; In English; See also 20000032812; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Both solar generators are undergoing separate Post-Flight Investigation Programmes (PFIP). These programmes cover investigations of all solar array (SA) components and mechanisms. Since both programmes have much in common, most of the component and material investigations are the same. Extremely valuable information on numerous essential subjects, such as atomic oxygen, radiation, meteoroid and space debris environment resulting damage, low cycle fatigue, material degradation etc. are expected to be obtained for both types of arrays. We will also be able to explain and understand the anomalies experienced on both solar arrays in orbit. The paper will outline both Post-Flight Investigation Programmes and will concentrate on reporting the first results and findings.
Author
Solar Generators; Data Acquisition; Data Processing; Meteoritic Damage; Fatigue (Materials)

20000032843 Astro Aerospace Corp., Carpinteria, CA USA
An Introduction to the Astro Edge Solar Array
Spence, B. R., Astro Aerospace Corp., USA; Marks, G. W., Astro Aerospace Corp., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 323-331; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Astro Edge solar array is a new and innovative low concentrator power generating system which has been developed for applications requiring high specific power, high stiffness, low risk, light weight, reliability, low stowed volume, negligible thermal snap, and affordability. The basic system is of modular construction which utilizes conventional materials and technology, and standard photovoltaic solar cells and laydown processes. Mechanisms, restraint/release devices, wiring harnesses, substrates, and support structures are designed to be simple, functional, lightweight, and modular. A brief overview of the Astro Edge solar array is discussed.
Author
Concentrators; Solar Arrays; Fabrication; Photovoltaic Cells; Electric Generators

20000032844 National Renewable Energy Lab., Golden, CO USA
An Update on the Department of Energy's Photovoltaic Program
Benner, John P., National Renewable Energy Lab., USA; Fitzgerald, Mark, National Renewable Energy Lab., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 31-33; In English; See also 20000032812; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Funding for the terrestrial photovoltaics program is $78 million in 1994. This is more than double the minimum level reached in 1989 and runs counter to the general trend of decreasing budgets for Department of Energy (DOE) programs. During the past five years, the program has expanded its mission from research and development to also address manufacturing technology and commercialization assistance for photovoltaics devices. These new activities are directed toward revitalizing the market to reinstate the rapid rate of sales growth needed to attract investment. The program is approaching balance among efforts in each of the three areas. This translates to a reduction in some of the R & D activities of most relevance to the space power community. On the other hand, some of the advancements in manufacturing may finally bring thin-film technologies to reality for space arrays.

This talk will describe the status and direction of DOE program with an eye toward highlighting its impact on technology of interest for space.
Author
Photovoltaic Conversion; Technology Utilization; Manufacturing; Commercialization

20000032847 NASA Lewis Research Center, Cleveland, OH USA
InGaAs PV Device Development for TPV Power Systems
Wilt, David M., Essential Research, Inc., USA; Fatemi, Navid S., Essential Research, Inc., USA; Hoffman, Richard W., Jr., Essential Research, Inc., USA; Jenkins, Phillip P., NYMA, Inc., USA; Brinker, David J., NYMA, Inc., USA; Scheiman, David, NYMA, Inc., USA; Lowe, Roland, Kent State Univ., USA; Chubb, Donald, NASA Lewis Research Center, USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 341-351; In English; See also 20000032812; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

lndium Gallium Arsenide (InGaAs) photovoltaic devices have been fabricated with bandgaps ranging from 0.75 eV to 0.60 eV on Indium Phosphide (InP) substrates. Reported efficiencies have been as high as 11.2% (AMO) for the lattice matched 0.75 eV devices. The 0.75 eV cell demonstrated 14.8% efficiency under a 1500 K blackbody with a projected efficiency of 29.3%. The lattice mismatched devices (0.66 and 0.60 eV) demonstrated measured efficiencies of 8% and 6% respectively under similar conditions. Low long wavelength response and high dark currents are responsible for the poor performance of the mismatched devices. Temperature coefficients have been measured and are presented for all of the bandgaps tested.
Author
Indium Gallium Arsenides; Photovoltaic Cells; Fabrication; Efficiency

20000032848 NASA Lewis Research Center, Cleveland, OH USA
Pulsed Laser Illumination of Photovoltaic Cells
Yater, Jane A., NASA Lewis Research Center, USA; Lowe, Roland, Kent State Univ., USA; Jenkins, Philip, NYMA, Inc., USA; Landis, Geoffrey A., NYMA, Inc., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 353-362; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In future space missions, free electron lasers (FEL) may be used to illuminate photovoltaic array receivers to provide remote power. The induction FEL and the radio-frequency (RF) FEL both produce pulsed rather than continuous output. In this work, we investigate cell response to pulsed laser light which simulates the RF FEL format, producing 50 ps pulses at a frequency of 78 MHz. A variety of Si, GaAs, CaSb and CdInSe2 (CIS) solar cells are tested at average incident powers between 4 mW/sq cm and 425 mW/sq cm. The results indicate that if the pulse repetition is high, cell efficiencies are only slightly reduced by using a pulsed laser source compared to constant illumination at the same wavelength. Because the pulse separation is less than or approximately equal to the minority carrier lifetime, the illumination conditions are effectively those of a continuous wave laser. The time dependence of the voltage and current response of the cells are also measured using a sampling oscilloscope equipped with a high frequency voltage probe and current transformer. The frequency response of the cells is weak, with both voltage and current outputs essentially dc in nature. Comparison with previous experiments shows that the RF FEL pulse format yields much more efficient photovoltaic conversion of light than does an induction FEL pulse format.
Author
Pulsed Lasers; Illumination; Photovoltaic Cells; Free Electron Lasers; Solar Cells; Light Beams

20000032850 AstroPower, Inc., Newark, DE USA
High Efficiency GaP Power Conversion for Betavoltaic Applications
Sims, Paul E., AstroPower, Inc., USA; DiNetta, Louis C., AstroPower, Inc., USA; Barnett, Allen M., AstroPower, Inc., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 373-382; In English; See also 20000032812
Contract(s)/Grant(s): NSF III-92-61713; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

AstroPower is developing a gallium phosphide (GaP) based energy converter optimized for radio luminescent light-based power supplies. A ”two-step” or ”indirect’ process is used where a phosphor is excited by radioactive decay products to produce light that is then converted to electricity by a photovoltaic energy converter. This indirect conversion of beta-radiation to electrical energy can be realized by applying recent developments in tritium based radio luminescent (RL) light sources in combination with the high conversion efficiencies that can be achieved under low illumination with low leakage, gallium phosphide based devices. This tritium to light approach is inherently safer than battery designs that incorporate high activity radionuclides because the beta particles emitted by tritium are of low average energy and are easily stopped by a-thin layer of glass. GaP layers were grown by

liquid phase epitaxy and p/n junction devices were fabricated and characterized for low light intensity power conversion. AstroPower has demonstrated the feasibility of the GaP based energy converter with the following key results: 23.54% conversion efficiency under 968 microW/sq cm 440 nm blue light, 14.59% conversion efficiency for 2.85 microW/sq cm 440 nm blue light, and fabrication of a working 5 V array. We have also determined that at least 20 microW/sq cm optical power is available for betavoltaic power systems. Successful development of this device is an enabling technology for low volume, safe, high voltage, milliwatt power supplies with service lifetimes in excess of 12 years.
Author
Gallium Phosphides; Energy Conversion Efficiency; Beta Particles; Radioisotope Batteries; Light Sources; High Voltages; Emittance

20000032851 NYMA, Inc., Brook Park, OH USA
Review of Solar Cell Temperature Coefficients for Space
Landis, Geoffrey A., NYMA, Inc., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 385-399; In English; See also 20000032812; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Energy conversion efficiency is an important parameter for solar cells, and well reported in the literature. However, solar cells heat up when in sunlight, and the efficiency decreases. The temperature coefficient of the conversion efficiency is thus also extremely important, especially in mission modeling, but is much less well reported. It is of value to have a table which compiles into a single document values of temperature coefficient reported in the literature. In addition to modeling performance of solar cells in Earth orbit, where operating temperatures may range from about 20 C to as high as 85 C, it is of interest to model solar cells for several other recently proposed missions. These include use for the surface of Mars, for solar electric propulsion missions that may range from Venus to the Asteroid belt, and for laser-photovoltaic power that may involve laser intensities equivalent several suns. For all of these applications, variations in operating temperature away from the nominal test conditions result in a significant changes in operating performance. In general the efficiency change with temperature is non-linear, however, in the range from negative 100 C through room temperature to a few hundred degrees C, efficiency is usually quite well modeled as a linear function of temperature (except for a few unusual cell types, such as amorphous silicon, and for extremely low bandgap cells, such as InGaAs). .
Author
Solar Cells; Temperature Ratio; Energy Conversion Efficiency; Heat Transfer Coefficients; Indium Gallium Arsenides; Operating Temperature; Performance Prediction

20000032854 NASA Lewis Research Center, Cleveland, OH USA
Summary of Workshop on InP: Status and Prospects
Walters, R. J., Naval Research Lab., USA; Weinberg, I., NASA Lewis Research Center, USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 419-421; In English; See also 20000032812; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The primary objective of most of the programs in InP solar cells is the development of the most radiation hard solar cell technology. In the workshop, it was generally agreed that the goal is a cell which displays high radiation tolerance in a radiation environment equivalent to a 1 MeV electron fluence of about 10(exp 16)/sq cm. Furthermore, it is desired that the radiation response of the cell be essentially flat out to this fluence - i.e. that the power output of the cell not decrease from its beginning of life (BOL) value in this radiation environment. It was also agreed in the workshop that the manufacturability of InP solar cells needs to be improved. In particular, since InP wafers are relatively dense and brittle, alternative substrates need to be developed. Research on hetero-epitaxial InP cells grown on Si, Ge, and GaAs substrates is currently underway. The ultimate goal is to develop hetero-epitaxial InP solar cells using a cheap, strong, and lightweight substrate.
Author
Indium Phosphides; Solar Cells; Technology Assessment; Radiation Tolerance

20000032855 Lockheed Missiles and Space Co., Sunnyvale, CA USA
Systems, Arrays and Applications Workshop 1
Pack, G. J., Lockheed Missiles and Space Co., USA; Gerlach, Lothar, ESA/ESTEC, UK; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 423-424; In English; See also 20000032812; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The charter of this workshop was to evaluate photovoltaic technologies from the broad perspective of future mission needs and operational requirements. We were given a set of six questions to start the discussion, however; these were viewed as sample

questions which didn't constrain our deliberations. Our primary objective in discussing the provided questions and other items of interest to the group was to answer the question: How should NASA spend its scarce space power resources? It was clear from the papers presented in the main session and the depth of technical talent present in the audience, that there are significantly more good projects available than there is funding for. Thus NASA is faced with the problem of deciding whether to allocate their resources across a range of projects or to focus on a small subset of tasks that are mission enabling.
Author
Technology Assessment; Photovoltaic Conversion

20000032856 NYMA, Inc., Brook Park, OH USA
Future Directions in PV Cell Development: Summary of the Workshop at SPRAT-13
Landis, Geoffrey A., NYMA, Inc., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 425-429; In English; See also 20000032812; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The "mission" of this workshop was to identify what areas of PV cell development would be most fruitful to direct NASA's scarce research money toward in order to have the greatest impact on future space power systems. Cost is the main issue for space photovoltaics, but cell cost is only a minor (10%) component of the cost. The parameter that is most desired out of next-generation photovoltaic technology is high conversion efficiency. to get a product to market required fast cycle time and a low development and qualification cost. One thing that aids low development cost the ability to directly replace existing cells in existing array designs, so that a new array design doesn't have to be developed. There is a good argument that development of radiation tolerant cell technology could open up a new range of intermediate orbits, with potentially high commercial value. This may be a strong argument for continued development of InP and other radiation tolerant cell designs.
Derived from text
Low Cost; Photovoltaic Conversion; Energy Conversion Efficiency

20000032857 Schafer (W. J.) Associates, Inc., North Olmsted, OH USA
Array Technologies Workshop 1
Allen, Douglas, Schafer (W. J.) Associates, Inc., USA; Meulenberg, Andrew, Communications Satellite Corp., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 431-435; In English; See also 20000032812; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The following is a summary of responses to questions posed to the workshop and related discussions. Approximately 40 people attended the workshop and included representatives of satellite design and fabrication companies, cell development and manufacturing companies, panel development and manufacturing companies, Universities, and several government organizations. Commercial, DoD, and civil applications were all well represented by workshop attendees, as were rigid, flexible, and concentrator array technologies. Most of the time in the workshop was spent discussing questions 1 and 2, the remaining questions received only minimal deliberation. Question 1. What will determine the selection of a specific array type (rigid, flexible, concentrator). Question 2. Are 300 W/kg, 300 W/sq m, and $300/W achievable goals for rigid, flexible, and concentrator arrays? If not, what is practically achievable for each array type.
Author
Satellite Design; Manufacturing; Fabrication; Arrays

20000032858 Communications Satellite Corp., Clarksburg, MD USA
UV Testing of INTELSAT-7, 7A, and 8 Solar Cells
Meulenberg, A., Communications Satellite Corp., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 223-225; In English; See also 20000032812; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

A 4000 hour experiment, conducted in late 1992 through mid 1993, confirmed earlier results on the ultraviolet damage effects in covered solar cells of various types being used, or proposed for use, in INTELSAT programs. Two different UV test systems were used to identify systematic errors and to study the effects of UV source-bulb age on degradation rate. After correction for contamination and UV source-bulb aging, the extrapolated degradation rates for irradiated and unirradiated INTELSAT-5,-6 single AR (SAR) coated cells and INTELSAT-7,-7A, -8 double layer AR (DAR) coated cells in both the 1993 tests confirm the following hypotheses resulting from the 1992 experiment: (1) Irradiated cells display significantly more UV degradation than do the unirradiated cells for tests exceeding 2000 hours. [The new data indicates that degradation effects from electron irradiation are proportional to t(sup 2) (the square of the UV hours), at least for times less than or equal to 3000 hours.]. (2) This difference does not depend upon antireflective coating, cell resistivity, or manufacturer within the sensitivity and reproducibility of the

experiment. (3) There is a clear difference in degradation rate between single AR coated cells (TiO(x)) and double layer AR coated cells (SiO(x) and Al2O3?). At 100,000 hours (11.4 years) the DAR coated cells display more degradation than do the SAR coated cells, even though at 1,000 hours the DAR cells display less degradation. ($) UV degradation rates, to modern covered silicon solar cells, at the beginning of bulb life drop from approx. 2 times the average rate to near zero after 2000 hours (average end-of-life for the xenon short-arc lamps used in the tests).
Derived from text
Ultraviolet Detectors; Solar Cells; Performance Tests; Experimentation; Damage; Electron Irradiation; Coatings

20000033155 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Critical Infrastructure Assurance: Electric Power Reliability
Bremer, Maximilian K.; Feliz, Daniel; Perry, Troy; Jan. 1999; 44p; In English
Report No.(s): AD-A374150; AFIT-FY-00-70; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In this policy analysis exercise (PAE), we analyze the North American electric power infrastructure and offer recommendations for reducing vulnerabilities. We examine the electric power industry, the threats to it, its vulnerabilities, and its relationships with other organizations. Our major sources of information consist of interviews, attendance at an infrastructure protection conference, and extensive academic research. Our recommendations focus on reducing three specific vulnerabilities: physical terrorism, cyber attacks and confluence of events. Finally, we assess the benefits of our recommendations and the obstacles to implementation.
DTIC
Vulnerability; Conferences; Electric Power Plants; Reliability Analysis

45
ENVIRONMENT POLLUTION

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

20000032202 Howard Univ., Dept. of Physics and Astronomy, Washington, DC USA
Fourier Transform Infrared (FT-IR) Spectroscopy of Atmospheric Trace Gases HCl, NO and SO2
Haridass, C., Howard Univ., USA; Aw–Musse, A., Howard Univ., USA; Dowdye, E., Howard Univ., USA; Bandyopadhyay, C., Howard Univ., USA; Misra, P., Howard Univ., USA; Okabe, H., Howard Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 17-22; In English; See also 20000032189
Contract(s)/Grant(s): NAGW-2950; NAG3-1677; EPA-R819720-01-3; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
Fourier Transform Infrared (FT-IR) spectral data have been recorded in the spectral region 400-4000/cm of hydrogen chloride and sulfur dioxide with I/cm resolution and of nitric oxide with 0.25 cm-i resolution, under quasi-static conditions, when the sample gas was passed through tubings of aluminum, copper, stainless steel and teflon. The absorbance was measured for the rotational lines of the fundamental bands of (1)H(35)Cl and (1)H(37)Cl for pressures in the range 100-1000 Torr and for the (14)N(16)O molecule in the range 100-300 Torr. The absorbance was also measured for individual rotational lines corresponding to the three modes of vibrations (upsilon(sub 1) - symmetric stretch, upsilon(sub 2) - symmetric bend, upsilon(sub 3) - anti-symmetric stretch) of the SO2 molecule in the pressure range 25-150 Torr. A graph of absorbance versus pressure was plotted for the observed rotational transitions of the three atmospherically significant molecules, and it was found that the absorbance was linearly proportional to the pressure range chosen, thereby validating Beer's law. The absorption cross-sections were determined from the graphical slopes for each rotational transition recorded for the HCl, NO and SO2 species. Qualitative and quantitative spectral changes in the FT-IR data will be discussed to identify and characterize various tubing materials with respect to their absorption features.
Author
Atmospheric Composition; Emission Spectra; Gas Spectroscopy; Infrared Spectroscopy; Nitric Oxide; Hydrogen Chlorides; Sulfur Dioxides; Trace Contaminants

20000032205 Texas Univ., Dept. of Computer Science, El Paso, TX USA
Creating a GIS-Based Decision-Support System
Alvarado, Lori, Texas Univ., USA; Gates, Ann Q., Texas Univ., USA; Gray, Bob, Texas Univ., USA; Reyes, Raul, Texas Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems

Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volume 2 and 3, pp. 512-517; In English; See also 20000032189
Contract(s)/Grant(s): NCCW-89; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Tilting the Balance: Climate Variability and Water Resource Management in the Southwest, a regional conference hosted by the Pan American Center for Environmental Studies, will be held at The University of Texas at El Paso on March 2-4, 1998. The conference is supported through the US Global Change Research Program (USGCRP) established by the President in 1989, and codified by Congress in the Global Change Research Act of 1990. The NASA Mission to Planet Earth program is one of the workshops sponsors. The purpose of the regional workshops is to improve understanding of the consequences of global change. This workshop will be focused on issues along the border and the Rio Grande River and thus will bring together stakeholders from Mexico, California, Texas, New Mexico, Arizona and Colorado representing federal, state, and local governments; universities and laboratories; industry, agricultural and natural resource managers; and non-governmental organizations. This paper discusses the efforts of the NASA PACES center create a GIS-based decision-support system that can be used to facilitate discussion of the complex issues of resource management within the targeted international region.
Author

Decision Support Systems; Geographic Information Systems; Climate Change; Conferences; Water Resources; Resources Management; Decision Making

20000032320 Universities Space Research Association, Huntsville, AL USA

The HSCaRs Summer Enrichment Program: Research Opportunities for Minority and Women Undergraduates in Global Change Science

Estes, Maurice G., Jr., Universities Space Research Association, USA; Perkey, Donald J., Institute for Global Change Research and Education, USA; Coleman, Tommy L., Alabama A & M Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 883-888; In English; See also 20000032189
Report No.(s): 98URC157; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The Center for Hydrology, Soil Climatology, and Remote Sensing (HSCaRS) was established July 1, 1995, through a cooperative agreement between the National Aeronautics and Space Administration (NASA) and Alabama A&M University. One challenge in the Center was to develop an educational component that would increase participation by students in mainstream research and increase the production of underrepresented minorities who are U.S. citizens or permanent residents in NASA-related fields. This goal was strongly supported by a number of educational research publications. The Task Force on Women, Minorities, and the Handicapped in Science and Technology reported in the 1988 Interim Report entitled, Changing America: The New Face of Science and Engineering, that one of America's most urgent tasks is to strengthen the science and engineering work force. The Task Force asserts that, "by the year 2000, 85 percent of new entrants to the Nation's work force will be members of minority groups and women." According to the Wall Street Journal, summer internships are flourishing, with an emphasis on minorities. Bausch and Lomb, Inc., and Chevron Corporation are increasing summer internship opportunities and are focusing recruiting efforts on minority candidates. The Aluminum Company of America is focusing internship opportunities on minorities and women with engineering and technical training. The challenge is clear: More women and minority scientists must be educated to meet the needs of America's technical work force. Based on this data, a summer research internship program with an emphasis on minority and women students was designed. Undergraduates were selected, as opposed to graduate students, We hoped to recruit outstanding students in the physical sciences and mathematics and give them a positive research experience that would encourage them to attend graduate school and pursue research careers. Also, a survey of current NASA programs for students indicated that more opportunities were available for K-12 and graduate students than undergraduates. The primary objective of the HSCaRS Summer Enrichment Program (SEP) is to make significant contributions to the NASA Mission to Planet Earth and HSCaRS research missions by providing undergraduate student research internships, with an emphasis on minority and women students. Additional objectives are to encourage more minority and women students to pursue advanced degrees in Earth system science and to increase the participation of minority institutions in the U.S. Global Change Research Program. Also, the SEP strives to make students in the traditional science disciplines more aware of the opportunities in Earth system science. In designing the SEP, it was acknowledged that HSCaRS was a new research effort and Center. Consequently, students were not expected to recognize the Center immediately as one would older, more established research laboratories with national reputations, such as Los Alamos, Battelle, National Center for Atmospheric Research (NCAR), etc. Yet we still wanted to compete nationally for the best students. Therefore, we designed the program with a competitive financial package that includes a stipend of $400 per week, round-trip transportation from home to the summer research site, and free campus housing and meal plans provided by Alabama A&M University. The internship program was 10 weeks in residence at Alabama A&M University or IGCRE in 1996 and adjusted to eight weeks in 1997. Students had the opportunity to select from general research areas such as: micro-meteorology, soil data analysis, hydrologic modeling, instrumentation, geographic information systems, soil hydrology,

computer science, etc. Student participants also enrolled in an introductory global change science course as part of the summer program (a copy of the course outline is in the appendix). The program included participation in a field program for approximately two weeks in 1996, but did not have a significant field work component in the second year. We hope to be able to offer student researchers a field experience again in 1998 as a learning experience, regardless of the relationship of the field program to their majors or particular research projects.
Derived from text
Education; Minorities; Earth Sciences; Research; Students

20000032329 Alabama A & M Univ., Center for Hydrology, Soil Climatology and Remote Sensing, Normal, AL USA
Long Term Effects of Poultry Litter on Soil Physical and Chemical Properties in Cotton Plots
Surrency, J., Alabama A & M Univ., USA; Tsegaye, T., Alabama A & M Univ., USA; Coleman, T., Alabama A & M Univ., USA; Fahsi, A., Alabama A & M Univ., USA; Reddy, C., Alabama A & M Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volume 2 and 3, pp. 916-920; In English; See also 20000032189
Contract(s)/Grant(s): NCCW-84; NCC8-140; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Poultry litter and compost can alter the moisture holding capacity of a soil. These organic materials can also increase the nutrient status of a soil during the decomposition process by microbial actions. The objective of this study was to evaluate the effect of poultry litter and compost on the dielectric constant and moisture holding capacity of soil. The Delta-T theta-probe was used to measure volumetric soil water content and the apparent dielectric constant of the upper 6-cm of the soil profile. Soil texture, pH, and organic matter were also determined for each plot. Results of these analyses indicated that the pH of the soil ranged from 6.4 to 7.7 and the volumetric soil moisture content ranged from 0.06 to 0.18 cu m/cu m for the upper 6-cm of the soil profile. The effect of poultry litter and compost on soil properties resulted in an increase in the volumetric moisture content and dielectric constant of the soil due to the improvement of the soil structure.
Author
Composting; Cotton; Long Term Effects; Moisture Content; Organic Materials; Soil Moisture; Soil Science; By-Products; Solid Wastes; Chickens; Permittivity

20000032331 Texas Univ., PACES, El Paso, TX USA
Research and Interpretation of the Camino Real from Taos, New Mexico, to Parral and Chihuahua, Chihuahua
Enriquez, Alfredo, Texas Univ., USA; Peterson, John A., Texas Univ., USA; Pingitore, Nicholas E., Jr., Texas Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 927-932; In English; See also 20000032189
Report No.(s): 98URC165; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The Camino Real from Chihuahua to Taos was the major thoroughfare for Spanish exploration and settlement of the region of northern New Spain. Missions, presidios, and haciendas, the three vital links in the Spanish Colonial system, are all still to be found in the region, dating from as early as the late 17th century. The Camino Real was the connective fiber for these sites during historical times. The archaeological traces of the Camino Real arid its associated settlements unfortunately are poorly documented and have never been integrated into models for the region. Human settlement in what was northern New Spain has been contingent on water resources. The nodes of settlement and the routes of the Camino Real were constrained by water availability throughout the arid expanses of the Chihuahua Desert. Prehistoric settlement, which has extended at least 12,000 years before present in the region, likewise was limited by water resources, many of which have changed through the Holocene. However, the correlation of known archaeological sites with existing and fossil water resources has never been evaluated. The goal of this project is to use satellite imaging to delineate remaining traces of the Camino Real and associated water resources. These findings are being compared with historical records pertaining to that route. Historical and prehistoric archaeological settlement data and geohydrological data for northern Mexico and the American Southwest are integrated with the NASA data in order to develop predictive models for human settlement. This project correlates investigations of the Camino Real and colonial era settlements, prehistoric settlement systems in the region, and geohydrological investigations to model surface and near-surface water availability throughout the settlement history of the region. A predictive model for human settlement based on geohydrological resources is developed and applied to contemporary as well as historical settlement.
Derived from text
Archaeology; Remote Sensing; Satellite Imagery; Water Resources; Surface Water; Fossils

20000032348 Michigan Technological Univ., Houghton, MI USA

Effect of Fresh Poultry Litter and Compost on Soil Physical and Chemical Properties

Carr, Stacy, Michigan Technological Univ., USA; Tsegaye, Teferi, Alabama Agricultural and Mechanical Coll., USA; Coleman, Tommy, Alabama Agricultural and Mechanical Coll., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 382-387; In English; See also 20000032189

Contract(s)/Grant(s): NCCW-0084; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Application of poultry litter and compost as a substitute for fertilizer not only uses unwanted waste and decreases expenditures for commercial fertilizer, it adds nutrients to soil for plant uptake. The properties of soil affected by poultry litter were analyzed to determine the positive and negative aspects of using this substitute fertilizer. This study focused on changes associated with saturated hydraulic conductivity, bulk density, nitrate concentrations, and pH after application of varying concentrations of poultry litter and compost. Soil samples from Tennessee Valley Substation in Alabama were analyzed in a laboratory at Alabama A&M University. As a result of the application of fresh poultry litter and compost, we found that the saturated hydraulic conductivity increased and the bulk density decreased, while the pH was generally not affected. Using poultry litter and compost as an alternative commercial fertilizers could be adapted by the farming community to protect the sustainability of our environment. Unwanted waste is used productively and soil is enriched for farming.

Author

Composting; Fertilizers; Waste Utilization; Manures; Metabolic Wastes; Chickens; Soil Science; Chemical Properties

20000032496 National Inst. of Radiological Sciences, Chiba, Japan

Radioactivity survey data in Japan, Part 1, Environmental materials

Mar. 31, 1999; 34p; In English

Report No.(s): DE99-758731; NIRS-RSD-120; No Copyright; Avail: Department of Energy Information Bridge

The collection and pretreatment of samples are explained for rain and dry fall-out, airborne dust, service water and freshwater, soil, seawater, sea sediments, total diet, rice, milk, vegetables, tea, fish, shellfish and seaweeds. The preparation of samples for analysis is explained for rain, service water and freshwater, soil and sea sediments, rice, airborne dust, diet, milk, vegetables, fish and shellfish, seaweeds, tea and others. The separation of strontium-90 and cesium-137, the determination of stable strontium, calcium and potassium, and the counting of activity using low background beta counters are described. As the results, the strontium-90 and cesium-137 in rain and dry fall-out, airborne dust, service water, freshwater, soil, seawater and sea sediment from October, 1996 to March, 1997 are reported. The graphs showing the change of these data from 1992 to 1996 are shown. Finally, 47 sampling locations in Japan are shown. Samples were sent to Japan Chemical Analysis Center from 46 contracted prefectures.

NTIS

Cesium 137; Pretreatment; Rain; Fallout; Environmental Monitoring

20000032500 Japan Atomic Energy Research Inst., Tokyo, Japan

Database on tritium behavior in the chronic HT release experiment, 1, Meteorological data and tritium concentrations in air and soil

Noguchi, H.; Yokoyama, S.; Kinouchi, N.; Murata, M.; Amano, H.; Mar. 31, 1999; 136p; In English

Report No.(s): DE99-758366; JAERI-DATA/CODE-99-022; No Copyright; Avail: Department of Energy Information Bridge

This report comprises a database that can be used to develop and validate tritium models to assess doses to the general public due to HT continuously released from fusion facilities into the atmosphere. The data was collected in the 1994 chronic HT release experiment carried out at the Chalk River Laboratories in Canada. The data set include meteorological conditions such as solar radiation, net solar radiation, wind speed, air temperature and humidity, soil temperature and soil heat flux; soil conditions such as bulk density, water content and free pore volume fraction; HT and HTO concentrations in air, HTO concentrations in soil moisture and HTO deposition to water surface. Evapo-transpiration rates and turbulent diffusivity are estimated and tabulated. The report also contains experimental methods to observe meteorological conditions and take air and soil samples.

NTIS

Data Bases; Tritium; Soils; Weather; Evapotranspiration; Transpiration

20000032589 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Trajectory Hunting: A Case Study of Rapid Chlorine Activation in December 1992 as Seen by UARS

Danilin, M. Y., Atmospheric and Environmental Research, Inc., USA; Santee, M. L., Jet Propulsion Lab., California Inst. of Tech., USA; Rodriquez, J. M., Miami Univ., USA; Ko, M. K. W., Atmospheric and Environmental Research, Inc., USA; Mergenthaler, J. M., Lockheed Martin Palo Alto Research Lab., USA; Kumer, J. B., Lockheed Martin Palo Alto Research Lab., USA; Tabazadeh,

A., NASA Ames Research Center, USA; Livesey, Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Geophysical Research; Feb. 16, 2000; ISSN 0148-0227; Volume 105, No. D3, pp. 4003-4018; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS5-32844; NAS5-98131; NAS5-97039
Report No.(s): Paper-199JD901054; Copyright; Avail: Issuing Activity

Trajectory hunting (i.e., a technique to find air parcels sampled at least twice over the course of a few days) is applied to analyze Upper Atmosphere Research Satellite (UARS) measurements in conjunction with the Atmospheric and Environmental Research, Inc. (AER) photochemical box model. As a case study, we investigate rapid chlorine activation in the Arctic lower stratosphere on December 29, 1992 associated with a polar stratospheric cloud (PSC) event. Eleven air parcels that have been sampled several times along 5-day trajectories at the 465 K (approx. 46 hPa), 520 K (approx. 31 hPa), and 585 K (approx. 22 hPa) levels were investigated. For the first time, the latest versions of the Cryogenic Limb Array Etalon Spectrometer (CLAES, version 9) and Microwave Limb Sounder (MLS, version 5) data sets are analyzed, and their consistency is assessed. A detailed sensitivity study with the AER photochemical box model along these trajectories leads to the conclusion that for the December 24-29, 1992 episode (1) the individual CLAES version 9 ClONO2 and MLS version 5 ClO measurements are self-consistent within their uncertainties; and (2) most of the time, UARS measurements of ClO, ClONO2, HNO3, and aerosol extinction at 780 cm (exp -1) agree within the range of their uncertainties with the model calculations. It appears that the HNO3 and aerosol extinction measurements for four parcels at 520 K look more supportive for the nitric acid trihydrate (NAT) scheme. However, the uncertainties in the individual UARS measurements and U.K. Meteorological Office temperature do not allow a definite discrimination between the NAT and supercooled ternary solution (STS) PSC schemes for this chlorine activation episode in December 1992.

Author

Chlorine; Trajectories; Upper Atmosphere Research Satellite (UARS); Photochemical Reactions; Aerosols; Stratosphere; Satellite Observation

20000032629 National Inst. for Occupational Safety and Health, Div. of Physical Sciences and Engineering, Cincinnati, OH USA

Walk-Through Survey Report: Potential Options for the Control of Border Agents Exposure to Vehicle Emissions at USA Port of Entry, Calexico, California

Dunn, K.; Mead, K. R.; Heitbrink, W. A.; Dec. 1999; 14p; In English
Report No.(s): PB2000-100634; ECTB-010-03A; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A team of three researchers from the National Institute for Occupational Safety and Health (NIOSH) visited the USA/Mexico border crossing between Calexico, California and Mexicali, Mexico. The purpose of the visit was to review the facility operations and develop potential options for reducing border agent exposure to vehicle exhaust. The facility at Calexico differs from the San Ysidro in size (10 lanes versus 24 lanes), ventilation scheme, and traffic volume. This report discusses observations and recommendations concerning the control of border agents' exposure to vehicle emissions at the Calexico Port of Entry into the USA.

NTIS

Surveys; Exposure; Exhaust Emission; Combustion Products; Exhaust Gases; Air Pollution

20000032746 NASA Marshall Space Flight Center, Huntsville, AL USA

National Emission Standards for Hazardous Air Pollutants (NESHAP) Memorandum of Agreement (MOA) Between NASA Headquarters and MSFC (Marshall Space Flight Center) for NASA Principal Center for Review of Clean Air Regulations

Caruso, Salvadore V., NASA Marshall Space Flight Center, USA; Clark–Ingram, Marceia A., NASA Marshall Space Flight Center, USA; [2000]; 15p; In English, 29 Mar. - 3 Apr. 2000, Moffett Field, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a memorandum of agreement on Clean Air Regulations. NASA headquarters (code JE and code M) has asked MSFC to serve as principle center for review of Clean Air Act (CAA) regulations. The purpose of the principle center is to provide centralized support to NASA headquarters for the management and leadership of NASA's CAA regulation review process and to identify the potential impact of proposed CAA reguations on NASA program hardware and supporting facilities. The materials and processes utilized in the manufacture of NASA's programmatic hardware contain HAPs (Hazardous Air Pollutants), VOCs (Volatile Organic Compounds), and ODC (Ozone Depleting Chemicals). This paper is presented in viewgraph form.

Derived from text

Air Pollution; Air Quality; Exhaust Emission; NASA Programs; Regulations

20000032798 Norwegian Inst. for Air Research, Kjeller, Norway

Air quality in Norwegian cities. Development, reasons, measures , future

Larssen, S.; Hagen, L. O.; Dec. 31, 1999; 33p; In Norwegian; In English

Report No.(s): DE99-771607; NILU-OR-69/98; No Copyright; Avail: Department of Energy Information Bridge

The report is a survey of the air pollution development in Norwegian cities and towns during the latter part of this century. It deals with particular pollutants some of which are SO2, NO(sub x), benzenes, lead, soot and various air borne particulate matter. There are sections on traffic, vehicle technology and pollution problems, various pollution development possibilities and pollution control measures.

NTIS

Air Quality; Pollution Control; Air Pollution; Pollution Monitoring

20000032799 Oslo Univ., Center for International Climate and Environmental Research, Norway

Efficient and accurate carbon cycle model for use in simple climate models

Alfsen, K. H.; Berntsen, T.; Dec. 31, 1999; 18p; In English

Report No.(s): DE99-771602; CICERO-WP-1999/1; No Copyright; Avail: Department of Energy Information Bridge

The publication describes a simple but accurate model for calculating CO2 concentration levels in the atmosphere. the model is based on extracts from Joos, F., Bruno, M., Fink, T., Siegenthaler, U. and Stocker, T.F. (1996): An efficient and accurate representation of complex oceanic and bio spheric models of anthropogenic carbon uptake, Tellus 48B, 397-417.

NTIS

Carbon Cycle; Climate Models; Air Pollution

20000032801 Technical Research Centre of Finland, Espoo, Finland

Integrated cost-effectiveness analysis of greenhouse gas emission abatement. The case of Finland

Lehtilae, A.; Tuhkanen, S.; Dec. 31, 1999; 163p; In English

Report No.(s): DE99-771569; VTT-PUB-374; ISBN 951-38-5357-8; No Copyright; Avail: Department of Energy Information Bridge

In Finland greenhouse gas emissions are expected to increase during the next decades due to economic growth, particularly in the energy intensive industrial sectors. The role of these industries is very central in the national economy. The emission control according to the Kyoto Protocol will effectiveness of different technical options for reducing the emissions of carbon dioxide, methane, and nitrous oxide in Finland. The analysis is performed with the help of a comprehensive energy system model for Finland, which has been extended to cover all major sources of methane and nitrous oxide emissions in the energy sector, industry, waste management and agriculture. The focus being on technical options, no consideration is given to possible policy measures, emission trading or joint implementation in the study. Under the boundary conditions given for the development of the Finnish energy economy, cost-effective technical measures in the energy system include increases in the use of wood biomass, natural gas and wind energy, increases in the contribution of CHP to the power supply, and intensified energy conservation in all end-use sectors. Additional cost-effective measures are landfill gas recovery, utilisation of the combustible fraction of waste and catalytic conversion of N(sub 2)O in nitric acid production. With baseline assumptions, the direct annual costs of emission abatement are calculated to be about 2000 MFIM (330 M(epsilon)) in 2010. The marginal costs are estimated to be about 230 FIM (40 (epsilon)) per tonne of CO(sub 2)-equivalent in 2010. The cost curie derived from the analysis could be used in further analyses concerning emissions trading.

NTIS

Cost Effectiveness; Greenhouse Effect; Exhaust Emission; Exhaust Gases

20000032803 NASA Goddard Space Flight Center, Greenbelt, MD USA

SHADOZ (Southern Hemisphere ADditional OZonesondes): An Ozonesonde Network and Resource for Remote Sensing Research and Education

Thompson, Anne M., NASA Goddard Space Flight Center, USA; Witte, Jacquelyn C., NASA Goddard Space Flight Center, USA; [2000]; 4p; In English; 28th; 28th International Symposium on Remote Sensing of Environment, 27-31 Mar. 2000, Cape Town,, South Africa; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Balloon-borne ozone instrumentation (ozonesondes), launched at fixed sites, is used to study local patterns in stratospheric and tropospheric ozone and to provide validation for satellite ozone products and model calculations of ozone. A paucity of coordinated ozonesonde data in the southern hemisphere tropics is being remedied in a 3-year project of coordinated ozonesondes launches at 10 sites. The data are available to the scientific community at the SHADOZ website at NASA/Goddard. Stations and their operational characteristics, with examples of ozone observations, are given. One expectation of SHADOZ is that wide

dissemination of data and interaction with users and field projects will leverage local funding to maintain infrastructure and operations. SHADOZ data are well-suited for educational projects in which students learn about regional ozone patterns.
Author
Ozone; Ozonometry; Atmospheric Composition; Southern Hemisphere; Balloon-Borne Instruments; Airborne Equipment

20000032955 NASA Goddard Space Flight Center, Greenbelt, MD USA
Application of a Reduced Order Kalman Filter to Initialize a Coupled Atmosphere-Ocean Model: Impact on the Prediction of El Nino
Ballabrera–Poy, Joaquim, Universities Space Research Association, USA; Busalacchi, Antonio J., NASA Goddard Space Flight Center, USA; Murtugudde, Ragu, Maryland Univ., USA; February 2000; 64p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 621-75-02; RTOP 229-15-35; RTOP 291-01-08; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A reduced order Kalman Filter, based on a simplification of the Singular Evolutive Extended Kalman (SEEK) filter equations, is used to assimilate observed fields of the surface wind stress, sea surface temperature and sea level into the nonlinear coupled ocean-atmosphere model. The SEEK filter projects the Kalman Filter equations onto a subspace defined by the eigenvalue decomposition of the error forecast matrix, allowing its application to high dimensional systems. The Zebiak and Cane model couples a linear reduced gravity ocean model with a single vertical mode atmospheric model of Zebiak. The compatibility between the simplified physics of the model and each observed variable is studied separately and together. The results show the ability of the model to represent the simultaneous value of the wind stress, SST and sea level, when the fields are limited to the latitude band 10 deg S - 10 deg N. In this first application of the Kalman Filter to a coupled ocean-atmosphere prediction model, the sea level fields are assimilated in terms of the Kelvin and Rossby modes of the thermocline depth anomaly. An estimation of the error of these modes is derived from the projection of an estimation of the sea level error over such modes. This method gives a value of 12 for the error of the Kelvin amplitude, and 6 m of error for the Rossby component of the thermocline depth. The ability of the method to reconstruct the state of the equatorial Pacific and predict its time evolution is demonstrated. The method is shown to be quite robust for predictions I up to six months, and able to predict the onset of the 1997 warm event fifteen months before its occurrence.
Author
Atmospheric Models; El Nino; Kalman Filters; Ocean Models; Reduced Order Filters; Air Water Interactions; Predictions

20000033377 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Electro-Kinetic Removal of Oil from a Contaminated Soil
Yeh, Kuo–Liang, National Central Univ., Taiwan, Province of China; Wu, Ray–Shyan, National Central Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; 2000; ISSN 0253-3839; Volume 23, No. 1, pp. 61-69; In English; Copyright; Avail: Issuing Activity

An electro-kinetic method which combined effects of electrophoresis, electro-osmosis, electrolysis, and ion exchange, was evaluated for the removal of crude oil from a contaminated soil. A field test was designed to evaluate the removal process and to measure physical and chemical chances which occurred in the soil as a result of electro-kinetic treatment. A lot of 12 m x 5 m x 1 m was used for the field test and a DC power of 110 V was applied. The observations of the test are physical and chemical changes in soil, pH value at electrodes, discoloration of the surface soil, and the oil content in soil. Testing results indicated that the electro-kinetic treatment induced a hydraulic gradient that helped most of the lighter hydrocarbons in crude oil be removed from the soil within three weeks. The pH values of 2.5 at the anode and 11 at the cathode were measured and indicated that the reduction and oxidation processes occurred as expected.
Author
Electrolysis; Removal; Contamination; Soils; Procedures; Crude Oil

20000033423 NASA Goddard Space Flight Center, Greenbelt, MD USA
The GEOS Ozone Data Assimilation System: Specification of Error Statistics
Stajner, Ivanka, NASA Goddard Space Flight Center, USA; Riishojgaard, Lars Peter, NASA Goddard Space Flight Center, USA; Rood, Richard B., NASA Goddard Space Flight Center, USA; Feb. 03, 2000; 32p; In English
Contract(s)/Grant(s): NCC5-92; RTOP 621-82-31-20; RTOP 622-59-07-21; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A global three-dimensional ozone data assimilation system has been developed at the Data Assimilation Office of the NASA/Goddard Space Flight Center. The Total Ozone Mapping Spectrometer (TOMS) total ozone and the Solar Backscatter Ultraviolet (SBUV) or (SBUV/2) partial ozone profile observations are assimilated. The assimilation, into an off-line ozone

transport model, is done using the global Physical-space Statistical Analysis Scheme (PSAS). This system became operational in December 1999. A detailed description of the statistical analysis scheme, and in particular, the forecast and observation error covariance models is given. A new global anisotropic horizontal forecast error correlation model accounts for a varying distribution of observations with latitude. Correlations are largest in the zonal direction in the tropics where data is sparse. Forecast error variance model is proportional to the ozone field. The forecast error covariance parameters were determined by maximum likelihood estimation. The error covariance models are validated using x squared statistics. The analyzed ozone fields in the winter 1992 are validated against independent observations from ozone sondes and HALOE. There is better than 10% agreement between mean Halogen Occultation Experiment (HALOE) and analysis fields between 70 and 0.2 hPa. The global root-mean-square (RMS) difference between TOMS observed and forecast values is less than 4%. The global RMS difference between SBUV observed and analyzed ozone between 50 and 3 hPa is less than 15%.
Author
Error Analysis; Ozone; Earth Observing System (EOS); Data Acquisition; Mathematical Models; Statistical Analysis

46
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.

20000032112 Sonoquest/Advanced Ultrasonics Research, Wellesley Hills, MA USA
Seismoacoustic Waves in Water-Covered Sand ***Final Report, May 1997-Dec 1999***
Chamuel, Jacques R.; Dec. 1999; 47p; In English
Contract(s)/Grant(s): N00014-97-C-0065
Report No.(s): AD-A373739; JRC-74-99; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A collection of new findings are presented contributing to fundamental physical understanding of broadband (3-500 KHz) transient seismoacoustic wave phenomena in various sand conditions (water-saturated, naturally settled, disturbed, drained, liquefied, compacted, water-covered, air bubbles) important for acoustic modeling of seafloor and predicting the penetration and conversion of seismoacoustic waves in sediments. The experimental results compare waveforms of different types of seismoacoustic waves. An explanation is given for the anomalous slow compressional wave observed in water-saturated sand by Boyle and Chotiros (1992). Other experimental results presented include a) the effect of ripples on surface and interface waves dispersion, b) the existence of high-frequency fast compressional waves (1650 m/s) in drained sand, c) the effect of puddles and water edges on converting interface waves into body shear waves, d) the nonexistence of a second Rayleigh wave along with Scholte wave in soft sediments, and e) the first experimental results on wedge waves along the edge of sand dollar skeletons.
DTIC
Underwater Acoustics; Ocean Bottom; Sands; Bubbles; Sediments; Rayleigh Waves; Compression Waves

20000032186 NASA Goddard Space Flight Center, Greenbelt, MD USA
Wintertime East Asian Jet Stream and Its Association with the Asian-Pacific Climate
Yang, Song, General Sciences Corp., USA; Lau, K.–M., NASA Goddard Space Flight Center, USA; Kim, K.–M., Universities Space Research Association, USA; [2000]; 1p; In English; 2nd; Asian Monsoon System, 27-31 Mar. 2000, Cheju, Korea, Republic of; No Copyright; Avail: Issuing Activity; Abstract Only

Interannual variability of the wintertime East Asian westerly jet stream and the linkage between this variability and the Asian-Pacific climate are investigated. The study emphasizes on the variability of the jet core and its association with the Asian winter monsoon, tropical convection, upper tropospheric wave patterns, and the teleconnection of the jet with other climate systems. The relationship between the jet and North Pacific sea surface temperature pattern (SST) is also explored. NCEP/NCAR reanalysis, NASA GISS surface temperature, NASA GEOS reanalysis, NOAA reconstructed SST, GPCP precipitation, and NOAA snow cover data sets are analyzed in this study. An index of the East Asian jet has been defined by the December-February means of the 200 mb zonal winds that are averaged within a box enclosing the jet maximum, which shifts only moderately from one year to another especially in the south-north direction. The jet links to a teleconnection pattern whose major climate anomalies appear over the Asian continent and western Pacific (west of the dateline). This pattern differs distinctly from the teleconnection pattern associated with El Nino/Southern Oscillation (ENSO), which causes the Pacific/North American pattern to the east of the dateline. A strong jet is accompanied clearly by an increase in the intensity of the atmospheric circulation over Asia and the Pacific. In particular, the winter monsoon strengthens over East Asia, leading to cold climate in the region, and convection intensifies over the tropical Asia-Australia sector. Changes in the jet are associated with broad-scale modification in the upper tropospheric wave

patterns that leads to downstream climate anomalies over the eastern Pacific. Through this downstream influence, the East Asian jet causes climate signals in North America as well. A strong jet gives rise to warming and less snow cover in the western USA but reverse climate anomalies in the eastern part of the country, although these signals are relatively weaker than the jet-related anomalies in East Asia. There is a strong association between the East Asian jet and the North Pacific SST (NPSST). A strong jet is accompanied by a cooling in the extratropical Pacific and a warming in the tropical-subtropical Pacific. Evidence also indicates that the extratropical NPSST pattern plays a role in modulating the intensity of the jet stream. ENSO, the jet, and the NPSST are mutually interactive on certain time scales and such an interaction links closely to the climate anomalies in the Asian-Pacific-American regions.
Author
Jet Streams (Meteorology); Climate; Linkages; Variability; Air Jets; Climatology

20000032261 Texas Univ., Pan-American Center for Earth and Environmental Studies, El Paso, TX USA
An Integrated Geophysical Analysis of the Albuquerque Basin
Gillespie, Cindy L., Texas Univ., USA; Keller, G. Randy, Texas Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 703-708; In English; See also 20000032189
Report No.(s): 98URC127; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
The Albuquerque Basin is one of the largest and deepest basins associated with the Rio Grande rift. Several deep wells and tens of kilometers of seismic reflection data, interpreted by water utilities and oil and gas companies, provide a good model of the structure and stratigraphy of the area. Seismic reflection data, for example, define large scale features such as the geometry of the basins and the presence of faults. Deep well data allow stratigraphic correlations within the basin. Integration of these results with gravity and remote sensing tools provides a ”3D” picture of the basin. Water usage from the Albuquerque Basin has increased due to industrial and residential use. It has been proposed that most of the shallow, highly permeable part of the aquifer has already been ”tapped out.” Locating alternative aquifers, to supply the growing demand for more water, are costly.
Derived from text
Geophysics; Structural Basins; New Mexico; Rio Grande (North America); Stratigraphy

20000032277 Alabama A & M Univ., Dept. of Plant and Soil Scinece, Normal, AL USA
Ultrasonic Velocity Variations with Soil Composition for Moisture Measurement
Metzl, R., Alabama A & M Univ., USA; Choi, J., Alabama A & M Univ., USA; Aggarwal, M. D., Alabama A & M Univ., USA; Manu, A., Alabama A & M Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 199-202; In English; See also 20000032189
Contract(s)/Grant(s): NASA-URC-10-82104
Report No.(s): 98URC037; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM
Soil moisture content may be measured by many methods, but the presently available techniques all have drawbacks when used in ground truth measurements for remote sensing. Ultrasonic velocity varies with soil moisture content, and may be used as the basis of a new measurement technique. In order to characterize a sensor capable of field use, soil particle size distribution data are compared to ultrasonic velocity in a variety of soils over a wide moisture range.
Author
Soil Moisture; Remote Sensing; Ultrasonics; Velocity; Algorithms; Moisture Content

20000032806 NASA Goddard Space Flight Center, Greenbelt, MD USA
Crustal Deformation Associated with Glacial Fluctuations in the Eastern Chugach Mountains, Alaska
Sauber, Jeanne, NASA Goddard Space Flight Center, USA; Plafker, George, Geological Survey, USA; Molnia, Bruce F., Geological Survey, USA; Bryant, Mark A., Ashtech, USA; [2000]; 34p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The changes of the solid Earth in south central Alaska in response to two major glacial fluctuations on different temporal and spatial scales have been estimated and we evaluated their influence on the stress state and ongoing tectonic deformation of the region. During the recent (1993-1995) Bering Glacier surge, a large transfer of ice from the Bagley Ice Field to the Bering Glacier terminus region occurred. We estimated the elastic displacement of the solid Earth due to ice mass redistribution from Global Positioning System (GPS) measurements at sites near the surging glacier. We can account for these displacements by transfer of an ice volume of about 14 cubic km from the surge reservoir area to the terminus region. We examined the background seismicity (M(sub L) is greater than 2.5) before, during, and after the surge. We found that the occurrence of small earthquakes (M(sub L)

is less than 4.0) in the surge reservoir region increased during the surge time interval possibly in response to a decrease in ice mass. This suggests that a small decrease in the vertical stress, o,3, could be enough to modulate the occurrence of small, shallow earthquakes in this dominantly thrust fault setting. During this century the southern Alaska coastal glaciers have been undergoing an overall decrease in volume. Based on our compilation of changes in the extent and thickness of the coastal glaciers between the Malaspina and Bering, we calculated surface displacements due to the Earth's viscoelastic response to annual thinning and to the cumulative retreat over the last 100 years. The uplift of the region due to an average annual thinning rate of 1-6 m/yr in the ablation region is 1-12 mm/yr. For our reference model with a viscosity of 5 x 10(exp 19) Pa s for depths between approximately equal 40 and 200 km the total viscoelastic response due to the retreat over the last century may be as much as a couple of meters within the coastal ablation zone near Icy Bay. The maximum decrease in sigma(sub V) between 0 and 10 km was approximately equal 1.0 MPa, which is significant in relation to the stress drops in recent earthquakes (approximately 2 to 10 MPa) but small in relation to the estimated tectonic stress magnitude. Therefore the occurrence of an earthquake such as the St. Elias (1979, M(sub S) = 7.2) may have been advanced in time; however, most of the ongoing stress accumulation would be primarily due to tectonic forces.
Author
Crustal Fractures; Earthquakes; Geological Faults; Deformation; Displacement; Glaciers; Rheology

20000032964 NASA Marshall Space Flight Center, Huntsville, AL USA
Charged Particle Environment Definition for NGST: Model Development
Blackwell, William C., Sverdrup Technology, Inc., USA; Minow, Joseph I., Sverdrup Technology, Inc., USA; Evans, Steven W., NASA Marshall Space Flight Center, USA; Hardage, Donna M., NASA Marshall Space Flight Center, USA; Suggs, Robert M., NASA Marshall Space Flight Center, USA; [2000]; 12p; In English; Astronomical Telescopes and Instrumentation 2000, 27-31 Mar. 2000, Munich, Germany; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): NAS8-40836; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NGST will operate in a halo orbit about the L2 point, 1.5 million km from the Earth, where the spacecraft will periodically travel through the magnetotail region. There are a number of tools available to calculate the high energy, ionizing radiation particle environment from galactic cosmic rays and from solar disturbances. However, space environment tools are not generally available to provide assessments of charged particle environment and its variations in the solar wind, magnetosheath, and magnetotail at L2 distances. An engineering-level phenomenology code (LRAD) was therefore developed to facilitate the definition of charged particle environments in the vicinity of the L2 point in support of the NGST program. LRAD contains models tied to satellite measurement data of the solar wind and magnetotail regions. The model provides particle flux and fluence calculations necessary to predict spacecraft charging conditions and the degradation of materials used in the construction of NGST. This paper describes the LRAD environment models for the deep magnetotail (XGSE is less than -100 Re) and solar wind, and presents predictions of the charged particle environment for NGST.
Author
Charged Particles; Environment Models; Geomagnetic Tail; Magnetosheath; Solar Wind; Wind Measurement; Wind Variations

20000033063 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Study on High-Level Synthesis of VLSI Processors Based on Integration of Allocation and Scheduling and Its Application
Takahashi, Daisuke, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 401-402; In Japanese; Copyright; Avail: Issuing Activity

In intelligent integrated systems, it is essential to respond very quickly to the dynamically changing real-world environment. Therefore, development of special-purpose VLSI processors with super high performance will be a very important subject. In this article, practical high-level synthesis of VLSI processors based on integration of allocation and scheduling is developed to achieve the highest performance under area constraint. A model of parallel-structure VLSI processors is defined which have multiple processing elements (PEs) such as multipliers connected by multiple buses. A formulation of the problem is done in the processor model. The branch and bound method is developed for the tree search, where each node denotes step assignment and PE assignment corresponding to scheduling and allocation, respectively. As a result, the search time can be greatly reduced in many practical processors. The proposed method is also utilized as a parallel programming tool for multi-CPU processors.
Author
Nonlinear Programming; Parallel Processing (Computers); Parallel Programming; Scheduling; Very Large Scale Integration; Systems Integration

20000033065 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Study on an Asynchronous Multiple-Valued VLSI Processor Based on Dual-Rail Logic

Saito, Takahiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 395-396; In Japanese; Copyright; Avail: Issuing Activity

This paper presents a new asynchronous data-transfer scheme in a multiple-valued current-mode VLSI circuit based on dual-rail differential logic. In the proposed 2-phase multiple-valued asynchronous communication, R-valued dual-rail complementary signals are used to represent a 'data value,' while the 'spacer' is represented as (0,0). The sum of R-valued dual-rail complementary values is a constant (R-1), which makes it easy to distinguish a data-arrival state from a data-transition state. This scheme can be extended to any multiple-valued data representation in the asynchronous communication. New basic components, a signal-state detector to detect a data-arrival state, and a current-controlled threshold detector to produce dual-rail spacer signals (0,0), are also proposed to realize a compact asynchronous control circuit. It is demonstrated that the overhead for the proposed asynchronous circuit is very small in comparison with the corresponding synchronous multiple-valued current-mode logic circuit. Author

Logic Circuits; Signal Detectors; Very Large Scale Integration; Threshold Logic; Data Transfer (Computers)

20000033066 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Study on Design of a Parallel Stereo Vision VLSI Processor

Nakazato, Hiroumi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 393-394; In Japanese; Copyright; Avail: Issuing Activity

For intelligent, robots. a very high-speed stereo vision is required to perform real-time three-dimensional (3-D) instrumentation at high speed. In this paper, we propose a high-performance stereo vision VLSI processor for 3-D instrumentation based on correspondence matching of local patches of two images. Both spatial parallel architecture and pipeline architecture are effectively employed for reducing the delay time from image acquisition to output of 3-D distances. to supply required data in parallel to arithmetic units, we propose a new frame buffer using a shift resister array, As a result, the 3-D instrumentation using image of size 256 x 256 can be performed in less than 100msec using the proposed VLSI processor.
Author

Stereoscopic Vision; Very Large Scale Integration; Pipelining (Computers); Parallel Processing (Computers)

20000033067 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Study on an Image Recognition VLSI Processor for Highly-Safe Intelligent Integrated Systems

Kitayama, Nobuyasu, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 391-392; In Japanese; Copyright; Avail: Issuing Activity

High-speed and highly-reliable human extraction plays an essential role in highly-safe intelligent integrated systems such as a intelligent vehicle and a home service robot. Invariant properties that are common to all the humans should be used for human extraction. This paper presents a human extraction algorithm based on connectivity of human parts such as hands, legs, and a head. Since thinning is the most-time consuming time minimization of a thinning VLSI processor under all area constraint is discussed. In the thinning algorithm, to achieve high performance, a scheduling such that life times of intermediate data become minimum is important to reduce a total memory area. It is established that the performance of the designed VLSI processor is higher than that of the VLSI processor based on the conventional architecture.
Author

Algorithms; Very Large Scale Integration; Character Recognition; Systems Integration

20000033130 NASA Goddard Space Flight Center, Greenbelt, MD USA

Magnetism of Carbonados

Kletetschka, G., NASA Goddard Space Flight Center, USA; Taylor, P. T., NASA Goddard Space Flight Center, USA; Wasilewski, P. J., NASA Goddard Space Flight Center, USA; [1999]; 3p; In English; Lunar and Planetary Science Conference, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Carbonados are porous polycrystalline (with crystal sizes up to 100 micrometer) diamonds. Carbonado is found only in alluvial deposits in Bahia, Brazil and in the Central African Republic (CAR). Alluvial deposit host is 1.5 Ga while the carbonados are between 2.6 - 3.8 Ga. The process of fusing the carbonado microcrystals together is not fully understood, partly due to fact that the origin of these carbonado, is not known. Several modes of origins are proposed for carbonado. First, a crustal origin. Carbonados have a light carbon and helium isotopic signature. They contain an enrichment of the rare-earth elements (REE). Carbonados have tightly trapped atmospheric noble gases and contain an evidence of high He content despite the carbonado expected depletion of He at mantle temperatures. Carbonados have high porosity incompatible with high pressure mantle

conditions. Second, a mantle origin is proposed based on similar REE pattern to kimberlites. The presence of nitrogen platelet (by IR spectra) indicates high temperature origin and syngenetic inclusions of rutile, ilmenite, and magnetite indicates high pressure and high temperature conditions consistent with mantle origin as well. Third, it is proposed that carbonado diamonds are a result of early impacts into crustal rocks. This is indicated by the rare and controversial occurrence of high pressure diamond polymorph, londsdaleite, frequently found in diamonds from meteorite impact sites, and by observation of planar deformation features, possibly indicating shock events. Finally, it is suggested that carbonados have an extraterrestrial origin, as indicated by a long term annealing based on observation of a zero-phonon line, attributed to paired nitrogen atoms in association with a vacancy. Derived from text

Diamonds; Magnetic Properties; Polycrystals; Porosity; Magnetization

20000033184 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Study on a Collision Detection VLSI Processor Based on Area-Time Product Minimization of a Content-Addressable Memory

Sasaki, Kazuhiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 397-398; In Japanese; Copyright; Avail: Issuing Activity

High-speed collision detection is important for highly safe vehicles. In collision detection. high computational power is required to perform matching operation between vehicle, and obstacle pixels. This paper presents time minimization of a collision detection VLSI processor based on a content-addressable memory (CAM) under an area constraint. The. time minimization can be attributed to minimization of an area-time product, of a CAM. A conventional CAM evaluates magnitude relationships between all the stored words and an input words in parallel. In the proposed CAM, the magnitude relationships are evaluated in two steps. In the first step, matching operation is performed in a coarse rectangular solid representation of a vehicle. In the second step, if collision exists between obstacles and a coarse rectangular solid, matching operation is performed between obstacles and only the fine rectangular solids included in the coarse rectangular solid. Checks for the other fine rectangular solids are omitted. This results in the reduction of comparators without decreasing the performance. The performance of the proposed VLSI processor is about, 1.63 times faster than that of the one using a conventional CAM.

Author

Very Large Scale Integration; Midair Collisions; Optimization; Collision Avoidance

20000033424 NASA Goddard Space Flight Center, Greenbelt, MD USA

Coseismic Excitation of the Earth's Polar Motion

Chao, B. F., NASA Goddard Space Flight Center, USA; Gross, R. S., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Apart from the "shaking" near the epicenter that is the earthquake, a seismic event creates a permanent field of dislocation in the entire Earth. This redistribution of mass changes (slightly) the Earth's inertia tensor; and the Earth's rotation will change in accordance with the conservation of angular momentum. Similar to this seismic excitation of Earth rotation variations, the same mass redistribution causes (slight) changes in the Earth's gravitational field expressible in terms of changes in the Stokes coefficients of its harmonic expansion. In this paper, we give a historical background of the subject and discuss the related physics; we then compute the geodynamic effects caused by earthquakes based on normal-mode summation scheme. The effects are computed using the centroid moment tensor (CMT) solutions for 15,814 major earthquakes from Jan., 1977, through Feb., 1999, as provided in the Harvard CMT catalog. The computational results further strengthens these findings and conclusions: (i) the strong tendency for earthquakes to make the Earth rounder and more compact (however slightly) continues; (ii) so does the trend in the seismic "nudging" of the rotation pole toward the general direction of approx. 140 E, roughly opposite to that of the observed polar drift, but two orders of magnitude smaller in drift speed.

Author

Excitation; Polar Wandering (Geology); Seismology; Earth Rotation; Geodynamics

20000033459 NASA Goddard Space Flight Center, Greenbelt, MD USA

UV 380 nm Reflectivity of the Earth's Surface

Herman, J. R., NASA Goddard Space Flight Center, USA; Celarier, E., Software Corp. of America, USA; Larko, D., Raytheon ITSS, USA; Feb. 22, 2000; 38p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The 380 nm radiance measurements of TOMS (Total Ozone Mapping Spectrometer) have been converted into a global data set of daily (1979 to 1992) Lambert equivalent reflectivities R of the Earth's surface and boundary layer (clouds, aerosols, surface haze, and snow/ice). Since UV surface reflectivity is between 2 and 8% for both land and water during all seasons of the year

(except for ice and snow cover), reflectivities larger than the surface value indicates the presence of clouds, haze, or aerosols in the satellite field of view. Statistical analysis of 14 years of daily data show that most snow/ice-free regions of the Earth have their largest fraction of days each year when the reflectivity is low (R less than 10%). The 380 nm reflectivity data shows that the true surface reflectivity is 2 to 3% lower than the most frequently occurring reflectivity value for each TOMS scene. The most likely cause of this could be a combination of frequently occurring boundary-layer water or aerosol haze. For most regions, the observation of extremely clear conditions needed to estimate the surface reflectivity from space is a comparatively rare occurrence. Certain areas (e.g., Australia, southern Africa, portions of northern Africa) are cloud-free more than 80% of the year, which exposes these regions to larger amounts of UV radiation than at comparable latitudes in the Northern Hemisphere. Regions over rain-forests, jungle areas, Europe and Russia, the bands surrounding the Arctic and Antarctic regions, and many ocean areas have significant cloud cover (R greater than 15%) more than half of each year. In the low to middle latitudes, the areas with the heaviest cloud cover (highest reflectivity for most of the year) are the forest areas of northern South America, southern Central America, the jungle areas of equatorial Africa, and high mountain regions such as the Himalayas or the Andes. The TOMS reflectivity data show the presence of large nearly clear ocean areas and the effects of the major ocean currents on cloud production.
Author
Reflectance; Ultraviolet Radiation; Earth Surface; Total Ozone Mapping Spectrometer; Boundary Layers

20000033461 Texas Univ., Austin, TX USA
Consistency Between Liquefaction Prediction Based on SPT, CPT, and Vs Measurements at the Same Sites
Chrisley, James C.; Jan. 27, 2000; 148p; In English
Report No.(s): AD-A374157; AFIT-FY00-40; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Liquefaction induced ground failure is a major cause of damage during earthquakes. Liquefaction is a phenomenon that is not limited to one specific region in the world, but occurs worldwide. Liquefaction has not only caused major financial property loss but also has been attributed to the loss of lives throughout the world. Since the early 1970's, the prediction of liquefaction potential has been an area of high interest throughout the engineering community. The ability to predict whether or not a site in an active seismic zone will liquefy has the potential of saving a tremendous amount of money in property losses and more importantly the potential to save lives. This report uses the Vs data set compiled by Andrus, Stokoe, and Chung (1999) and presents SPT and CPT measurements from the same sites. In general, each site has experienced at least one earthquake, determination of field liquefaction has been made, at least one Vs measurement has been made in the critical layer, and at least one of the other field measurements, SPT or CPT, has been performed in the same critical layer. to begin, each type of measured field data is plotted with the presently accepted correlation for that particular technique and evaluated for accuracy. For sites that had at least two different measurements, a comparison of the methods is made. It is shown, for this particular data set, which current method was able to most accurately predict liquefaction. Changes to the currently accepted correlations, made to obtain better agreement between the different methods, are then discussed. Finally, correlations between the three different field measurement techniques are presented; that is, V(s1) - N(1,60), V(s1) - q(c1,N), and q(c1,N) - N(1,60) relationships are presented for the potentially liquefiable materials in this data set.
DTIC
Earthquakes; Seismology; Liquefaction

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification

20000032093 NASA Marshall Space Flight Center, Huntsville, AL USA
El Nino During the 1990's: Harbinger of Climatic Change or Normal Fluctuation?
Wilson, Robert M., NASA Marshall Space Flight Center, USA; February 2000; 12p; In English
Report No.(s): NASA/TP-2000-209960; NAS 1.60:209960; M-964; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Today, El Nino refers to the extreme warming episodes of the globally effective, coupled ocean-atmospheric interaction commonly known as ENSO (i.e., "El Nino-Southern Oscillation"). Concerning its observed decadal frequency and severity, El Nino during the 1990's has often been regarded as being anomalous. Results of analysis reported herein; however, appear to mitigate this belief.
Author
Climate Change; Periodic Variations

20000032300 NASA Goddard Space Flight Center, Greenbelt, MD USA

Assessing the Importance of the Evaporation-Wind Feedback Mechanism in the Modulation of Simulated Madden-Julian Oscillations

Colon, Edward, Howard Univ., USA; Lindesay, James, Howard Univ., USA; Suarez, Max J., NASA Goddard Space Flight Center, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 269-274; In English; See also 20000032189

Report No.(s): 98URC049; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

An examination of simulated Madden-Julian Oscillation (MJO) response to active and suppressed air-sea interactions is made using an aquaplanet model employing a realistic representation of the hydrologic cyle. In general, the evaporation-wind feedback (EWF) results from a coupling between tropical zonal surface wind stresses and evaporation anomalies. Recent observational and theoretical studies have questioned the significance of EWF in sustaining the predominantly wavenumber 1 eastward propagating mode commonly attributed to the interaction between large scale convergence and cumulus-scale convection (conditional instability of the second kind, CISK). to ascertain the nature of the EWF dependence on lower boundary conditions and thus quantify its effect on MJO development, a series of numerical experiments were conducted employing various zonally symmetric sea surface temperature (SST) distributions with active and suppressed EWF mechanisms. Results suggest that a correlation exists between tropical SSTs and the efficacy of the EWF in vertically redistributing heat acquired through surface wind stresses. It has been determined that the removal of the EWF is not a crucial factor in the dampening of the simulated MJO at high equatorial SSTs. The additional energy fed into the developing convective mode by the EWF selectively amplifies higher order wave modes in all numerical experiments thus boosting overall variances in oscillatory responses.

Author

Evaporation; Modulation; Oscillations; Wind (Meteorology); Hydrology; Computerized Simulation; Feedback

20000032351 Auburn Univ., AL USA

Correlation Between Precipitation and Crop Yield for Corn and Cotton Produced in Alabama

Hayes, Carol E., Auburn Univ., USA; Perkey, Donald J., Institute for Global Change Research and Education, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 400-405; In English; See also 20000032189

Contract(s)/Grant(s): NCC8-140; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

In this study, variations in precipitation during the time of corn silking are compared to Alabama corn yields. Also, this study compares precipitation variations during bloom to Alabama cotton yield. The goal is to obtain mathematical correlations between rainfall during the crop's critical period and the crop amount harvested per acre.

Derived from text

Cotton; Corn; Crop Growth; Plants (Botany)

20000032525 NASA Marshall Space Flight Center, Huntsville, AL USA

On the Bimodality of ENSO Cycle Extremes

Wilson, Robert M., NASA Marshall Space Flight Center, USA; February 2000; 24p; In English

Report No.(s): NASA/TP-2000-209961; NAS 1.60:209961; M-965; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

On the basis of sea surface temperature in the El Nino 3.4 region (5 deg. N.,-5 deg. S., 120-170 deg. W.) during the interval of 1950-1997, Kevin Trenberth previously has identified some 16 El Nino and 10 La Nina, these 26 events representing the extremes of the quasi-periodic El Nino-Southern Oscillation (ENSO) cycle. Runs testing shows that the duration, recurrence period, and sequencing of these extremes vary randomly. Hence, the decade of the 1990's, especially for El Nino, is not significantly different from that of previous decadal epochs, at least, on the basis of the frequency of onsets of ENSO extremes. Additionally, the distribution of duration for both El Nino and La Nina looks strikingly bimodal, each consisting of two preferred modes, about 8- and 16-mo long for El Nino and about 9- and 18-mo long for La Nina, as does the distribution of the recurrence period for El Nino, consisting of two preferred modes about 21- and 50-mo long. Scatterplots of the recurrence period versus duration for El Nino are found to be statistically important, displaying preferential associations that link shorter (longer) duration with shorter (longer) recurrence periods. Because the last onset of El Nino occurred in April 1997 and the event was of longer than average duration, onset of the next anticipated El Nino is not expected until February 2000 or later.

Author

El Nino; Southern Oscillation; Climate Change; Sea Surface Temperature; Climatology; Statistical Distributions

20000032784 NASA Goddard Space Flight Center, Greenbelt, MD USA

Raman Lidar Measurements of Water Vapor and Cirrus Clouds During the Passage of Hurricane Bonnie

Whiteman, D. N., NASA Goddard Space Flight Center, USA; Evans, K. D., NASA Goddard Space Flight Center, USA; Demoz, B., NASA Goddard Space Flight Center, USA; Starr, D. OC, NASA Goddard Space Flight Center, USA; Tobin, D., NASA Goddard Space Flight Center, USA; Feltz, W., NASA Goddard Space Flight Center, USA; Jedlovec, G. J., NASA Goddard Space Flight Center, USA; Gutman, S. I., NASA Goddard Space Flight Center, USA; Schwemmer, G. K., NASA Goddard Space Flight Center, USA; Cardirola, M., NASA Goddard Space Flight Center, USA; Melfi, S. H., NASA Goddard Space Flight Center, USA; Schmidlin, F. J., NASA Goddard Space Flight Center, USA; [2000]; 22p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA/GSFC Scanning Raman Lidar (SRL) was stationed on Andros Island in the Bahamas during August - September, 1998 as a part of the third Convection and Moisture Experiment (CAMEX-3) which focussed on hurricane development and tracking. During the period August 21 - 24, hurricane Bonnie passed near Andros Island and influenced the water vapor and cirrus cloud measurements acquired by the SRL. Two drying signatures related to the hurricane were recorded by the SRL (Scanning Raman Lidar) and other sensors. Cirrus cloud optical depths (at 351 nm) were also measured during this period. Optical depth values ranged from approximately 0.01 to 1.4. The influence of multiple scattering on these optical depth measurements was studied with the conclusion that the measured values of optical depth are less than the actual value by up to 20% . The UV/IR cirrus cloud optical depth ratio was estimated based on a comparison of lidar and GOES measurements. Simple radiative transfer model calculations compared with GOES satellite brightness temperatures indicate that satellite radiances are significantly affected by the presence of cirrus clouds if IR optical depths are approximately 0.02 or greater. This has implications for satellite cirrus detection requirements.

Author

Raman Spectra; Cirrus Clouds; Hurricanes; Radar Measurement; Water Vapor; Scanners

20000032790 NASA Goddard Space Flight Center, Greenbelt, MD USA

Retrieved Vertical Profiles of Latent Heat Release Using TRMM Rainfall Products

Tao, W.–K., NASA Goddard Space Flight Center, USA; Lang, S., Science Systems and Applications, Inc., USA; Olson, W. S., Maryland Univ. Baltimore County, USA; Meneghini, R., NASA Goddard Space Flight Center, USA; Yang, S., Maryland Univ. Baltimore County, USA; Simpson, J., NASA Goddard Space Flight Center, USA; Kummerow, C., NASA Goddard Space Flight Center, USA; Smith, E., NASA Marshall Space Flight Center, USA; Jan. 27, 2000; 60p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This paper represents the first attempt to use TRMM rainfall information to estimate the four dimensional latent heating structure over the global tropics for February 1998. The mean latent heating profiles over six oceanic regions (TOGA COARE IFA, Central Pacific, S. Pacific Convergence Zone, East Pacific, Indian Ocean and Atlantic Ocean) and three continental regions (S. America, Central Africa and Australia) are estimated and studied. The heating profiles obtained from the results of diagnostic budget studies over a broad range of geographic locations are used to provide comparisons and indirect validation for the heating algorithm estimated heating profiles. Three different latent heating algorithms, the Goddard Convective-Stratiform (CSH) heating, the Goddard Profiling (GPROF) heating, and the Hydrometeor heating (HH) are used and their results are intercompared. The horizontal distribution or patterns of latent heat release from the three different heating retrieval methods are quite similar. They all can identify the areas of major convective activity (i.e., a well defined ITCZ in the Pacific, a distinct SPCZ) in the global tropics. The magnitude of their estimated latent heating release is also not in bad agreement with each other and with those determined from diagnostic budget studies. However, the major difference among these three heating retrieval algorithms is the altitude of the maximum heating level. The CSH algorithm estimated heating profiles only show one maximum heating level, and the level varies between convective activity from various geographic locations. These features are in good agreement with diagnostic budget studies. by contrast, two maximum heating levels were found using the GPROF heating and HH algorithms. The latent heating profiles estimated from all three methods can not show cooling between active convective events. We also examined the impact of different TMI (Multi-channel Passive Microwave Sensor) and PR (Precipitation Radar) rainfall information on latent heating structures.

Author

Latent Heat; Rain; Trmm Satellite; Tropical Regions; Algorithms; Precipitation (Meteorology)

20000032923 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of Satellite Image Classification using Dynamic Thresholds

Aoki, Toshinori, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 457-458; In Japanese; Copyright; Avail: Issuing Activity

In this report, we propose a new cloud detection method which doesn't require known information. This method is based on clustering each local area obtained by dividing the satellite image. In 2 dimensional feature space composed of albedo and brightness temperature, EM algorithm estimates 2 Gaussian distributions from a distribution at the local area. From them it is divided into 2 clusters by Maximum Likelihood Classifier. Then, we classify cloud cluster by using average vectors estimated by EM algorithm. This method is applied to satellite images of NOAA and GMS. It shows good results of cloud detection.
Author
Image Classification; Satellite Imagery; Cloud Cover; Maximum Likelihood Estimates

20000033196 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Category Extraction Method from NOAA AVHRR Images by Using the 3 Dimensional Histogram
Kawano, Koichi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 433-434; In Japanese; Copyright; Avail: Issuing Activity

In this study, we developed the knowledge acquisition method by using 3 dimensional histograms to classify the image categories. This method is mainly composed of the two processes: one is the learning process which aggregates many satellite image scenes flagged by expert, the other is the recognition process which recognizes the specific category automatically for the unknown image scenes by using the 3 dimensional histogram obtained from the learning process. We applied to the sea category by using 63 scenes of the N-Land dataset in 1989 whole one year data, which were made of NOAA AVHRR data flagged by the expert of oceanography researchers. and we applied 28 N-Land scenes in 1990 whole one year data by using the obtained knowledge, and compared with the expert's decision. The results showed over the 90% recognition rate for almost all scenes. We also applied this method to the fire category, and showed that, all processes would perform automatically.
Author
Histograms; Satellite Imagery; Image Classification; Pattern Recognition

20000033267 NASA Goddard Space Flight Center, Greenbelt, MD USA
Evaluation of Bogus Vortex Techniques with Four-Dimensional Variational Data Assimilation
Pu, Zhao–Xia, Universities Space Research Association, USA; Braun, Scott A., NASA Goddard Space Flight Center, USA; Feb. 12, 2000; 46p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effectiveness of techniques for creating "bogus" vortices in numerical simulations of hurricanes is examined by using the Penn State/NCAR nonhydrostatic mesoscale model (MM5) and its adjoint system. A series of four-dimensional variational data assimilation (4-D VAR) experiments is conducted to generate an initial vortex for Hurricane Georges (1998) in the Atlantic Ocean by assimilating bogus sea-level pressure and surface wind information into the mesoscale numerical model. Several different strategies are tested for improving the vortex representation. The initial vortices produced by the 4-D VAR technique are able to reproduce many of the structural features of mature hurricanes. The vortices also result in significant improvements to the hurricane forecasts in terms of both intensity and track. In particular, with assimilation of only bogus sea-level pressure information, the response in the wind field is contained largely within the divergent component, with strong convergence leading to strong upward motion near the center. Although the intensity of the initial vortex seems to be well represented, a dramatic spin down of the storm occurs within the first 6 h of the forecast. With assimilation of bogus surface wind data only, an expected dominance of the rotational component of the wind field is generated, but the minimum pressure is adjusted inadequately compared to the actual hurricane minimum pressure. Only when both the bogus surface pressure and wind information are assimilated together does the model produce a vortex that represents the actual intensity of the hurricane and results in significant improvements to forecasts of both hurricane intensity and track.
Author
Assimilation; Mathematical Models; Vortices; Computerized Simulation; Hurricanes; Variations

20000033275 NASA Goddard Space Flight Center, Greenbelt, MD USA
Comments on "The Sensitivity Study of Radiative-Convective Equilibrium in the Tropics with a Convective Resolving Model"
Tao, W.–K., NASA Goddard Space Flight Center, USA; Shie, C.–L., NASA Goddard Space Flight Center, USA; Simpson, J., NASA Goddard Space Flight Center, USA; Feb. 01, 2000; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In general, there are two broad scientific objectives when using cloud resolving models (CRMs or cloud ensemble models-CEMs) to study tropical convection. The first one is to use them as a physics resolving models to understand the dynamic and microphysical processes associated with the tropical water and energy cycles and their role in the climate system. The second approach is to use the CRMs to improve the representation of moist processes and their interaction with radiation in large-scale

models. In order to improve the credibility of the CRMs and achieve the above goals, CRMs using identical initial conditions and large-scale influences need to produce very similar results. Two CRMs produced different statistical equilibrium (SE) states even though both used the same initial thermodynamic and wind conditions. Sensitivity tests to identify the major physical processes that determine the SE states for the different CRM simulations were performed. Their results indicated that atmospheric horizontal wind is treated quite differently in these two CRMs. The model that had stronger surface winds and consequently larger latent and sensible heat fluxes from the ocean produced a warmer and more humid modeled thermodynamic SE state. In addition, the domain mean thermodynamic state is more unstable for those experiments that produced a warmer and more humid SE state. Their simulated wet (warm and humid) SE states are thermally more stable in the lower troposphere (from the surface to 4-5 km in altitude). The large-scale horizontal advective effects on temperature and water vapor mixing ratio are needed when using CRMs to perform long-term integrations to study convective feedback under specified large-scale environments. In addition, it is suggested that the dry and cold SE state simulated was caused by enhanced precipitation but not enough surface evaporation. We find some problems with the interpretation of these three phenomena.
Derived from text
Sensitivity; Convection; Radiative Heat Transfer; Tropical Regions; Equilibrium; Climate Models

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.

20000032309 Kentucky State Univ., Div. of Mathematics and Science, Frankfort,KY USA
Estimation of Velocity Field from Oceanographic Image Sequences
Cho, Eungchun, Kentucky State Univ., USA; Iyengar, S. S., Louisiana State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 290-295; In English; See also 20000032189
Report No.(s): 98URC053; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Oceanographers desire accurate methods of tracking features in satellite images of the ocean in order to observe and quantify surface layer dynamics. Infrared images of the ocean showing sea surface temperatures are widely used for the studies of this type. Feature tracking from time series of satellite IR images poses two problems: First, the features of interest have weak edges and constantly evolving shapes from image to image. That means features merge, split, grow, shrink, disappear are created on time scales that are comparable to the sampling interval of the satellite imagery (I 2 hours). In other words, the phenomenology under investigation is Turbulent Fluid flow, not rigid body motion. The second problem which results from the first, is feature motion cannot be defined by parameters that are functions of scale as well as space and time. A simple example of different motions associated with different scales is seen in the ocean ”front”. Most ocean fronts exhibit shear across the frontal boundary. In this paper we present some new results in our oceanographic velocity of the image flow and more specifically, we discuss a new approximation method to estimate the velocity field of Gulf stream from a sequence of satellite images. In this method, connected components of the region representing a stream is identified, triangulated and the velocity field on the region is estimated by the affine approximation on each triangle.
Author
Velocity Distribution; Oceanography; Estimating; Mathematical Models; Satellite Imagery

20000032540 Scripps Institution of Oceanography, La Jolla, CA USA
Laboratory Study of Water Surface Roughness Generation by Wave-Current Interaction ***Final Report***
Klinke, Jochen, Scripps Institution of Oceanography, USA; [2000]; 1p; In English
Contract(s)/Grant(s): NAG5-5217; No Copyright; Avail: Issuing Activity; Abstract Only

Within the framework of this project, the blocking of waves by inhomogeneous currents was studied. A laboratory experiment was conducted in collaboration with Steven R. Long at the linear wave tank of the NASA Air-Sea Interaction Facility, Wallops Island, VA during May 1999. Mechanically-generated waves were blocked approximately 3m upstream from the wave paddle by an opposing current. A false bottom was used to obtain a spatially varying flow field in the measurement section of the wave tank. We used an imaging slope gauge, which was mounted directly underneath the sloping section of the false tank bottom to observe the wave field. For a given current speed, the amplitude and the frequency of the waves was adjusted so that the blocking occurred within the observed footprint. Image sequences of up to 600 images at up 100 Hz sampling rate were recorded for an area of approximately 25cm x 25cm. Unlike previous measurements with wave wire gauges, the captured image sequences show

the generation of the capillary waves at the blocking point and give detailed insight into the spatial and temporal evolution of the blocking process. The image data were used to study the wave-current interaction for currents from 5 to 25 cm/s and waves with frequencies between 1 and 3 Hz. First the images were calibrated with regard to size and slope. Then standard Fourier techniques as well the empirical mode decomposition method developed by Dr. Norden Huang and Dr. Steven R. Long were employed to quantify the wave number downshift from the gravity to the capillary regime.
Author
Wave Interaction; Air Water Interactions; Flow Distribution; Capillary Waves; Surface Roughness

20000032787 Atmospheric and Environmental Research, Inc., Cambridge, MA USA
Global and Regional Axial Ocean Angular Momentum Signals and Length-of-Day Variations (1985-1996), *1985-1996*
Ponte, Rui M., Atmospheric and Environmental Research, Inc., USA; Stammer, Detlef, Scripps Institution of Oceanography, USA; [1999]; 22p; In English
Contract(s)/Grant(s): NAS5-97270; NAS5-98182; JPL-958125; NAG5-7162; NAG5-3724; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Changes in ocean angular momentum about the polar axis (M) are related to fluctuations in zonal currents (relative component M(sub r)) and latitudinal shifts in mass (planetary component M(sub Omega)). Output from a 1 deg ocean model is used to calculate global M(sub r), M(sub Omega), and M time series at 5-day intervals for the period January 1985-April 1996. The annual cycle in M(sub r), M(sub Omega), and M is larger than the semiannual cycle, and M(sub Omega) amplitudes are nearly twice those of M(sub r). Year-to-year modulation of the seasonal cycle is present, but interannual variability is weak. The spectrum of M is red (background slope between omega(sup (-1) and omega(sup -2)) at subseasonal periods, implying a white or blue spectrum for the external torque on the ocean. Comparisons with previous studies indicate the importance of direct atmospheric forcing in inducing subseasonal M signals, relative to instabilities and other internal sources of rapid oceanic signals. Regional angular momentum estimates show that seasonal variability tends to be larger at low latitudes but there are many local maxima due to the spatial structure of zonal current and mass variability. At seasonal timescales, latitudes approximately 20 S - 10 N contribute substantial variability to M(sub Omega), while signals in M(sub r) can be traced to Antarctic Circumpolar Current transports and associated circulation. Variability in M is found to be small when compared with similar time series for the atmosphere and the solid Earth, but ocean signals are significantly coherent with atmosphere-solid Earth residuals, implying a measurable oceanic impact on length-of-day variations.
Author
Oceans; Angular Momentum; Zonal Flow (Meteorology); Air Currents; Wind (Meteorology)

20000032980 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The IERS Special Bureau for the Oceans
Gross, Richard S., Jet Propulsion Lab., California Inst. of Tech., USA; Bryan, Frank O., National Center for Atmospheric Research, USA; Chao, Yi, Jet Propulsion Lab., California Inst. of Tech., USA; Dickey, Jean O., Jet Propulsion Lab., California Inst. of Tech., USA; Marcus, Steven L., Jet Propulsion Lab., California Inst. of Tech., USA; Ponte, Rui M., Atmospheric and Environmental Research, Inc., USA; Tokmakian, Robin, Naval Postgraduate School, USA; May 12, 1999; 10p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The oceans have a major impact on global geophysical processes of the Earth. Non-tidal changes in oceanic currents and ocean-bottom pressure have been shown to be a major source of polar motion excitation and also measurably change the length of the day. The changing mass distribution of the oceans causes the Earth's gravitational field to change and causes the center-of-mass of the oceans to change which in turn causes the center-of-mass of the solid Earth to change. The changing mass distribution of the oceans also changes the load on the oceanic crust, thereby affecting both the vertical and horizontal position of observing stations located near the oceans. Recognizing the important role that non-tidal oceanic processes play in Earth rotation dynamics and terrestrial reference frame definition, the International Earth Rotation Service has recently created a Special Bureau for the Oceans in order to facilitate research into these and other solid Earth geophysical processes affected by the oceans.
Author
Oceans; Center of Mass; Mass Distribution; Earth Gravitation; Gravitational Fields

20000033140 NASA Goddard Space Flight Center, Greenbelt, MD USA
Global Mapping of Underwater UV Irradiances and DNA-Weighted Exposures using TOMS and SeaWiFS Data Products
Vasilkov, Alexander, Raytheon ITSS, USA; Krotkov, Nickolay, Raytheon ITSS, USA; Herman, Jay, NASA Goddard Space Flight Center, USA; McClain, Charles, NASA Goddard Space Flight Center, USA; Arrigo, Kevin, Stanford Univ., USA; Robinson, Wayne, NASA Goddard Space Flight Center, USA; [1999]; 33p; In English; Original contains color illustrations; No Copyright;

Avail: CASI; A03, Hardcopy; A01, Microfiche

The global stratospheric ozone-layer depletion results In an increase in biologically harmful ultraviolet (UV) radiation reaching the surface and penetrating to ecologically significant depths in natural waters. Such an increase can be estimated on a global scale by combining satellite estimates of UV irradiance at the ocean surface from the Total Ozone Mapping Spectrometer (TOMS) satellite instrument with the SeaWIFS satellite ocean-color measurements in the visible spectral region. In this paper we propose a model of seawater optical properties in the UV spectral region based on the Case I water model in the visible range. The inputs to the model are standard monthly SeaWiFS products: chlorophyll concentration and the diffuse attenuation coefficient at 490nm. Penetration of solar UV radiation to different depths in open ocean waters is calculated using the RT (radiative transfer) quasi-single scattering approximation (QSSA). The accuracy of the QSSA approximation in the water is tested using more accurate codes. The sensitivity study of the underwater UV irradiance to atmospheric and oceanic optical properties have shown that the main environmental parameters controlling the absolute levels of the UVB (280-320nm) and DNA-weighted irradiance underwater are: solar-zenith angle, cloud transmittance, water optical properties, and total ozone. Weekly maps of underwater UV irradiance and DNA-weighted exposure are calculated using monthly-mean SeaWiFS chlorophyll and diffuse attenuation coefficient products, daily SeaWiFS cloud fraction data, and the TOMS-derived surface UV irradiance daily maps. The final products include global maps of weekly-average UVB irradiance and DNA-weighted daily exposures at 3m and 10m, and depths where the UVB irradiance and DNA-weighted dose rate at local noon are equal to 10% of their surface values.

Author

Stratosphere; Ozone; Ozonosphere; Ozone Depletion; Atmospheric Composition; Total Ozone Mapping Spectrometer; Solar Radiation; Ultraviolet Radiation; Radiative Transfer

20000033413 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

Effects of Variable Shear Modulus on Wave-Induced Seabed Response

Lin, Yee–Shown, National Chung Hsing Univ., Taiwan, Province of China; Jeng, Dong–Sheng, National Chung Hsing Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; 2000; ISSN 0253-3839; Volume 23, No. 1, pp. 109-115; In English; Copyright; Avail: Issuing Activity

The shear modulus of a seabed is an important soil parameter in the analysis of the wave-seabed interaction problem. However, most previous investigations have only considered a porous seabed with uniform shear modulus, despite strong evidence of shear modulus varying with soil depth have been reported in the literature. In this study, the seabed is treated as varying linearly with soil depth (i.e., Gibson soil). The wave-induced seabed response is found to be affected significantly by variable shear modulus.

Author

Soil Science; Wave Interaction; Sea Floor Spreading

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.

20000032108 Mitre Corp., Jason Program Office, McLean, VA USA

Data Mining and the Human Genome

Joyce, Gerald F.; Abarbanel, Henry; Callan, Curtis; Dally, William; Dyson, Freeman; Jan. 07, 2000; 38p; In English

Contract(s)/Grant(s): 13-958534-04

Report No.(s): AD-A373525; JSR-99-310; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

As genomics research moves from an era of data acquisition to one of both acquisition and interpretation, new methods are required for organizing and prioritizing the data. These methods would allow an initial level of data analysis to be carried out before committing resources to a particular genetic locus. This JASON study sought to delineate the main problems that must be faced in bioinformatics and to identify information technologies that can help to overcome those problems. While the current influx of data greatly exceeds what biologists have experienced in the past, other scientific disciplines and the commercial sector have been handling much larger datasets for many years. Powerful data mining techniques have been developed in other fields that, with appropriate modification, could be applied to the biological sciences.

DTIC

Genetics; Data Acquisition; Mining; Data Management; Genetic Engineering

20000032195 Tuskegee Inst., Center for Food and Environmental Systems for Human Exploration of Space, AL USA

Analysis of proteins involved in biodegradation of crop biomass

Crawford, Kamau, Tuskegee Inst., USA; Trotman, Audrey, Tuskegee Inst., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 474-479; In English; See also 20000032189

Contract(s)/Grant(s): NCC9-51; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The biodegradation of crop biomass for re-use in crop production is part of the bioregenerative life support concept proposed by the National Aeronautics and Space Administration (NASA) for long duration, manned space exploration. The current research was conducted in the laboratory to evaluate the use of electrophoretic analysis as a means of rapidly assaying for constitutive and induced proteins associated with the bacterial degradation of crop residue. The proteins involved in crop biomass biodegradation are either constitutive or induced. As a result, effluent and cultures were examined to investigate the potential of using electrophoretic techniques as a means of monitoring the biodegradation process. Protein concentration for optimum banding patterns was determined using the Bio-Rad Protein Assay kit. Four bacterial soil isolates were obtained from the G.W. Carver research Farm at Tuskegee University and used in the decomposition of components of plant biomass. The culture, WDSt3A was inoculated into 500 mL of either Tryptic Soy Broth or Nutrient Broth. Incubation, with shaking of each flask was for 96 hours at 30 C. The cultures consistently gave unique banding patterns under denaturing protein electrophoresis conditions, The associated extracellular enzymes also yielded characteristic banding patterns over a 14-day period, when native electrophoresis techniques were used to examine effluent from batch culture bioreactors. The current study evaluated sample preparation and staining protocols to determine the ease of use, reproducibility and reliability, as well as the potential for automation.

Author

Proteins; Biodegradation; Crop Growth; Biomass; Soils; Reuse; Life Support Systems

20000032196 Morehouse School of Medicine, Atlanta, GA USA

Protein Kinases Possibly Mediate Hypergravity-Induced Changes in F-Actin Expression by Endothelial Cells

Love, Felisha D., Morehouse School of Medicine, USA; Melhado, Caroline D., Morehouse School of Medicine, USA; Bosah, Francis N., Morehouse School of Medicine, USA; Harris–Hooker, Sandra A., Morehouse School of Medicine, USA; Sanford, Gary L., Morehouse School of Medicine, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volume 2 and 3, pp. 480-482; In English; See also 20000032189

Contract(s)/Grant(s): NCCW-8; NAG9-644; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Basic cellular functions such as electrolyte concentration, cell growth rate, glucose utilization, bone formation, response to growth stimulation, and exocytosis are modified in microgravity. These studies indicate that microgravity affects a number of physiological systems and included in this are cell signaling mechanisms. Rijken and coworkers performed growth factor studies that showed PKC signaling and actin microfilament organization appears to be sensitive to microgravity, suggesting that the inhibition of signal transduction by microgravity may be related to alterations in actin microfilament organization. However, similar studies have not been done for vascular cells. Vascular endothelial cells play critical roles in providing nutrients to organ and tissues and in wound repair. The major deterrent to ground-based microgravity studies is that it is impossible to achieved true microgravity for longer than a few minutes on earth. Hence, it has not been possible to conduct prolonged microgravity studies except for two models that simulate certain aspects of microgravity. However, hypergravity is quite easily achieved. Several researchers have shown that hypergravity will increase the proliferation of several different cell lines while decreasing cell motility and slowing liver regeneration following partial hepatectomy, These studies indicate the hypergravity also alters the behavior of most cells. Several investigators have shown that hypergravity affects the activation of several protein kinases (PKs) in cells. In this study, we investigated whether hypergravity alters the expression of f-actin by bovine aortic endothelial cells (BAECs) and the role of PK's (calmodulin 11 dependent, PKA and PKC) as mediators of these effects.

Author

Proteins; High Gravity Environments; Electrolytic Cells; Cardiovascular System; Cell Division; Microgravity; Stimulation; Bones; Liver

20000032197 Tuskegee Inst., Center for Food and Environmental Systems for Human Exploration of Space, AL USA

Biodegradation of Fresh vs. Oven-Dried Inedible Crop Residue in a Continuously Stirred Tank Reactor

Crawford, Kamau, Tuskegee Inst., USA; Strayer, Richard, Tuskegee Inst., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 483-488; In English; See also 20000032189

Contract(s)/Grant(s): NCC9-51; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The degradation of soluble organics and mineral recovery from fresh and oven-dried biomass were compared in an Intermediate-Scale Aerobic Bioreactor (8 L working volume) to determine if drying crop residue improves performance in a continuously stirred tank reactor (CSTR). The study was conducted in an Intermediate-Scale Aerobic Bioreactor (ISAB) CSTR with dimensions of 390 mm height x 204 mm diameter. The pH in the bioreactor was controlled at 6.0, temperature at 30 C, and aeration at 7.0 L/min. Gases monitored were CO2 evolution and dissolved oxygen. Homogeneously mixed wheat cultures, used either fresh or oven-dried biomass and were leached, then placed in the ISAB for a 4-day degradation period. Studies found that mineral recovery was greater for leached oven-dried crop residue. However, after activity by the mixed microbial communities in the ISAB CSTR, there were little notable differences in the measured mineral recovery and degradation of soluble organic compounds. Degradation of soluble organic compounds was also shown to improve for leached oven-dried crop residue, but after mixing in the CSTR the degradation of the fresh biomass seemed to be slightly greater. Time for the biomass to turn in the CSTR appeared to be one factor for the experimental differences between the fresh and oven-dried biomass. Other factors, although not as defined, were the differing physical structures in the cell walls and varying microbial components of the fresh and oven-dried treatments due to changes in chemical composition after drying of the biomass.
Author
Biodegradation; Crop Growth; Bioreactors; Drying; Farm Crops; Organic Compounds; Ovens; Temperature Control

20000032203 Texas Univ., Pan American Center for Earth and Environmental Studies, El Paso, TX USA
Applied Statistical Methods to Predict the Northward Migration of Africanized Honey Bees
Vargas, Gabriel, Texas Univ., USA; Muniz, Margarita, Texas Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3507-511, pp. 507-511; In English; See also 20000032189; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Africanized Honey Bees have been slowly migrating north from South America since the 1950's. Miles and miles make up their migration path that seems to ignore boundaries, crossing the Texas Mexico border in 1990. Many counties in the lower valley of Texas became infected zones and serious attacks, some including one thousand plus stings on humans were reported in some areas. Our research team is committed to find out what will stop the northward migration pattern. We believe that there exists natural phenomena which we consider are and will be variables that alter their migration pattern. The State of Texas has been broken into ten ecological areas to search for characteristics that are exclusive to each. Variables such as annual average temperature, precipitation, water bodies, vegetation, and the number of successive days between frosts have been carefully selected to start our research. The northern portion of Texas contains a unique feature that the AHB's have not encountered in their long journey. This feature is colder temperatures than those found in the South. We are working on a model that will consist of a series of experiments that will conclude with a high percent of certainty that temperature is of high impact on the AHB's migration pattern. to aid in the tracking of the AHB's ground cover, the Spans Explorer, a Geographical Information System (GIS) tool is being utilized. The Spans Explorer software transforms our PC into a library of data, which is collected from various resources, This database is enriched with information for each of the 255 counties in the state of Texas that can be analyzed and correlated. Our research is based on information which, can be extracted from geological maps. Information on temperature, precipitation, water bodies, vegetation, and the number of successive days between frosts are patiently taken for each county. Our database is setup for user input of all county information. The various variables are compared and correlation between them is determined. The variables mentioned for our research were gathered for all areas whether they are mountains and basins, plains, coastal areas, prairies, or piney woods. A total often separate areas divide the entire state and these ten areas are used as the classification scheme for the collected data. These ten areas are: 1. Piney woods, 2. Gulf prairies and Marshes, 3. Post oak Savannah, 4. Backland prairies, 5. Coast Timbers and Prairies, 6. South Texas Plains, 7. Edwards Plateau, 8. Rolling Plains 9. High plains, and 10. Trans Pecos and Mountains. All information pertaining to annual precipitation, temperature, the number of frost-free days, and the amount of surface lake acres have been entered to the Spans software for each and every county in each of the ten ecological areas.
Author
Bees; Data Bases; Geological Surveys; Migration; North America; Statistical Analysis; Surface Water; Transformations (Mathematics)

20000032209 Tuskegee Inst., AL USA
Photosynthetic Response to Long- and Short-Term Changes in Carbon Dioxide in Sweetpotatoes Grown Hydroponically with Enhanced Mineral Nutrition
Hamilton, Casey, Tuskegee Inst., USA; Terse, Anita, Tuskegee Inst., USA; Hileman, Douglas R., Tuskegee Inst., USA; Mortley, Desmond G., Tuskegee Inst., USA; Hill, Jill, Tuskegee Inst., USA; NASA University Research Centers Technical Advances in

Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 34-39; In English; See also 20000032189
Contract(s)/Grant(s): NCC9-51; NAGW-2940; USDA-ALX-FS-2; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Sweetpotato [Ipomoea batatas L.(Lam.)] has been selected by NASA as a potential food for long-term space missions. In previous experiments, sweetpotato plants grown hydroponically under elevated levels of CO2 depleted the nitrogen in the nutrient solution between the hi-weekly solution replacements. In this experiment, the effect of enhanced nutrient replenishment on photosynthetic rates of sweetpotato was determined. CO2 response curves were determined for ”TU-82-155” and ”Georgia-Jet” sweetpotatoes grown hydroponically in growth chambers at three different CO2 concentrations (400, 750, and 1000 micro-mol/mol CO2). Gas exchange measurements were made using infrared gas analysis, an open-flow gas exchange system, and a controlled-climate cuvette. Photosynthetic measurements were made at CO2 concentrations from 50-1000 micro-mol/mol CO2. Net photosynthetic rates showed an increase with increasing measurement CO2 in all nutrient regimes, but the response of photosynthetic rates to the growth CO2 conditions varied among the experiments and between the two varieties. Enhanced mineral nutrition led to increased net photosynthetic rates in ”Georgia Jet” plants, but not in ”TU-82-155” plants. The results of this study will help to determine the CO2 requirements for growth of sweetpotato on proposed space missions.
Author
Carbon Dioxide; Potatoes; Nutrition; Photosynthesis; Minerals; Gas Exchange; Space Missions; Replenishment

20000032210 Tuskegee Inst., Center for Food and Environmental Systems for Human Exploration of Space, AL USA
Automated pH Control of Nutrient Solution in a Hydroponic Plant Growth System
Smith, B., Tuskegee Inst., USA; Dogan, N., Tuskegee Inst., USA; Aglan, H., Tuskegee Inst., USA; Mortley, D., Tuskegee Inst., USA; Loretan, P., Tuskegee Inst., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 40-44; In English; See also 20000032189
Contract(s)/Grant(s): NCC9-51; USDA-ALX-FS-2; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Over, the years, NASA has played an important role in providing to and the development of automated nutrient delivery and monitoring, systems for growing crops hydroponically for long term space missions. One example are the systems used in the Biomass Production Chamber (BPC) at Kennedy Space Center (KSC). The current KSC monitoring system is based on an engineering workstation using standard analog/digital input/output hardware and custom written software. The monitoring system uses completely separate sensors to provide a check of control sensor accuracy and has the ability to graphically display and store data form past experiment so that they are available for data analysis [Fortson, 1992]. In many cases, growing systems have not been fitted with the kind of automated control systems as used at KSC. The Center for Food and Environmental Systems for Human Exploration of Space (CFESH) located on the campus of Tuskegee University, has effectively grown sweetpotatoes and peanuts hydroponically for the past five years. However they have adjusted the pH electrical conductivity and volume of the hydroponic nutrient solution only manually at times when the solution was to be replenished or changed out according to its protocol (e.g. one-week, two-week, or two-day cycle). But the pH of the nutrient solution flowing through the channel is neither known nor controlled between the update, change out, or replenishment period. Thus, the pH of the nutrient solution is not held at an optimum level over the span of the plant’s growth cycle. to solve this dilemma, an automated system for the control and data logging of pH data relative to sweetpotato production using the nutrient film technique (NFT) has been developed, This paper discusses a microprocessor-based system, which was designed to monitor, control, and record the pH of a nutrient solution used for growing sweetpotatoes using NFT.
Derived from text
Vegetation Growth; Potatoes; Automatic Control; pH; Computer Programs; Computers; Biomass; Minerals

20000032214 Tuskegee Inst., Center for Food and Environmental Systems for Human Exploration of Space, AL USA
A System for Managing Replenishment of a Nutrient Solution Using an Electrical Conductivity Controller
Davis, D., Tuskegee Inst., USA; Dogan, N., Tuskegee Inst., USA; Aglan, H., Tuskegee Inst., USA; Mortley, D., Tuskegee Inst., USA; Loretan, P., Tuskegee Inst., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 51-56; In English; See also 20000032189
Contract(s)/Grant(s): NCC9-51; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Control of nutrient solution parameters is very important for the growth and development of plants grown hydroponically. Protocols involving different nutrient solution replenishment times (e.g. one-week, two-week, or two-day replenishment) provide

manual periodic control of the nutrient solution's electrical conductivity (EC). Since plants take-up nutrients as they grow, manual control has a drawback in that EC is not held constant between replenishments. In an effort to correct this problem the Center for Food and Environmental Systems for Human Exploration of Space at Tuskegee University has developed a system for managing and controlling levels of EC over a plant's entire growing cycle. A prototype system is being tested on sweetpotato production using the nutrient film technique (NFT), and it is being compared to a system in which sweetpotatoes are grown using NFT with manual control. NASA has played an important role in the development of environmental control systems. They have become a forerunner in growing plants hydroponically with some control systems through the use of networked data acquisition and control using environmental growth chambers. Data acquisition systems which involve the use of real-time, calibration, set points, user panel, and graphical representation programming provide a good method of controlling nutrient solution parameters such as EC and pH [Bledsoe, 19931]. In NASA's Biomass Production Chamber (BPC) at Kennedy Space Center, control is provided by a programmable logic controller (PLC). This is an industrial controller which combines ladder computer logic which has the ability to handle various levels of electrical power. The controller controls temperature, light and other parameters that affect the plant's environment, in the BPC, the Nutrient Delivery System (NIX), a sub-system of the PLC, controls nutrient solution parameters such as EC, pH, and solution levels. When the nutrient EC measurement goes outside a preset range (120-130 mS/m) a set amount of a stock solution of nutrients is automatically added by a metering pump to bring the EC back into operating range [Fortson, 1992]. This paper describes a system developed at Tuskegee University for controlling the EC of a nutrient solution used for growing sweetpotatoes with an EC controller and a computer with LabView data acquisition and instrumentation software. It also describes the preliminary data obtained from the growth of sweetpotatoes using this prototype control system.
Derived from text
Vegetation Growth; Potatoes; Electrical Resistivity; Controllers; Control Systems Design; Minerals; Biomass; Real Time Operation; Replenishment

20000032305 New Mexico Univ., Dept. of Electrical and Computer Engineering, Albuquerque, NM USA
Image Acquisition and the Eye of the Fly
Moya, John A., New Mexico Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 830-835; In English; See also 20000032189
Report No.(s): 98URC148; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Detailed study has been carried out on various animal eyes, such as those of the fly. The fly's eye possesses certain significant advantages which have made it among one of the most investigated. One of these is its structure, which allows one to study a very small portion and still gain an understanding of the larger eye. In this paper, a model of the sensory portion of the fly's eye is presented. The effectiveness of the model is briefly addressed by a comparison of its performance with experimental data.
Author
Eye (Anatomy); Mathematical Models; Insects; Image Processing; Photoreceptors

20000032441 Ohio State Univ., Dept. of Plant Biology, Columbus, OH USA
Differentiation and Tropisms in Space-Grown Moss ***Final Report, 15 Dec. 1995 - 15 Dec. 1999***
Sack, Fred D., Ohio State Univ., USA; Kern, Volker, Ohio State Univ., USA; [1999]; 3p; In English
Contract(s)/Grant(s): NAG10-0179
Report No.(s): OSURF-731847; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This grant supported a Space Shuttle experiment on the effects of microgravity on moss cells. Moss provides a rich system for gravitational and spaceflight research. The early phase of the moss life cycle consists of chains of cells that only grow only at their tips. In the moss Ceratodon purpureus these filaments (protonemata) grow away from gravity in the dark, in a process called gravitropism. The tipmost cells, the apical cells, contain heavy starch-filled bodies called amyloplasts that probably function in g-sensing and that sediment within the apical cell. The SPM-A (Space Moss aka SPAM) experiment flew in November - December, 1997 on STS-87 as part of the Collaborative US Ukrainian Experiment (CLTE). The experiment was accommodated in hardware purpose-built by NASA KSC and Bionetics and included Petri Dish Fixation Units (PDFU) and BRIC-LEDs. Together, this hardware allowed for the culture of the moss on agar in commercial petri dishes, for unilateral illumination with red light of varying intensity, and for chemical fixation in situ. The key findings of the spaceflight were quite unexpected. Neither the orientation of tip-growth nor the distribution of amyloplasts was random in microgravity.
Author
Spaceborne Experiments; Tropism; Microgravity; Gravitation; Gravitropism

20000032456 Scripps Institution of Oceanography, La Jolla, CA USA

Prebiotic Evolution of Nitrogen Compounds ***Final Report, 1996-1999***

Arrhenius, G., Scripps Institution of Oceanography, USA; [1999]; 5p; In English; Sponsored in part by the Wallenberg Foundation Contract(s)/Grant(s): NAG5-4563; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Support from this four year grant has funded our research on two general problems. One involves attempts to model the abiotic formation of simple source compounds for functional biomolecules, their concentration from dilute state in the hydrosphere and, in several cases, surface induced reactions to form precursor monomers for bioactive end products (refs. 1-5). Because of the pervasiveness and antiquity of phosphate based biochemistry and the catalytic activity of RNA we have exploring the hypothesis of an RNA World as an early stage in the emergence of life. This concept is now rather generally considered, but has been questioned due to the earlier lack of an experimentally demonstrated successful scheme for the spontaneous formation of ribose phosphate, the key backbone molecule in RNA. That impediment has now been removed. This has been achieved by demonstrating probable sources of activated (condensed) highly soluble and strongly sorbed phosphates in nature (Refs. 1,2) and effective condensation of aldehyde phosphates to form ribose phosphate in high yield (ref.6), thereby placing the RNA World concept on a somewhat safer experimental footing. Like all work in this field these experiments are oversimplifications that largely ignore competing side reactions with other compounds expected to be present. None the less our choice of experimental conditions aim at selective processes that eliminate interfering reactions. We have also sought to narrow the credibility gap by simulating geophysically and geochemically plausible conditions surrounding the putative prebiotic reactions.

Author

Nitrogen Compounds; Catalytic Activity; Surface Reactions; Biochemistry

20000032988 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Method for Relative Measurements of the Acoustic Nonlinearity Parameter in Liquids and Biological Tissues at Very High Frequencies

Suzuki, Tsunehisa, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 219-220; In Japanese; Copyright; Avail: Issuing Activity

In this paper, transmission line method for the measurement of the acoustic nonlinearity parameter of liquids and biological tissues at very high frequencies was investigated experimentally as follows: (i) A new method by sweeping the ultrasonic frequency (f-sweeping method) suitable for the measurement of the nonlinearity parameter of tissues. (ii) The relative measurement using water as the reference material to eliminate the problem of diffraction effects. (iii) The effects of diffraction on the measurements.

Author

Acoustic Measurement; Liquids; Nonlinearity; Tissues (Biology); Ultrasonics

20000033303 Research and Technology Organization, Human Factors and Medicine, Neuilly-sur-Seine, France

Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management ***Les differences entre individus concernant les facultes d'adaptation aux rythmes irreguliers activite-repos/Le point sur l'utilisation des medicaments pour la gestion des periodes veille-sommeil***

Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefullness Management; March 2000; 171p; In English, 3-4 Jun. 1999, Venice, Italy; See also 20000033304 through 20000033323

Report No.(s): RTO-MP-31; AC/323(HFM)TP/11; ISBN 92-837-1031-2; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche; C01, CD-ROM

This Lecture Series evaluates the human factors implications for pilots of "superagile flight", specifically with regard to agile airframes, agile weapons, and rapidly configurable systems. During interviews, experienced pilots have confirmed the operational need for military aircraft agility. Although pilots have noted that their experiences to date have not caused them any major concerns regarding the potential for physiological problems, significant gaps remain in our understanding of the effects of multi-axis accelerations. Human consequences are also anticipated in the area of situational awareness. Presentation of aircraft attitude and energy state in a helmet mounted display will be a design challenge. The minimal constraints on aircraft incidence angles and the expanded weapon launch envelopes anticipated with the forthcoming and next generations of air systems requires the provision of novel displays to enable pilots to effectively operate such air systems. Decision aids, intelligent interfaces and automated subsystems are required to enable pilots to maintain situational awareness whilst coping with dramatic increases in the tempo of the tactical situation and the 'data deluge'. Moreover, many of the current pilot protection systems will be inadequate for everyday

use in such an unconstrained flight envelope and during ejection. Additional challenges in selection, simulation, and training are also anticipated
Author
Human Factors Engineering; Decision Support Systems; Drugs; Sleep; Rhythm (Biology)

20000033527 Medical Research Council, Radiation and Genome Stability Unit, Harwell, UK
Further Development of the Laser-Plasma Induced X-Ray Source for Cellular Radiobiology and DNA Biochemistry
Hill, M. A., Medical Research Council, UK; Stevens, D. L., Medical Research Council, UK; Fulford, J., Medical Research Council, UK; ONeill, P., Medical Research Council, UK; Goodhead, D. T., Medical Research Council, UK; Nottola, A., Essex Univ., UK; Tallents, G. J., Essex Univ., UK; Shaikh, W., Rutherford Appleton Lab., UK; Westhall, J., Rutherford Appleton Lab., UK; Turcu, E., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 140; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Ultrasoft X-rays provide a unique tool for investigating the intracellular mechanisms of radiation action. They produce low energy, isolated electron tracks randomly throughout the irradiated material. These electrons have well defined energies and short tracks comparable in size to those of critical Structures in the cell, such as DNA, nucleosomes and chromatin fibers. They can therefore he used as a fine probe of the energy and spatial requirements for specific types of radiation damage and so provide much needed data for understanding and modeling the processes involved. Also, these tracks arc similar to the numerous secondary electrons and electron 'track ends' produced in the slowing down spectrum of more energetic electrons produced by most irradiations. Hence, they are representative of this substantial component in any ionizing irradiation. The high intensity and broad X-ray beam produced by the RAL laser-plasma source is important in overcoming the high attenuation of these low energy X-rays to produce the sample dose rate required. The high intensity also allows greater flexibility in the range of potential biological and chemical endpoints open to investigation. The carbon Lyman alpha line (367 cV) is of particular interest, with an attenuation through mammalian cells and water sample not too dissimilar to that of the C(sub k)(277 eV) and Cu(sub L) (956 eV) produced by the MRC cold cathode source. In parallel with the redesign of the target chamber for these experiments. spectroscopy measurements have also been made, since knowledge of the spectrum is important in determining the mean absorbed dose to an irradiated sample.
Author
Laser Plasmas; X Ray Sources; Radiobiology; Deoxyribonucleic Acid; Biochemistry; Product Development; Fabrication; Lyman Alpha Radiation

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.

20000032107 Boston Univ., Biomedical Engineering Dept., Boston, MA USA
Physiological Vibration and Resonance of LFS on the Respiratory System ***Final Report, 1 Jul. 1997 - 31 Mar. 1999***
Jackson, Andrew C.; Nov. 29, 1999; 114p; In English
Contract(s)/Grant(s): N00014-97-1-0928
Report No.(s): AD-A373523; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

Model predictions of the effects of LFS on the human respiratory system suggested that pressures within airways can be greater than pressures applied to the body surface. In the current study, more physiologically and anatomically accurate human and rat lung models were developed to further study the consequences of LFS as well as to infer human lung behavior from measurements made in rats. The human model was also used to predict whether pressure amplification would be more significant in asthmatics by incorporating airway heterogeneity and broncho-constriction into the model. Pressure amplification was predicted to be reduced in asthmatics. A comparison between human and rat lung behavior indicated that resonances in rat lungs occur in human lungs at about one-tenth the frequency. Thus, the resonances predicted to occur in rat lungs at higher frequencies, i.e., 5,000 and 11,000 Hz, could produce pressure amplification in humans at much lower frequencies (i.e., 50-100 Hz). We are confident in the human model predictions since they compared very well with physiological measurements over a wide frequency

range (2-2000 Hz). However, we have less confidence in the rat model since ft could be validated only for a limited frequency range (20-80 Hz) due to the paucity of published rat data.
DTIC
Vibration; Respiratory System; Aerospace Medicine; Respiratory Physiology

20000032163 West China Unv. of Medical Sciences, Biomedical Engineering Dept., Chengdu, China
Circadian Rhythm of Gene Expression of Myocardial Contractile Protein, Left Ventricular Pressure and Contractility
Wang, Zheng–rong, West China Unv. of Medical Sciences, China; Wang, Ling, West China Unv. of Medical Sciences, China; Wan, Chao–min, West China Unv. of Medical Sciences, China; Cornelissen, Germaine, Minnesota Univ., USA; Anand, Inder, VA Medical Center, USA; Halberg, Franz, Minnesota Univ., USA; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 391-396; In English
Contract(s)/Grant(s): NSF 39-470193; Copyright; Avail: Issuing Activity

A number of cardiovascular variables exhibit a circadian rhythm. Whether myocardial contractile response and gene expression of the contractile protein also show changes with a similar period was investigated. Circadian variabilities in the left ventricular developed pressure (LVP) and contractility (LV dp/dt max) were measured in 24 Sprague-Dawley rats by directly left ventricular catheterizing and compared with changes in the gene expression of alpha-myosin heavy chain (alpha-MHC) in myocytes obtained from the same animals by dot blotting analysis. A circadian rhythm was seen in the variability of LVP (P is less than 0.001), LV dp/dt max (P is less than 0.001) and the biochemically measured expression of the alpha-MHC gene (Pis less than 0.01). As compared to the amplitude of the rhythm in alpha-MHC gene expression, the amplitude of the contractility rhythm was large (Pis less than 0.01) and the circadian amplitude of the LVP(Pis less than 0.001) was the largest, representing perhaps a composite of intracardiac plus any extracardiac contributions. One of factors which determines the circadian rhythm of myocardial contractile function is alpha-MHC gene expression level.
Author
Cardiovascular System; Circadian Rhythms; Gene Expression; Activity Cycles (Biology); Cardiac Ventricles

20000032389 Air Force Research Lab., Biodynamics and Acceleration Branch, Wright-Patterson AFB, OH USA
The AFRL Biodynamics Data Bank and Modeling Applications
Buhrman, John R., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 1-1 - 1-4; In English; See also 20000032388; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The Air Force Research Laboratory (AFRL) has studied the response of human volunteers and human surrogates to impact accelerations for over thirty years. The results of this research have been used to enhance the design of escape, crash protection, and life support systems, while providing invaluable biodynamic response data for the development and validation of impact simulation and injury models. The data that have been collected include accelerations, forces, and motions from in-house tests conducted on man-rated test facilities, including both a horizontal impulse accelerator and vertical deceleration tower. The test data and related summary information from these tests have been compiled and entered into a data bank residing on a server using MS Access, Excel, and Visual Basic software. The compilation of data and related software are referred to as the Biodynamics Data Bank (BDB). The contents of the BDB include general information describing the objective, test matrix, and results from seventy in-house test programs. Also included are the time history and peak biodynamic response data collected during these programs, encompassing approximately 5,000 impact tests. Anthropometry measurements from over 200 test subjects and bibliographic information from 10,000 related references are also included. Slow-motion videos of the tests are currently being digitized as AVI files for future entry into the BDB. Plans also include the scanning and subsequent entry of documentation photographs that will provide a visual image of each test set-up. to provide the user with more efficient access to the BDB, a test index has been developed which contains a complete list of all test parameters including the type of seat fixture, restraint system, and input acceleration profile. This index can be used to perform searches to create data sets of tests with specific parameters, thus enabling the researcher to address specific issues of interest. These features make the Biodynamics Data Bank an ideal source of test data for computer model development and validation.
Author
Anthropometry; Computerized Simulation; Biodynamics; Data Bases; Impact Tests; Impact Acceleration; Physiological Responses; Information Dissemination

20000032402 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada
A Model of Cardiovascular Performance During Sustained Acceleration
Walsh, C., Ryerson Polytechnic Univ., Canada; Cirovic, S., Toronto Univ., Canada; Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999,

pp. 14-1 - 14-9; In English; See also 20000032388
Report No.(s): DCIEM-98-P-XX; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

During aerial combat maneuvers, G(z) can cause visual impairment or loss of consciousness (G-LOC). Anti-G suits, positive pressure breathing, and anti-G straining maneuvers reduce the risk of G-LOC. However, complex G-profiles are problematic. to assist in designing G-protective measures for such profiles, we are developing a model of human cardiovascular performance. We present preliminary results from a model that deals with the mechanical aspects of cardiovascular response to G(z). Physiological reflexes are neglected. We consider a closed loop vascular network with a time varying elastance heart model. Blood flow is modeled by a one-dimensional (1-D) approximation: a pair of first order partial differential equations govern continuity and momentum. The blood pressure is determined by the external pressure and a tube law. The dominant physical phenomenon is wave propagation. The vasculature is modeled as a network of uniform flexible tubes. Valves are placed at the entrances and exits to the ventricles, and in the veins. The equations are solved numerically using a split coefficient matrix method. The algorithm is first order, and it is suited to wave propagation. The boundary conditions are implemented using the method of characteristics. The results show cardiac output falling as G(z) increases and rising again when G(z) is reduced. Because there are no physiological reflexes, the central arterial pressure rises and falls with cardiac output, rather than being regulated to its physiological value. G-suit inflation, during periods of high G(z), returns the cardiac output to resting values when both the lower body and abdomen are covered. Protection is significantly reduced if only the lower body is covered. Simulations, in which Gz increases from 1G to 4G, are only plausible when there is at least one valve in the inferior vena cave.

Author

Cardiovascular System; Physiological Responses; Biological Models (Mathematics); Gravitational Effects; Protective Clothing; Safety Devices; Human Factors Engineering; Simulation

20000032403 Ryerson Polytechnic Univ., Dept. of Mechanical Engineering, Toronto, Ontario Canada

Effect of High +Gz Accelerations on the Left Ventricle

Behdinan, K., Ryerson Polytechnic Univ., Canada; Tabarrock, B., Victoria Univ., Canada; Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 15-1 - 15-9; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

During certain maneuvers, fighter pilots are subjected to high accelerations reaching 10g levels. The effect of this acceleration on the left ventricle is most severe when it is directed along the body z axis. Under such accelerations it is difficult for the heart to function and supply the body with blood and further more there is concern that the heart may suffer tissue tear as a result of high stresses on the heart tissue. In this study a detailed finite element analysis is carried out to determine the stress state of the left ventricle under high Gz loading. to develop the FE model, surface geometry data was acquired from view Point Data Lab in Utah. The surface data for the interior and the exterior of the left ventricle was then used with a software from XYZ Scientific Application Inc. of Livermore to develop a 3D FE model. The model is made up of 3830 solid elements with three layers between the inner and the outer surfaces. Finite element results for deflections, strains and stresses are obtained for a number of acceleration levels. The analysis accounts for geometric nonlinearities and uses the updated Lagrangian method in the MARC finite element program.

Author

Finite Element Method; Heart Function; Gravitational Effects; Human Body; Biological Models (Mathematics); Physiological Responses; Stress (Physiology); Aircraft Maneuvers

20000032404 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada

A Model of Cerebral Blood Flow During Sustained Acceleration

Cirovic, S., Toronto Univ., Canada; Walsh, C., Ryerson Polytechnic Univ., Canada; Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 16-1 - 16-7; In English; See also 20000032388
Report No.(s): DCIEM-98-P-XX; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Radial accelerations generated in modern combat aircraft maneuvers (Gz) may result in impaired vision or loss of consciousness (G-LOC). We are interested in developing mathematical models of cerebral blood flow during exposure to Gz. Our previous model showed that intracranial vascular resistance does not change with Gz since the vessels are protected from collapse by the cerebrospinal fluid and that reduction of the blood flow to the brain is mainly due to the increased vascular resistance of the large extracranial veins. Based on the previous results, we propose a model with simplified presentation of the arteries and intracranial vessels and a more detailed description of the jugular veins. The extracranial arteries are accounted for by the hydrostatic pressure drop from the heart to the head level. The intracranial vessels are represented by a resistance independent of the mechanical effects of Gz. However, a model of cerebral autoregulation is incorporated, which involves active change in

the cranial vascular resistance in reaction to the change in blood pressure at the head level. The jugular veins are modeled using one dimensional equations of fluid dynamics and a non-linear relation between the transmural (blood minus external) pressure and the local vessel cross-sectional area. The central arterial and venous pressures are taken to be 105 mmHg and 5 mmHg respectively and Gz was varied from -5 to +10. to simulate the effects of positive pressure breathing, blood pressures at the arterial and venous ends of the model were elevated by the same amount, so that the perfusion pressure was always maintained at 100 mmHg. The model is successful in reproducing the drop in cerebral blood flow with +Gz. This reinforces our belief that the elevated venous resistance plays a significant role in G-LOC. The autoregulation has a positive impact at moderate +Gz but is ineffective at higher +Gz. This is mainly due to the fact that the venous resistance becomes absolutely dominant at high +Gz and a further decrease in the cranial vascular resistance makes little difference. The model predicts an increase in the blood flow in the case when the central venous and arterial pressures are elevated. We attribute this to the fact that an elevated central venous pressure prevents the venous collapse and maintains the extracranial veins patent.
Author

Mathematical Models; Acceleration Stresses (Physiology); Aircraft Maneuvers; Blood Flow; Blood Pressure; Brain Circulation; Cardiovascular System

20000032405 Engineering Services, Inc., Toronto, Ontario Canada

Linear and Nonlinear Models of the Physiological Responses to Negative-to-Positive Gz Transitions

Kapps, A., Engineering Services, Inc., Canada; Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 18-1 - 18-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The identification and modeling of experimental data for negative-to-positive Gz (Push-Pull) transitions discussed in this paper is aimed at predicting typical and atypical physiological responses in order to develop Push-Pull countermeasures. A novel analysis of Push-Pull data in both the time and frequency domains was developed. Eye-level blood pressure dynamics in response to Push-Pull transitions differ significantly from subject to subject. This individual sensitivity is much less profound in a sub-group of the tested subjects. Overall, the match between the predicted and measured eye-level blood pressure is much better with low Gz gradients than in the case of large Gz gradients. A model with a transfer function of low order (3 by 3) may be sufficient to match the behavior of eye-level blood pressure under both Push-Pul1 and positive Gz maneuvers. However, nonlinear models are required to fit blood pressure response data in a sub-group of subjects.
Author

Computerized Simulation; Mathematical Models; Flight Crews; Acceleration Stresses (Physiology); Acceleration Tolerance; Aerospace Medicine; Gravitational Effects

20000032408 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada

A Physiological Data Analysis Toolbox for the Analysis of Acceleration Data

Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Askari, V., Engineering Services, Inc., Canada; Lu, Z., Engineering Services, Inc., Canada; Kapps, A., Engineering Services, Inc., Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 21-1 - 21-9; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

As an alternative to using traditional first principle-based modeling of a protected subject's physiological responses to real-life acceleration trains (both positive and negative-to-positive Gz transitions), a nontraditional systematic approach is being designed to facilitate the evaluation and prediction of human cardiovascular responses to G-suit and Positive Pressure Breathing (PPB) pressure schedules. The purpose of this work is to develop novel improved Anti-G protection schedules optimized for individual pilots in general and push-pull protection in particular. The proposed nontraditional systematic models are based on input-output relationships supplemented by expert knowledge. Therefore, both the experimental design and physiological data processing architecture are critical in this project. Six subjects (two females and four males) participated in the initial experimental effort. Persistently excited non-linear G-suit and PPB pressure schedules, which are not direct linear functions of Gz levels, have been applied using two types of electronic valves: (i) a combined Breathing Regulator and Anti-G valve (BRAG valve); and (ii) two custom-designed electronic (SAMCAV)- valves. The recorded parameters were heart level blood pressure, ECG, respiratory rate, G-suit and PPB pressures. Among other issues, this paper describes a Physiological Data Analysis Toolbox (Phi-DAT) that integrates statistical, fuzzy and linear trend investigations with higher-order spectrum analysis of the experimental data. -DAT

has been designed as a preprocessor of the nontraditional systematic modeling architecture and proven very efficient in establishing correlation and trend dependencies between the non-linear pressure schedules employed and responses obtained.
Author
Physiological Responses; Acceleration Stresses (Physiology); Gravitational Physiology; Models; Computerized Simulation; Pressure Breathing; Pressure Suits; Flight Crews; Data Processing; Human Factors Engineering

20000032410 Air Force Research Lab., Human Effectiveness Directorate, Brooks AFB, TX USA
Mathematical Models for Predicting Human Tolerance to Sustained Acceleration
Burton, Russell R., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 23-1 - 23-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Mathematical models that predict G-level and G-duration tolerances are reviewed. These model are subdivided into relaxed and straining tolerances. The latter tolerance predicts G levels of subjects that are performing an anti-G straining maneuver. These models are equations based on hydrostatic pressure mathematics G = (P(a) * d)/h. where: G = +G level tolerance; P(a) = mean arterial blood pressure in mm Ha (100) at heart level d = density of Hg (i.e. 13.6); and, h= vertical distance in mm (350 mm). The tolerance model is based on tolerance data obtained from subjects to the same continuous of G to fatigue. These G tolerance models were validated using published data. These G-level and duration models predict, with hugely accuracy, tolerances for relaxed or straining subjects using various anti-G protective systems/methods.
Author
Mathematical Models; Human Tolerances; Acceleration Stresses (Physiology); Human Factors Engineering; Acceleration Tolerance; Gravitational Effects

20000032411 BC Research, Inc., Vancouver, British Columbia Canada
A Biomechanical Approach to Evaluating the Health Effects of Repeated Mechanical Shocks
Morrison, J. B., Simon Fraser Univ., Canada; Robinson, D. G., BC Research, Inc., Canada; Nicol, J. J., BC Research, Inc., Canada; Roddan, G., BC Research, Inc., Canada; Martin, S. H., BC Research, Inc., Canada; Springer, M.–J.–N., BC Research, Inc., Canada; Cameron, B. J., BC Research, Inc., Canada; Albano, J. P., Army Aeromedical Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 24-1 - 24-8; In English; See also 20000032388
Contract(s)/Grant(s): DAMD17-91-C-1115; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Operators of industrial and military vehicles are routinely exposed to repeated mechanical shocks. Numerous studies have associated these exposures with an increased incidence of low back pain and degenerative disorders of the spine. This paper describes a method of evaluating the effect of repeated mechanical shocks on the health of vehicle operators. The method provides a health hazard assessment (HHA) in which the risk of injury to the operator is related to the acceleration measured at the vehicle seat. The HHA process consists of four stages. Dynamic response models are used to predict accelerations of the lumbar spine in the x, y and z axes from accelerations at the seat. Compressive forces at the L4/L5 vertebral joint are estimated from peak lumbar accelerations using relationships derived from biomechanical analysis. The effect of repeated compressive loading is calculated using a dose model based on the fatigue failure properties of tissue and the compressive strength of the vertebral joint. The risk of injury to the operator is then determined from the accumulated compressive dose, the fatigue life of the SyStem, the variance of vertebral joint strength data, and the cumulative probability of failure. The HHA model can be used to predict the risk of injury from a single exposure or from the cumulative effects of a Iffe time. The HHA was tested using a range of repeated shock profiles. Results indicate that the risk of injury predicted by the HHA compares favorably with human tolerance data obtained from acute exposures and with injury incidence data obtained from chronic exposure of vehicle operators.
Author
Mechanical Shock; Biodynamics; Health; Human Tolerances; Human Factors Engineering; Occupational Diseases; Operational Hazards

20000032413 Institute for Human Factors TNO, Soesterberg, Netherlands
Modelling Motion Sickness
Bos, J. E., Institute for Human Factors TNO, Netherlands; Bles, W., Institute for Human Factors TNO, Netherlands; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 26-1 - 26-4; In English; See also 20000032388; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

To analyze and or anticipate air crew performance per- and post-flight, we present a model that predicts spatial orientation and motion sickness. We first demonstrate a close linkage between spatial orientation and motion sickness, resulting in the postulation that sickness only arises when sensed and expected estimates of gravity change differently. Including observer

theoretical considerations, this concept lead to predictions of seasickness corresponding with experimental data. The model offers the possibility to predict all types of motion sickness, including simulator sickness.
Author
Models; Motion Sickness; Flight Crews; Acceleration Stresses (Physiology); Human Performance; Computerized Simulation

20000032414 Army Research Lab., Survivability/Lethality Analysis Directorate, Aberdeen Proving Ground, MD USA
New Methodology for the Assessment of Battlefield Insults and Injuries on the Performance of Army, Navy, and Air Force Military Tasks
Neades, David N., Army Research Lab., USA; Klopcic, J. Terrence, Army Research Lab., USA; Davis, Edward G., Army Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 28-1 - 28-11; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

To address known limitations, shortfalls, and lack of a comprehensive standardized casualty assessment methodology, across the military services as well as within services, a new methodology has been developed for triservice use that allows the assessment of soldier performance following weapon-induced injury. This new methodology, embodied in the Operational Requirement-based Casualty Assessment (ORCA) modeling system, permits casUalty assessments to be performed in a consistent manner across virtually all types of military platforms, jobs, and weapon-induced threats. The ORCA computer code enables the analyst to calculate anatomical damage and the effect on individual performance as a result of exposure to one or more insult types including kinetic energy (fragments), chemical, and blast overpressure. The ORCA modeling system incorporates previously developed as well as newly developed injury criteria models, algorithms, and scoring systems to characterize human bioresponse to trauma from various types of battlefield insults and derives estimates of soldier
Author
Injuries; Human Performance; Warfare; Computerized Simulation; Casualties

20000032415 Air Force Research Lab., Human Effectiveness Directorate, Brooks AFB, TX USA
Dosimetry Models Used to Determine the Bioeffects of Directed Energy Exposure
Hurt, William D., Air Force Research Lab., USA; Mason, Patrick A., Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 29-1 - 29-7; In English; See also 20000032388
Contract(s)/Grant(s): F33615-90-C-0604; F41624-96-C-9009; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Determining the bioeffects of directed energy exposure is essential for establishing safety standards to protect military personnel and the general public. However, internal temperature measurements are invasive in nature, and therefore difficult or impossible to obtain. Furthermore, it would be unethical to expose human subjects to those field parameters producing substantial thermal increases. An alternative method to obtain the necessary information is the development of accurate anatomical models incorporating permittivity values for the major tissue types. Using the VisableMan dataset available from the National Library of Medicine, we have converted each of the 1870 photographic images into a color-coded image representing permittivity values. Each color corresponds to an entry in a look-up-table containing the permittivity properties of that tissue. The resulting dataset is imported into a mathematical model to predict electrical fields and specific absorption rate (SAR) values. Various mathematical models are available including the finite-difference time-domain code. Processing such a large dataset is best accomplished using parallel computer system. Combining anatomical and mathematical models provide the technology required to begin understanding the distribution of localized SAR values in the human resulting from directed energy exposure.
Author
Dosimeters; Mathematical Models; Human Beings; Biological Effects; Electromagnetic Radiation; Radiation Dosage

20000032416 Veridian, San Antonio, TX USA
A Submodel for Combat Casualty Assessment of Ocular Injury from Lasers
Miller, R. E., II, Veridian, USA; Carver, B., Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 30-1 - 30-11; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In an effort to standardize casualty assessments for DoD, the Joint Service Technical Coordination Group/Munitions Effectiveness and Aircraft Survivability Crew Casualty Working Group (CCWG) developed the Operational Requirements based Casualty Assessment (ORCA) model. The ORCA system consists of a functioning software code that will predict the effects of insult-to-injury-to-operational casualty from various types of trauma at specific times post-insult. As an integral part of ORCA, this submodel was designed to predict the probability for ocular injury from insult on the battlefield by directed energy, i.e., lasers, and assess casualty status. A unique, integrated, and multifaceted approach was devised to compute the effects of laser insult on

the elemental capabilities of vision, or visual taxons. The methodology is based on using equations and algorithms to calculate a functional index of ocular damage, utilizing this index to quantify the effects of combat injuries on the visual taxons, and applying the resultant values to a notional scale to determine the potential for combat casualty in terms of mission completion. This submodel also provides a capability to differentiate operational casualties from medical casualties in a format that is compatible with the ORCA system.
Author
Casualties; Mathematical Models; Injuries; Human Performance; Combat; Eye (Anatomy)

20000032417 Air Force Research Lab., Human Effectiveness Directorate, Wright-Patterson AFB, OH USA
Burn Prediction Using BURNSIM and Clothing Models
Knox, F. S., Air Force Research Lab., USA; Reynolds, D. B., Wright State Univ., USA; Conklin, A., Veridian, USA; Perry, C. E., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 31-1 - 31-17; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The development of BURNSIM, an interactive burn prediction model, has been previously presented at SAFE. Recently, a user who was incorporating BURNSIM into a larger Crew Casualty Model (ORCA) came to us for documentation of BURNSIM's validation. This prompted us to pull together several previously unpublished studies of BURNSIM's ability to accurately predict both human and porcine (pig) burns. The paper discussed the degree to which BURNSIM's predictions agree with data published by: Stoll (human), University of Rochester Atomic Energy Project (pig), Fort Knox (human), Moritz and Henriques (pig), and Knox etal (pig). This paper adds to that discussion by introducing efforts to model the protective effects of clothing. Three approaches have been taken: first, making experimental observations of how much heat is transferred through fabric to a sensor or pig skin: second, treating clothing as a simple filter and finally, describing clothing analytically as a multi-layered system through which heat must flow. Each method has its uses and problems. For example, the analytical model is the most general but requires that the user specify many things about the clothing system e.g. size of spaces, thermal properties of the fabric etc. These are not often known and may be difficult to obtain. BURNSIM was able to predict with reasonable accuracy when the initial conditions and thermal inputs are adequately defined.
Author
Burns (Injuries); Computer Programs; Mathematical Models; Casualties; Protection; Predictions

20000032418 Royal Military Coll. of Science, Shrivenham, UK
Thermal Output of Pyrotechnic Compositions and Evaluation of Skin Burns
Lawton, B., Royal Military Coll. of Science, UK; Merrifield, R., Health and Safety Executive, UK; Wharton, R. K., Health and Safety Executive, UK; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 32-1 - 32-12; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents a method of computing the heat dose for first, second, and third-degree burns from convection or radiation sources. Henriques' theory of skin burns is used with a simple numerical model of one-dimensional, transient heat conduction through skin. Allowance is made, where necessary, for heat absorption due to penetration of the skin by short wavelength radiation. The theory is used to compute the quantity-distance-burns relation for fires burning various pyrotechnic compositions of commercial and military interest.
Author
Burns (Injuries); Pyrotechnics; Radiation Damage; Human Performance; Radiation Injuries; Skin (Anatomy); Conductive Heat Transfer; Radiation Dosage

20000032419 JAYCOR, San Diego, CA USA
Biomechanical Modeling of Injury from Blast Overpressure
Stuhmiller, James H., JAYCOR, USA; Masiello, Paul J., JAYCOR, USA; Ho, Kevin H., JAYCOR, USA; Mayorga, Maria A., Walter Reed Army Inst. of Research, USA; Lawless, Nancy, Walter Reed Army Inst. of Research, USA; Argyros, Greg, Walter Reed Army Inst. of Research, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 33-1 - 33-7; In English; See also 20000032388
Contract(s)/Grant(s): DAMD17-96-C-6007; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The loading of the body by blast overpressure, often generated by explosives or weapon noise, can rapidly collapse the air-containing organs of the body and cause local injury. These effects can range from isolated pathologies, with no observable physiological consequences, to rupture of critical organs and death. Following World War II, animal models were used to study lethality, while in the past two decades the US Army Medical Research and Materiel Command has used animal models to study injury. The lethality data was correlated with pressure-duration characteristics of the free field blast, but these correlations become

ambiguous in reverberant environments. Correlations have been proposed based on the motion of the thorax, but without a biomechanical basis, they do not provide insight into injury location or scaling with species and gender. A model of the thoracic injury process has been developed that provides both a biomechanical understanding and a good correlation of experimental observation. This paper reviews the mathematical model, the data supporting the choice of material properties, and the correlation of calculated internal stress with observed injury.
Author
Biodynamics; Blast Loads; Injuries; Mathematical Models; Pathology; Animals; Computerized Simulation; Explosives; Casualties

20000032420 Air Force Research Lab., HEPR, Brooks AFB, TX USA
Altitude Decompression Sickness (DCS) Risk Assessment Computer (ADRAC)
Petropoulos, L. J., Air Force Research Lab., USA; Kannan, N., Texas Univ., USA; Pilmanis, A. A., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 27-1 - 27-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Decompression sickness (DCS) is caused by exposure to significant reductions in environmental pressure. These situations are encountered during diving, high altitude exposures or artificially induced pressure changes in hyperbaric or hypobaric chambers. For large and rapid pressure reductions, supersaturation occurs as a result of the inability of tissue gas exchange processes to expel excess nitrogen. These gases, which come out of solution when tissues are sufficiently supersaturated, collect as bubbles in the tissue. The size and location of these bubbles are thought to have a significant effect on the resulting DCS symptoms. The risks can be minimized or prevented with sufficient denitrogenation by prebreathing pure oxygen before such exposures. The risk of DCS increases with extended exposure times, very high altitudes, and greater physical activity during the exposure. The assessment of DCS risk for both civilian and military personnel under specified flight protocols is a critical problem that the USAF deals with on a regular basis. to provide answers to these questions, and also to obtain a clearer understanding of the effects of denitrogenation, the High Altitude Protection Function of the Air Force Research Laboratory is developing an appropriate model to predict DCS risk using physical and physiological principles.
Author
Decompression Sickness; Models; Mathematical Models; Computerized Simulation; Human Factors Engineering; Physiological Responses

20000032687 Flugmedizinisches Inst. der Luftwaffe, Fuerstenfeldbruck, Germany
Physiological Consequences: Cardiopulmonary, Vestibular, and Sensory Aspects
Welsch, H., Flugmedizinisches Inst. der Luftwaffe, Germany; Albery, W., Air Force Research Lab., USA; Banks, R. D., Biodynamic Research Corp., USA; Bles, W., Institute for Human Factors TNO, Netherlands; Human Consequences of Agile Aircraft; March 2000, pp. 4 - 1 - 4 - 8; In English; See also 20000032683; Copyright Waived; Avail: CASI; A02, Hardcopy

Discussing the physiological consequences of enhanced fighter maneuverability (EFM), aspects of cardiopulmonary reactions will be seen during high G maneuvers, especially the combination of negative G-load followed by high G-onset maneuvers (”push-pull”). The aircrafts’ capability to reach high altitude within a very short time (due to the lift to weight ratio of more than 1) may produce new problems even during normal aircraft operation, e.g. decompression sickness (DCS). The incidence of vestibular problems may be increased by unconventional acceleration exposures Sensory stimulations may be induced by high acceleration alterations in the roll, pitch, and yaw axis. The support by an advanced G-protection garment will be needed. For the ”care free” handling the advanced G-protection device must work without any delay in time even during high acceleration transitions, must secondly include high altitude protection, and thirdly must ensure pilot comfort. Furthermore special training devices are required such as the human centrifuge as a dynamic flight simulator (DFS) with a fully gimballed system, and a spatial (dis)orientation device with a fully three-axes gimballed system. Pilot selection and medical survey with high sophisticated diagnostic tools will become more and more important. Last not least the need of special physical training will be required to power, to train the cardiovascular reflexes, and to increase psychomotoric stability and mental mobility.
Author
Physiological Effects; Aircraft Maneuvers; Flight Characteristics; Flight Fatigue; Human Factors Engineering; Human Centrifuges; Gravitational Effects; Aircraft Pilots; Pilot Performance

20000032967 NASA Ames Research Center, Moffett Field, CA USA
Crew Factors in Flight Operations, 11, A Survey of Fatigue Factors in Regional Airline Operations
Co, Elizabeth L., San Jose State Univ., USA; Gregory, Kevin B., Sterling Software, Inc., USA; Johnson, Julie M., San Jose State Univ., USA; Rosekind, Mark R., NASA Ames Research Center, USA; October 1999; 44p; In English

Contract(s)/Grant(s): RTOP 548-30-32
Report No.(s): NASA/TM-1999-208799; IH-003; NAS 1.15:208799; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report is the eleventh in a series on the physiological effects of flight operations on flight crews. A 119-question survey was completed by 1,424 flight crewmembers from 26 regional carriers to identify factors contributing to fatigue in regional airline operations. Eighty-nine percent of crewmembers identified fatigue as a moderate or serious concern with 88% reporting that it was a common occurrence and 92% reporting that, when it occurs, fatigue represents a moderate or serious safety issue. However, 86% reported they received no company training addressing fatigue issues. Identified fatigue factors included multiple flight segments, scheduling considerations, varying regulations, and others. The two most commonly cited fatigue factors regarded flying multiple (more than four) segments. Scheduling factors accounted for nine of the ten most common recommendations to reduce fatigue in regional operations. Differing requirements among regulations were cited as contributing to fatigue. Other identified factors were the flight deck environment, automation, and diet. The data suggested specific recommendations, including education of industry personnel about fatigue issues and examination of scheduling practices. Education plays a critical role in any effort to address fatigue. Analyzing scheduling practices and identifying potential improvements may result in reduced fatigue as well as other benefits to operations.
Author
Physiological Effects; Flight Operations; Flight Crews; Human Performance; Mental Performance; Flight Fatigue; Flight Stress (Biology)

20000032987 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on UPS of a Totally Implantable Medical Device
Watanabe, Hiroyuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 221-222; In Japanese; Copyright; Avail: Issuing Activity

Transcutaneous energy transmission system (TETS) has been proposed to drive totally implantable medical devices such as an a artificial heart. In the system, power is transcutaneously transmitted into the body, by making use of electromagnetic combination of two transcutaneous coils. A secondary power source is needed in case of missing power transmission from outside of the body. In this paper, an electric double layer capacitor (EDLC) is considered as the secondary power source. An EDLC can be charged and discharged with larger current and be cycled much more times compared to chemical batteries such as a Li-ionized or Ni-MH battery.
Author
Heart Implantation; Power Supplies; Capacitors

20000032990 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Measurements and Analysis of Heart Wall Vibration using Ultrasound
Nakaya, Shigemitsu, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 215-216; In Japanese; Copyright; Avail: Issuing Activity

We have developed a novel method for accurately measuring the velocity signals on the multiple points preset on an ultrasonic beam in the heart wall by tracking the movement of the heart wall. In this paper, we control the directions of the ultrasonic beams so that the velocity signals are simultaneously measured at the multiple points on the surface of the left, ventricular (LV) wall. From these data, we estimate the spatial distribution of the eigen-vibration of the LV wall at the end-diastole. by applying the time-frequency analysis to the velocity signals of the heart wall, we determine the instantaneous eigen-frequency of the LV at end-diastole. From the eigen-frequency, the wall thickness, and the average radius of the LV, end-diastolic pressure and myocardial elasticity of the LV are noninvasively estimated.
Author
Diastolic Pressure; Elastic Properties; Heart; Ultrasonics; Vibration Measurement; Signal Measurement

20000032999 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Dynamics Analysis on Single Neuronal Activity During Sleep
Nakamura, Kazuhiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 189-192; In Japanese; Copyright; Avail: Issuing Activity

Spontaneous single-unit activity during sleep was recorded from neurons in the region of the feline's lateral geniculate nucleus. The dynamical characteristics of the activity were analyzed for a time series of successive spike-counts measured within a fixed time-window. The results showed a white noise-like spectrum in the low frequency range, 0.04-1.0 Hz, during steady state non-REM sleep (slow-wave sleep), and a 1/f-noise, during REM sleep. We therefore did not reject our working hypothesis that

neurons in the central processor systems of the brain have a transition in slow dynamics in their spontaneous activity between non-REM and REM sleep. Possible mechanisms underlying the transition in slow dynamics between non-REM and REM sleep are discussed in view of an alteration in neuronal interactions due to changes in the effects of aminergic/cholinergic modulations of the brain during sleep. The functional meaning of the transition in slow dynamics during sleep is also discussed in view of the suppression and the reactivation of central excitatory networks during non-REM and REM sleep, respectively.
Author
Rapid Eye Movement State; Sleep; Dynamic Characteristics

20000033013 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Study on Development of Functional Electrical Stimulation System with 2-Dimensional Stimulus Data
Furuse, Norio, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 118-121; In Japanese; Copyright; Avail: Issuing Activity

EMG signals were measured during voluntary elbow flexion with different shoulder position maintained and with shoulder flexion controlled by an active orthosis. The EMG signals were compared mutually. The results suggested that 2-dimensional stimulus data was effective in functional electrical stimulation (FES) for controlling paralyzed upper extremities. A command input system using residual motor function for motor disabled patients was constructed, and the command input system was found to be applicable to the residual motor functions providing good performance of the FES system operation.
Author
Electromyography; Electric Stimuli; Signal Measurement

20000033014 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Generation of Optimal Stimulation for FES Standing up using Computer Model Simulation
Eom, Gwang–Moon, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 114-117; In English; Copyright; Avail: Issuing Activity

The most attention of this thesis was paid to the automatic generation of stimulation data for FES standing-up in paraplegic patients, to overcome the difficulties in the present EMG-based method. Automatic generation of ”standard stimulation data” was selected as a first purpose of this thesis. At first, a simulation system of FES induced motion was developed. Musculotendon model in the system was simplified for application in the stimulation data generation. Standard stimulation data for unassisted standing was generated by dynamic optimization with the simulation system. The generated stimulation data were roughly in agreement with the normal subjects’ EMG and the cost function was properly incorporated in it. From these, it may be said that the model-based method is useful for generating standard stimulation data. The same technique could be applied to generation of patient-specific stimulation data once the musculoskeletal system of a patient was properly identified. Therefore, a model and an identification scheme were developed. In the model, musculotendon and moment arm are lumped together resulting in a torque generator, which facilitated simple and noninvasive identification. A systematic protocol was developed for the identification. The model and its identification method were validated taking the vastus lateralis muscle at the knee joint as an example. The predicted joint angle trajectories closely matched the experimental data. This shows that the model was proper and the identification was successful. This also implies that the model-based generation of patient specific stimulation data is promising.
Author
Computerized Simulation; Musculoskeletal System; Electromyography; Mathematical Models; Paralysis; Stimulation; System Identification

20000033102 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Measurement of Physiological and Phsychological Condition in Human by Multiple Biosignals
Fukumoto, Takenori, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 343-344; In Japanese; Copyright; Avail: Issuing Activity

Evaluation of the physiological and psychological condition under stressing and relaxing stimulation is required when talking about environmental influence. We developed a system which can measure multiple biosignals in parallel and examined its validity by measuring multiple biomedical signals. Our results suggest that it is possible to evaluate the physiological and psychological condition under both stressing and relaxing stimulation by the developed system.
Author
Stress (Psychology); Stress (Physiology); Signal Processing; Stimulation

20000033262 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne Australia
Neural Network Training on Human Body Core Temperature Data
Sanders, Peter; Lau, Wai M.; Dec. 1999; 16p; In English
Report No.(s): AD-A373812; DSTO-TN-0241; DODA-AR-011-160; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A multi-layer Adaptive Linear Element neural network computer program was trained with back-propagation on physiological response data from nine subjects walking on a treadmill in two simulated tropical environments. The 100 minute end-point body core temperatures calculated were compared to the measured responses. It was found that although correlation was low and simultaneous high specificity and sensitivity were not displayed, the results were comparable to the predictions from an established human thermal response prediction programme for these subjects. It is concluded that the neural network modelling technique has merit in this field and should be explored further as more data become available.
DTIC
Human Body; Neural Nets; Aerospace Medicine; Body Temperature; Computer Programs

20000033305 Army Aeromedical Research Lab., Fort Rucker, AL USA
The Efficacy of Amphetamines for 64 Hours of Sustained Operations
Caldwell, John A., Army Aeromedical Research Lab., USA; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 2 - 1 - 2 - 8; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

Dextroamphetamine sulfate (Dexedrine(regitered trademark)) is a powerful central nervous system (CNS) stimulant that improves alertness and postpones the need for sleep. In aviation, where a high degree of alertness is essential during long flights, dextroamphetamine can counteract the decreased vigilance and attention, slowed reaction time, negative psychological mood, and sometimes perceptual disturbances associated with severe fatigue. Countermeasures other than dextroamphetamine have been tested to overcome these problems, but the most popular strategy, that of emphasizing proper work/rest management, is almost impossible to successfully implement due to the unpredictability of combat operations. Other potential measures such as brief periods of exercise only temporarily reduce the negative impact of sleep loss, while exposure to cold air or noise is virtually ineffective or, in the case of loud music, actually deleterious. Improving the physical fitness of personnel likewise does little to reduce the impact of sleep loss.
Author
Amphetamines; Central Nervous System Stimulants; Alertness; Countermeasures

20000033306 Air Force Hospital (251th), Athens, Greece
Non Benzodiazepines Hypnotics: Another Way to Induce Sleep
Kodounis, Antonios, Air Force Hospital (251th), Greece; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 3 - 1 - 3 - 8; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The third generation hypnotics, zolpidem and zopiclone can be used to optimize rest periods during sustained operations and help the military personnel. This is possible because these drugs provide a good quality of sleep, without residual effects in the morning after administration. A literature review of the possible limitations of use of these drugs in pilots has been presented.
Author
Drugs; Personnel; Sleep; Hypnosis

20000033307 Dortmund Univ., Inst. for Occupational Physiology, Germany
The Effects of Low Frequency Electromagnetic Fields on the Melatonin Synthesis in Man
Griefahn, Barbara, Dortmund Univ., Germany; Degen, Gisela, Dortmund Univ., Germany; Blaszkewicz, Meinolf, Dortmund Univ., Germany; Golka, Klaus, Dortmund Univ., Germany; Kuenemund, Christa, Dortmund Univ., Germany; Their, Ricarda, Dortmund Univ., Germany; Griefahn, Barbara, Dortmund Univ., Germany; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 4 - 1 - 4 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

Some studies (mainly in rodents) have raised concerns regarding a carcinogenic potential of low-frequency electric and/or magnetic fields which may be related to the inhibition of melatonin synthesis. This hormone - isolated by Lerner et al. in 1958 [14] - is thought to exert an oncostatic effect probably by acting as a free radical scavenger [20, 21, 22]. The chronobiological properties of melatonin are much better founded. Melatonin mediates the entrainment (synchronization) of the periodic diurnal

alterations of physiologic functions (core temperature, heart rates etc. [2, 4]). Moreover, melatonin has probably numerous other functions which are as yet insufficiently studied (thermoregulation, cardiovascular and immune functions etc.) [6, 7].
Author
Electromagnetic Fields; Low Frequencies; Thermoregulation; Synchronism

20000033309 Etat-Major de la Marine, Antenne Programmes, Toulon, France
Caffeine to Sustain Operational Fatigue
Sicard, B., Etat-Major de la Marine, France; Lagarde, D., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Batejat, D., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Chauffard, F., Nestle Research Centre, Switzerland; Enslen, M., Nestle Research Centre, Switzerland; Doireau, P., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Beaumont, M., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Tachon, P., Nestle Research Centre, Switzerland; Ballevre, O., Nestle Research Centre, Switzerland; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 6 - 1 - 6 - 3; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Sleep deprivation and desynchronization from circadian rhythm are common in military operation. Caffeine is the most widely used psychostimulant and may be useful in operational fatigue-coping strategies. In this paper we will review the current policies on caffeine in the military, then we will discuss effects and potential use of a slow release caffeine formulation.
Author
Caffeine; Sleep Deprivation; Military Operations; Circadian Rhythms

20000033312 Surrey Univ., School of Biological Sciences, Guildford, UK
Acute and Delayed Effects of Melatonin: Operational Significance
Arendt, Josephine, Surrey Univ., UK; Middleton, Benita, Surrey Univ., UK; Stone, Barbara, Defence Evaluation Research Agency, UK; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 9 - 1 - 9 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The primary function of melatonin in mammals is to convey information about the changing length of the night in the course of the year. Melatonin appears not to be essential for circadian organization but reinforces functions associated with darkness. In diurnal humans this of course included sleep and lowered body temperature. It may act as an adjunct to light for the maintenance of synchrony with the solar day. Exogenous melatonin can both advance and delay the timing of sleep and other circadian functions and appears to stabilise sleep to a 24h period taken daily at an appropriate time in free running conditions. However there is at yet little evidence that it can consistently synchronise free running strongly endogenous variables such as core temperature. Its effects on sleep in free run are complex, depend on circadian time of administration, and in part can be interpreted on a photoperiodic basis.
Author
Diurnal Variations; Circadian Rhythms; Sleep

53
BEHAVIORAL SCIENCES

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

20000032299 North Carolina Agricultural and Technical State Univ., Greensboro,NC USA
Effects of Personality and Gender on a Simulated Flight Task
Strickland, D., North Carolina Agricultural and Technical State Univ., USA; Johnson–Dunnings, H., North Carolina Agricultural and Technical State Univ., USA; Wright, S., North Carolina Agricultural and Technical State Univ., USA; Ntuen, C., North Carolina Agricultural and Technical State Univ., USA; Portalatin, M., North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 263-268; In English; See also 20000032189
Report No.(s): 98URC048; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Traditionally, studies in the area of human factors and supervisory control have focused on the perception and cognitive aspects of the controller in the system. This research was conducted to determine possible effects of personality and gender on an individual's ability to respond to the system, as well as the individual's perception of workload. For this study, a flight simulation prototype with five separate gauges was created to act as the system. Potential participants between the ages of 17 and

30 were given questionnaires to determine whether they were one of the following personality types: Introvert/Extroverts or TypeA/Type B. Based on their responses to the questionnaires, five individuals of each personality type were chosen to participate in the testing (10 males and 10 females). They were exposed to two 30 minute simulated flight sessions, during which time they monitored the gauges for automation failure. Response times to failures were collected and analyzed using analysis of variance. Each participant also filled out workload surveys to determine his/her perceived workload for each session. Statistical analysis indicated significant differences (at an alpha level of 0.05) in response times and workload measures based on gender and personality, as well as the interaction of the two variables. Further research using more subjects is recommended to validate results obtained. Validation may lead to changes in pilot training programs.
Author
Flight Simulation; Human Factors Engineering; Personality; Females; Males; Flight Crews

20000032628 Minnesota Univ., Dept. of Computer Science, Minneapolis, MN USA
Automatic Detection of Driver Fatigue, Phase 3 ***Final Report, 1998-1999***
Kaur, S. S.; Eriksson, M.; Papanikolopoulos, N. P.; Jun. 1999; 54p; In English
Report No.(s): PB2000-100636; MN/RC-1999-30; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Sleep deprivation and sleep disorder continues to cause problems on the road. Reducing the number of accidents related to driver fatigue would save the society a significant amount of money and personal suffering. Monitoring the driver's symptoms can help determine driver fatigue early enough to prevent accidents due to lack of awareness. The report describes advances towards a non-intrusive approach for real-time detection of driver fatigue. It uses a video camera that points directly toward the driver's face and monitors the driver's eye to deter micro-sleeps, or short periods of sleep of about three-to-four seconds.
NTIS
Detection; Fatigue (Biology); Human Performance

20000032670 Brigham and Women's Hospital, Boston, MA USA
The Deployment of Visual Attention: Two Surprises
Wolfe, Jeremy M.; Search and Target Acquisition; March 2000, pp. 20-1 - 20-11; In English; See also 20000032651; Copyright Waived; Avail: CASI; A03, Hardcopy

The visual system is not capable of processing of all aspects of a scene in parallel. While some visual information can be extracted from all locations at once, other processes, including object recognition, are severely limited in their capacity. Selective attention is used to limit the operation of these limited-capacity processes to one (or, perhaps, a few) objects at a time. Searching for a target in a scene, therefore, requires deployment of attention from one candidate target to the next until the target is found or the search is abandoned. Common-sense suggests that distractor objects that have been rejected as targets are marked in some fashion to prevent redeployment of attention to non-target items. Introspection suggests that sustained attention to a scene builds up a perception of that scene in which more and more objects are simultaneously recognized. Neither common-sense nor introspection are correct in this case. Evidence suggests that covert attention is deployed at random among candidate targets without regard to the prior history of the search. Rejected distracters are not marked during a search. Prior to the arrival of attention, visual features are loosely bundled into objects. Attention is required to bind features into a recognizable object. For an object to be recognized, there must be a link between a visual representation and a representation in memory. Our data suggest that only one such link can be maintained at one moment in time. Hence, counter to introspection, only one object is recognized at one time. These surprising limits on our abilities may be based on a trade off speed for apparent efficiency.
Author
Visual Perception; Target Recognition; Visual Observation; Position (Location); Pattern Recognition; Mental Performance

20000032672 Army Research Lab., White Sands Missile Range, NM USA
Depth Perception Applied to Search and Target Acquisition
Watkins, Wendell R., Army Research Lab., USA; Alaways, LeRoy, Military Academy, USA; Search and Target Acquisition; March 2000, pp. 22-1 - 22-11; In English; See also 20000032651; Copyright Waived; Avail: CASI; A03, Hardcopy

A search and target acquisition test was performed under an exchange scientist program with the TNO Human Factors Research Institute at Soesterberg, The Netherlands in September 1998. The test was performed at a military training base using several of the scientists from TNO wearing Dutch forest camouflage uniforms. Sets of wide baseline stereo photos were obtained for targeted and non-targeted scenes at two sites. The targeted and non-targeted scene photos were taken on the same day within a few minutes of each other. The imagery obtained was taken with a 35 mm camera with a 200 mm lens for target ranges from 100 m to 1 km. A single field of view was used for all of the targeted and non-targeted scenes at each site. The photos were taken with color slide film and were digitized to 3K by 2K pixel resolution. These imagery data sets were used to perform search and

target acquisition tests. Preliminary analysis of single line of sight search and target acquisition observer tasks was performed for the same scenes with and without targets. Results of these observer tests are presented. Additionally, the scenes used in these tests were made into stereo pair images for observer display. There are several aspects to the display of wide baseline stereo images that must be taken into consideration for optimum depth perception for use in search and target acquisition. Rule of thumb guidelines for optimizing the depth perception of the contour of camouflaged targets versus terrain features have been derived. Author

Space Perception; Target Acquisition; Camouflage; Photographs; Target Recognition; Stereoscopic Vision; Visual Discrimination; Visual Observation

20000032686 Institut de Medicine Aerospatiale Armee, Dept. Sciences Cognitives, Bretigny sur Orge, France

Psychological Consequences and Pilot "Situational Awareness" Survey

Grau, J. Y., Institut de Medicine Aerospatiale Armee, France; Human Consequences of Agile Aircraft; March 2000, pp. 3 - 1 - 3 - 15; In English; See also 20000032683; Copyright Waived; Avail: CASI; A03, Hardcopy

The technological design and developments already applied to a number of aircraft, which represent the basis of tomorrow's aircraft, tend to change the tasks performed by pilots. Since the 80's, automation and computerization have invaded cockpits, leading to a change in the role of pilots. Whereas pilots used to need competencies directed towards handling and navigating the aircraft, what is now increasingly required of them is the ability to manage complex systems. With the arrival of new concepts like supermaneuverability and superagility, it seems extremely important to try and understand the psychological consequences these concepts will have on pilots. Enabling new types of operation, supermaneuverability and superagility alter existing tasks and will probably create new ones, which will have their own psychological constraints. What makes these constraints different from those existing on present aircraft, and what consequences could they have on pilot performance? These two questions can be addressed by two preliminary comments: (1) As of today, supermaneuverability and superagility are still extremely novel concepts. Various "prototype" aircraft point to the developments, which will eventually make these concepts a reality in the near future, but there still is no such thing as "real" operational experience. The difficulty in accurately studying the consequences these future aircraft will have on pilots, lies in trying to define the exact role the pilot will be asked to play aboard. (2) The psychological consequences studied in this chapter will be limited to the consequences borne by the pilot in terms of taking and processing information. This chapter does not take into account psychological aspects based on personality or motivation.

Derived from text

Aircraft Pilots; Human-Computer Interface; Pilot Performance; Flight Fatigue; Stress Analysis; Human Factors Engineering

20000032689 Swedish Air Force, Aeromedical Center, Stockholm, Sweden

Selection, Training and Simulation

Linder, Jan, Swedish Air Force, Sweden; Tielemans, W., Swedish Air Force, Sweden; Albery, W., Swedish Air Force, Sweden; Human Consequences of Agile Aircraft; March 2000, pp. 6 - 1 - 6 - 10; In English; See also 20000032683; Copyright Waived; Avail: CASI; A02, Hardcopy

In this paper a "superagility training structure" has been discussed and proposed. The super agile pilot will in the new superagility arena be clearly dependent on both old training principles but also on training where some new interacting factors might come into play: (1) At first Selection plays a major role with physiological, intellectual and stress management resources; (2) Certain human constraints like musculoskeletal, cardiovascular, respiratory, sensory and mental are discussed;(3) Normal life and regular training where almost everything the pilot does also have a definite implication also on flying; (4) Specific single task training where a pilot trains crucial abilities like G-tolerance, back/neck tolerance and so on. Today there is a lack in this area of specific training. There is also a need for training devices for pilots regarding the sensory system and the cognitive performance; (5) Specific combined tasks training where the pilot have to train in a more complex way, e.g. survival training or mission scenarios in a Multi Mission Trainer (MMT; and (6) Full ground mission task where the pilot uses a Full Mission Simulator (FMS) or a Dynamic Flight Simulator (DFS). Some parts of the Superagility Training Structure have not been a scope of this paper. They are Basic flying and Tactical/operational flying.

Derived from text

Pilot Selection; Physiological Tests; Flight Simulation; Pilot Training; Human Factors Engineering; Flight Fatigue; Flight Stress (Biology); Pilot Performance

20000033304 Institut de Medicine Aerospatiale Armee, Bretigny sur Orge, France

The Use of Modafinil in Operational Settings: Individual Differences Implications

LaGarde, Didier, Institut de Medicine Aerospatiale Armee, France; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 1 - 1 - 1 - 4; In English; See

also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Disruptions in wake-sleep rhythms, particularly induced by SUSOPS and CONOPS, are limiting factors for military personnel in operation. Pharmacological aids, such as hypnotic or stimulant substances can be effective countermeasures. Modafinil (MODIODAL PROVIGIL is a synthetic molecule prescribed for the treatment of narcolepsia and idiopathic hypersomnia. The wakening effect is potent : modafinil allows healthy volunteers to stay awake and efficient for more than 60 hours, without side effects. Its mechanism of action is complex, and it could induce wakefulness by different mechanisms., as compared with other classical vigilance enhancing drugs such as amphetamines. A neuroprotective effect against neurotoxic organophosphate agents was recently discovered. Modafinil seems to be a powerful and safe countermeasure in the management of sleep-wake rhythm during operational situations.

Author

Military Operations; Amphetamines; Organic Phosphorus Compounds; Personnel

20000033308 Defence Evaluation Research Agency, Protection and Performance Dept., Farnborough, UK

Promoting Sleep: Adapting to Shiftwork and Time Zone Change

Stone, Barbara M., Defence Evaluation Research Agency, UK; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 5 - 1 - 5 - 11; In English; See also 20000033303; Copyright Waived; Avail: CASI; A03, Hardcopy

The changes in performance that arise in shiftworkers and after transmeridian flights can be attributed, at least in part, to the reduction in both the quality and quantity of sleep which occurs as a result of disruption of the normal pattern of sleep and wakefulness. Sleep disturbance associated with shiftwork is well documented (1-4). Sleep during the day is shorter and more disturbed than sleep at night, and it has been estimated that, by the end of a week of night duty, the equivalent of at least one night's sleep may have been lost (5). While the duration of slow-wave sleep is unchanged following the night shift, due to prior wakefulness, stage 2 and rapid eye movement (REM) sleep are reduced. Further, in shiftworkers over about 40 years old, the usual decline in sleep quality and quantity with increasing age exacerbates the problems associated with an unusual pattern of work and rest (6-8). This age-related difference in sleep is also evident in studies of transmeridian travel (9).

Author

Sleep; Sleep Deprivation; Wakefulness

20000033310 Institute for Human Factors TNO, Soesterberg, Netherlands

The Effects of Tyrosine on Cognitive Functions during Sustained Operations

Wientjes, Cornelis J. E., Institute for Human Factors TNO, Netherlands; Deijen, J. Berend, Vrije Univ., Netherlands; Vullinghs, Huub F. M., Royal Netherlands Army, Netherlands; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 7 - 1 - 7 - 8; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The effect of supplementation of the amino acid L-tyrosine on cognitive task performance was assessed during a highly demanding two-week combat training course. A tyrosine group (10 subjects) received daily doses of a protein-rich drink (containing 2 g tyrosine), while a placebo group (11 subjects) received the same doses of a carbohydrate rich drink (containing no proteins). Cognitive task performance was evaluated immediately preceding the course, as well as at the end of the first week of the course. Although there were no group differences in task performance prior to the course, the tyrosine group clearly performed better than the placebo group on several cognitive performance tasks during the course. Overall, up to 40% of the cognitive performance decrement that was due to die impact of stress and fatigue, was counteracted by the supplementation of tyrosine. The findings suggest that tyrosine supplementation can be effective in preventing cognitive degradation in highly demanding military operational environments that include sustained operations, as well as physical and psychological stressors.

Author

Tyrosine; Military Operations; Human Performance; Amino Acids; Cognition

20000033311 Aeromedical Inst., Soesterberg, Netherlands

Sleep and Alertness Management During Military Operations: Questions to be Answered

Simons, M., Aeromedical Inst., Netherlands; Valk, P. J. L., Aeromedical Inst., Netherlands; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 8 - 1 - 8 - 8; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

Sleep and alertness management is a major point of attention for the medical support of military round the clock operations. Crew's awareness on the effects of fatigue and sleepiness should be enhanced. Flight surgeons should be trained on the use of practical methods to prevent serious fatigue and to enhance performance and alertness of the crew. Although. in civil and in

military aviation a considerable number of studies have been conducted on fatigue countermeasures and preventive strategies, results are not readily available for practical use by flight surgeons. In order to develop useful guidelines for flight surgeons and crew, the international aeromedical research community should be able to produce a database on what is already known and identify areas where knowledge is lacking. In this context research questions related to the use of strategic naps, hypnotics, stimulants, and chronobiotic treatment are put forward.
Author
Sleep; Alertness; Military Operations; Fatigue (Biology)

20000033313 Portuguese Air Force Aeromedical Center, Training and Flight Safety Dept., Lisbon, Portugal
Portuguese Air Force Aeromedical Centre Approach to Management of Sleep/Wakefulness of Aircrew
Ribeiro, Nuno Pedro, Portuguese Air Force Aeromedical Center, Portugal; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 10 - 1 - 10 - 3; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

The first time we noticed that we had a problem with the lack of guidelines to manage the sleep/wakefulness disturbances among aircrew was during the time we had a P3-P stationed in Sigonnela (IT) flying integrated in a NATO force. They were there during periods of 15 days flying following a schedule that we can see an example in Figure 1. According to this we sent there a flight surgeon that detected two major problems: the lack of regularity on shiftwork and overworkload. We have to add to the hours we can see in the example, 3) more hours of pre-flight briefing and two hours of debriefing, all with only one crew. An additional problem was the location of the rooms of the NCOs, either air crewmembers or ground crew-members, situated near the flight line, submitted to high levels of noise and very difficult to get dark enough during the day, limiting a good or sufficient period of sleep. All the personnel had difficulty to get alcoholic beverages or exercise near exhaustion.
Author
Aerospace Medicine; Flight Crews; Wakefulness; Sleep

20000033314 Aeronautica Militare Italiana, Reparto Medicina Aerospaziale, Rome, Italy
Sleep Tendency and Ability to Sustain Wakefulness
Porcu, Silvio, Aeronautica Militare Italiana, Italy; Casagrande, Maria, Aeronautica Militare Italiana, Italy; Ferrara, Michele, Aeronautica Militare Italiana, Italy; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 11 - 1 - 11 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

During sustained military operations it is often necessary to cope with prolonged periods of wakefulness and irregular rest-activity patterns. In these situations a severe sleep debt can accumulate, leading to increasing levels of sleepiness on the job and, consequently, to dangerous decreases of performance. A number of possible pharmacological and nonpharmacological countermeasures have been studied. Prophylactic naps (short periods of sleep before long periods of work) are probably the best non-pharmacological tool to reduce fatigue and improve performance (e.g., Bonnet, 1991). They have to take place according to some ”chronobiological rules”: for example., it is well known that sleep propensity shows a biphasic distribution, with an early morning (5.30-7.30 hours) and a mid afternoon (15.30) peak, defined ”primary and secondary sleep gates” by Lavie (1986). In addition, naps should be scheduled before the accumulation of a severe sleep debt and placed far from the circadian through of body temperature rhythm in order to minimize sleep inertia effects (e.g., Dinges, Orne Orne, 1985).
Author
Sleep; Wakefulness; Military Operations; Circadian Rhythms

20000033315 Polish Air Force Inst. of Aviation Medicine, Inst. of Psychiatry and Neurology, Warsaw, Poland
Usefulness of Sleep Records After Mild Head Trauma to Predict Shift Work Effectiveness
Maksymiuk, Grzegorz, Polish Air Force Inst. of Aviation Medicine, Poland; Jernajczyj, Wojciech, Polish Air Force Inst. of Aviation Medicine, Poland; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 12 - 1 - 12 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

Validity of polysomnography for determining the post-traumatic sequelae was evaluated in 33 male patients after a mild head trauma. The results indicate that shortly after the trauma accompanied by the brain commotion disturbances in sleep architecture can be detected by means of polysomnography. We also demonstrate that polysomnography is a sensitive method of evaluation of early post-traumatic alterations within the CNS. Based on the results of the present study we conclude that the described

diagnostic procedure should become a steady element of the clinical evaluation and qualification of patients presenting with subjective symptoms as the sequelae of a mild head trauma.
Author
Sleep Deprivation; Signs and Symptoms; Central Nervous System; Records

20000033316 Interior Dept., Center of Neurology and Medical Psychology, Genoa, Italy
Sleepiness in a Population of Italian Shift-work Policemen
Garbarino, S., Interior Dept., Italy; Nobili, L., Genoa Univ., Italy; Balestra, V., Genoa Univ., Italy; Beelke, M., Genoa Univ., Italy; DeCarli, F., National Council of Research, Italy; Cordelli, A., Interior Dept., Italy; Ferrillo, F., Genoa Univ., Italy; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 13 - 1 - 13 - 4; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Various studies have shown that sleep disorders and daytime sleepiness are the more frequent disturbances reported by shiftworkers (1,2). Shift-work interferes. with both the quality and quantity of sleep. Concerning the duration of sleep, there is a decrease in the number of hours of sleep both during morning shifts, due to early awakening, and during night shifts due to the inversion of the normal sleep-wake cycle (3). The increase in body temperature, observed starting from the early morning hours, and the unfavorable environmental conditions (noise, family and social life, etc.) make it more difficult to fall asleep during the day (4,5). Data reported in the literature show how sleepiness and fatigue can increase the risk of human errors and accidents (6,7). Night work and loss of sleep may account for some recent serious accidents (Three-Mile Island 1979, Chernobyl 1986, Exxon Valdez 1989).
Author
Sleep; Populations; Errors; Sleep Deprivation; Personnel

20000033317 Italian Air Force Pratica di Mare, Aerospace Medicine Dept., Rome, Italy
Sleep Inertia and On-Call Readiness
Ferrara, Michele, Italian Air Force Pratica di Mare, Italy; Casagrande, Maria, Italian Air Force Pratica di Mare, Italy; Porcu, Silvio, Italian Air Force Pratica di Mare, Italy; DeGennaro, Luigi, Rome Univ., Italy; Bertini, Mario, Rome Univ., Italy; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 14 - 1 - 14 - 7; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The effects of sleep deprivation and chronobiological variations in performance are undoubtedly among the most pervasive limiters of human ability in all situations that require sustained periods of continuous performance and in around-the-clock work settings (e.g. Dinges et al., 1988). These work scenarios are becoming increasingly common, often involving highly skilled and dedicated personnel as in sustained military operations, space flight preparation and launching, crisis and catastrophe management (Mitler et al., 1988). In all these situations, the negative effects of sleep loss during sustained operations must be compared to the adverse effects of sleep inertia upon abrupt awakening from sleep due to a possible emergency (Dinges et al., 1988; Dinges, 1990).
Author
Sleep; Inertia; Military Operations; Personnel; Sleep Deprivation

20000033318 Institut de Medicine Aerospatiale Armee, Bretigny sur Orge, France
Influence of Age and Gender on Jet-Lag Syndrome: Recommendations
Lagarde, Didier, Institut de Medicine Aerospatiale Armee, France; Beaumont, Maurice, Institut de Medicine Aerospatiale Armee, France; Batejat, Denise, Institut de Medicine Aerospatiale Armee, France; Catrycke, Marc, Institut de Medicine Aerospatiale Armee, France; VanBeers, Pascal, Institut de Medicine Aerospatiale Armee, France; French, Jonathan, Armstrong Lab., USA; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 15 - 1 - 15 - 3; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Jet-lag syndrome in civilian flight personnel is quite well known. In Air Force crews, especially during longhaul flights, jet-lag is associated with sleep deprivation and a specific environment. In this communication., we present some results of a real world experiment (simulation of troops deployment) after a transmeridian flight in which we evaluated notably the influence of age and gender in this kind of jet-lag. In our population, composed of 27 US Air Force reservists, males and females from 19 to 46 years old, we did not find any important differences due to age and/or gender. Only subjective data, recorded from Sleep Log, presented statistical differences. Nevertheless in the global population the jet-lag induced disturbances in 33% of the studied parameters. Some physiological and/or pharmacological recommendations are done.
Author
Age Factor; Jet Lag; Signs and Symptoms; Sleep Deprivation; Sex Factor

20000033319 Dortmund Univ., Inst. for Occupational Physiology, Germany

The Adaptability of Individuals to Shiftwork: A Possible Experimental Approach

Griefahn, Barbara, Dortmund Univ., Germany; Degen, Gisela, Dortmund Univ., Germany; Blaszkewicz, Meinolf, Dortmund Univ., Germany; Golka, Klaus, Dortmund Univ., Germany; Kuenemund, Christa, Dortmund Univ., Germany; Their, Ricarda, Dortmund Univ., Germany; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 18 - 1 - 18 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The Institute for Occupational Physiology at the University of Dortmund has been an important research center for shiftwork. This line of research was terminated a decade ago, when Joseph Rutenfranz died in 1989 and Peter Knauth became Professor at the University of Karlsruhe. Now, this topic will be resumed by a scientist with an extended experience in sleep research focused on experimental studies and field observations on sleep disturbances as caused by environmental noise [10, 11]. Research on shiftwork now will be executed in close cooperation with the biochemical unit of the institute.

Author

Adaptation; Personnel; Biochemistry

20000033320 Army Aeromedical Research Lab., Fort Rucker, AL USA

Napping Strategies to Counteract Sleep Deprivation

Caldwell, J. Lynn, Army Aeromedical Research Lab., USA; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 19 - 1 - 19 - 11; In English; See also 20000033303; Copyright Waived; Avail: CASI; A03, Hardcopy

There is an abundance of evidence indicating that a nap taken during long periods of otherwise continuous wakefulness is extremely beneficial for improving alertness and performance. However, scheduling naps is not a simple matter. Several factors are important to consider before implementing a napping regime into a continuous operations scenario.

Author

Alertness; Sleep Deprivation; Wakefulness

20000033321 Norwegian Defence Research Establishment, Kjeller, Norway

Polyphasic Sleep and Napping Strategies

Opstad, Per Kristian, Norwegian Defence Research Establishment, Norway; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 20 - 1 - 20 - 2; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Sleep deprivation is the most detrimental stress factor for mental performance during continuous military operations. First of all it affects all subjective parameters such as well-being, mood state, motivation, creativity, care for others or social surplus. These changes are followed by alterations in psychometric performance tests such as vigilance tasks, with increasing number of omissions, complex tasks, cognitive functions, reduced reaction speed and learning capacity. When sleep is totally denied for several days more serious neurological symptoms appear such as slow motion, balance disturbance, nystagmus, headache, visual hallucination and sleep narcosis. All this symptoms are most apparent during night-time.

Author

Sleep Deprivation; Human Performance; Mental Performance; Military Operations; Alertness; Stress (Biology)

20000033322 Aeronautica Militare Italiana, Reparto Medicina Aeroapaziale, Rome, Italy

Assessing the Adaptability to Irregular Rest-Work Rhythms in Military Personnel

Porcu, Silvio, Aeronautica Militare Italiana, Italy; Casagrande, Maria, Aeronautica Militare Italiana, Italy; Ferrara, Michele, Aeronautica Militare Italiana, Italy; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 21 - 1 - 21 - 5; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Operational decreases in performance resulting from sleep deprivation or irregular sleep-wake patterns are well known and are becoming increasingly important in today's industrialized society. Excessive sleepiness at unusual hours is estimated to affect approximately 5% of the general population and is associated with increased morbidity, loss of work hours, reduced productivity, increased work errors and impaired social and family relationship. In addition, there is an increased mortality risk when sleepiness affects motor vehicle and train drivers, aircraft pilots, nuclear power workers, and, generally, people involved in crucial occupations (e.g. Mittler, Carskadon, Czeisler, Demerit, Dinges, Curtis, Graeber, 1988).

Author

Adaptation; Personnel; Productivity; Estimating; Sleep Deprivation

20000033323 Kaunas Medical Univ., Inst. of Psychophysiology and Rehabilitation, Kaunas, Lithuania

Analysis of Heart Rate Variability During Sleep as a Tool for Assessment of Cardiovascular Adaptability and Fatigue in Sleep-Wake Cycle

Varoneckas, G., Kaunas Medical Univ., Lithuania; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 22 - 1 - 22 - 7; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

An assessment of general adaptation reserve of cardiovascular function by means of heart rate (HR) and HR variability analysis during sleep and functional tests is demonstrated. A possibility to evaluate a restoration of cardiovascular reserve after sleep by means of HR changes during active orthostatic test is shown. The level of autonomic HR control and balance of sympathetic-parasympathetic inputs might be measured by means of analysis of HR power spectrum main oscillatory components. The differences in cardiovascular reserve of healthy subjects and cardiac patients, as well as possibility of HR restoration during sleep was demonstrated. In conclusion, adaptability of cardiovascular function and fatigue-restoration cycle might be assessed by means of very simple methodology - an analysis of HR Poincare maps. Its practical application in the cases of fatigue, developed during disturbed wake-sleep cycle or overtraining situation in high physical or emotional overcrowding is shown.

Author

Heart Rate; Sleep; Cardiovascular System; Adaptation; Fatigue (Biology)

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..

20000032160 NASA Johnson Space Center, Houston, TX USA

A Human Factors Evaluation of a Methodology for Pressurized Crew Module Acceptability for Zero-Gravity Ingress of Spacecraft

Sanchez, Merri J., NASA Johnson Space Center, USA; March 2000; 146p; In English

Report No.(s): NASA/TM-2000-209764; NAS 1.15:209764; S-854; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This project aimed to develop a methodology for evaluating performance and acceptability characteristics of the pressurized crew module volume suitability for zero-gravity (g) ingress of a spacecraft and to evaluate the operational acceptability of the NASA crew return vehicle (CRV) for zero-g ingress of astronaut crew, volume for crew tasks, and general crew module and seat layout. No standard or methodology has been established for evaluating volume acceptability in human spaceflight vehicles. Volume affects astronauts'ability to ingress and egress the vehicle, and to maneuver in and perform critical operational tasks inside the vehicle. Much research has been conducted on aircraft ingress, egress, and rescue in order to establish military and civil aircraft standards. However, due to the extremely limited number of human-rated spacecraft, this topic has been un-addressed. The NASA CRV was used for this study. The prototype vehicle can return a 7-member crew from the International Space Station in an emergency. The vehicle's internal arrangement must be designed to facilitate rapid zero-g ingress, zero-g maneuverability, ease of one-g egress and rescue, and ease of operational tasks in multiple acceleration environments. A full-scale crew module mockup was built and outfitted with representative adjustable seats, crew equipment, and a volumetrically equivalent hatch. Human factors testing was conducted in three acceleration environments using ground-based facilities and the KC-135 aircraft. Performance and acceptability measurements were collected. Data analysis was conducted using analysis of variance and nonparametric techniques.

Author

Acceptability; Technology Assessment; Procedures; Human Factors Engineering; Gravitation

20000032198 Tuskegee Inst., Center for Food and Environmental Systems for Human Exploration of Space, AL USA

The Development of an Edible Peanut Protein Film

Patrick, N., Tuskegee Inst., USA; Jones, G., Tuskegee Inst., USA; Aglan, H., Tuskegee Inst., USA; Lu, J., Tuskegee Inst., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 489-494; In English; See also 20000032189

Contract(s)/Grant(s): NCC9-51; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The peanut is one of the crops chosen for use in NASA's Advanced Life Support Program (ALS). The peanut is a source of both oil and protein. After oil is extracted from the peanut, a protein rich flour remains. An edible peanut protein film is one use for this flour. Two types of film are developed for this study, one set of film contains 10% fat while the other set contains no fat. For film without fat the defatting of the peanut by the Soxhlet method is the first step in the manufacturing process of the film. Secondly, the protein is precipitated at its isoelectric point (pH 4.5) and centrifuged to separate the protein from the non-protein. After freeze-drying the protein it is milled in a ceramic ball mill to decrease particle size and sifted through a series of sieves to determine particle size distribution. Those particles retained on the 100 mesh sieves are utilized for film formation. Larger particles are re-ground and sifted. Five grams of protein is mixed with 50 mL of distilled water, 70 mL of 80% ethanol, 15 mL of 6N ammonium hydroxide and a plasticizer. This mixture is heated for 30 minutes until the temperature reaches 70 C. The mixture is then poured onto a level Teflon coated glass surface. After allowing the film to form overnight under a ventilation hood, it is manually removed from the plate. The processes and methods adopted have created flexible films of uniform thickness that are free of air bubbles. Thickness of films made from defatted peanut protein and partially defatted peanut protein were 0.10 Lm and 0.13 Lm respectively. Films with natural peanut fat are approximately three times as flexible and almost four times as strong as the films made without fat. Further research will be performed to evaluate its mechanical properties. This paper will greatly contribute to food preservation and waste management. Potential applications of this film are edible/biodegradable containers, wrapping for food preservation (against water, oxygen and oil), storage packets for seasonings or other ingredients and encapsulation for pharmaceutical use.

Author

Biodegradability; Farm Crops; Freeze Drying; Mechanical Properties; Oils; Preserving; Proteins

20000032264 NASA Marshall Space Flight Center, Huntsville,AL USA

Comparison of Human Modelling Tools For Efficiency of Prediction of EVA Tasks

Dischinger, H. Charles, Jr., NASA Marshall Space Flight Center, USA; Loughead, Tomas E., NASA Marshall Space Flight Center, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 160-164; In English; See also 20000032189

Report No.(s): 98URC030; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Construction of the International Space Station (ISS) will require extensive extravehicular activity (EVA, spacewalks), and estimates of the actual time needed continue to rise. As recently as September, 1996, the amount of time to be spent in EVA was believed to be about 400 hours, excluding spacewalks on the Russian segment. This estimate has recently risen to over 1100 hours, and it could go higher before assembly begins in the summer of 1998. These activities are extremely expensive and hazardous, so any design tools which help assure mission success and improve the efficiency of the astronaut in task completion can pay off in reduced design and EVA costs and increased astronaut safety. The tasks which astronauts can accomplish in EVA are limited by spacesuit mobility. They are therefore relatively simple, from an ergonomic standpoint, requiring gross movements rather than time motor skills. The actual tasks include driving bolts, mating and demating electric and fluid connectors, and actuating levers; the important characteristics to be considered in design improvement include the ability of the astronaut to see and reach the item to be manipulated and the clearance required to accomplish the manipulation. This makes the tasks amenable to simulation in a Computer-Assisted Design (CAD) environment. For EVA, the spacesuited astronaut must have his or her feet attached on a work platform called a foot restraint to obtain a purchase against which work forces may be actuated. An important component of the design is therefore the proper placement of foot restraints.

Derived from text

Extravehicular Activity; Computerized Simulation; Human Factors Engineering; Astronauts; Computer Aided Design; Performance Prediction

20000032301 New Mexico Univ., NASA Center for Autonomous Control Engineering, Albuquerque, NM USA

Integration of Artificial Intelligence, Muscles, and Neural Systems to Replicate Anthropomorphic Systems with Space Applications

Johnson, Mark A., New Mexico Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 819-823; In English; See also 20000032189

Report No.(s): 98URC146; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

An overview of the tasks required to integrate artificial intelligence (AI) and synthetic components which mimic anthropomorphic mechanisms is presented. A description is given of the various AI tools (Artificial Neural Networks (ANNs), Fuzzy logic (FL), Genetic Algorithms (GA), . . . which are needed and how they are applied to the problem of controlling both

the individual components and a complete anthropomorphic system. The methods used to put together individual components of the anthropomorphic system along with their characterization and integration are developed. Finally, the baseline parameters with which the completed system is to be tested and evaluated are discussed along with identification of potential space applications.
Author
Artificial Intelligence; Muscles; Systems Integration; Neural Nets; Technology Utilization; Aerospace Medicine; Human Body

20000032390 Naval Air Warfare Center, Crew Systems Research and Engineering Dept., Patuxent River, MD USA
Comparison of Vertebral Strength Properties of Anthropometrically Similar Male and Female Using Quantitative Computed Tomography
DiCuccio, M., Thomas Jefferson Univ., USA; Paskoff, G., Naval Air Warfare Center, USA; Whitley, P., M Technologies, Inc., USA; Schweitzer, M., Thomas Jefferson Univ., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 2-1 - 2-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In determining the risk of injury in the military aviation environment, a male and female of the similar height and weight have been assumed to have the same risk of vertebral injury during an escape or crash scenario. A Quantitative Computed Tomography (QCT) study has been performed to analytically quantify the vertebral strength properties between men and women. The study's goals were to examine the vertebral geometry, bone density, end-plate cortical bone thickness, and trabecular bone architectures of the C2, C5, T12 and L4 vertebrae for a subjects pool that consisted of 25 males and 25 females. Additionally, the development of a multivariant regression equation, which would predict the risk of vertebral injury for all individuals and would serve as a guide for designing escape and crash protection systems, was initiated. Preliminary analysis revealed that C2 and C5 trabecular bone mineral densities (BMD mg K2HPO4/cc) were significantly higher than those for T12 and L4. When separated by gender the same site relationship held. Female C2 and CS trabecular bone mineral densities were significantly higher than those for males. Preliminary analysis of gender comparison of endplate cross-sectional area, area density (cross-sectional area x BMD) and predicted strength for the L4 vertebrae revealed that only endplate cross-sectional area was significantly different.
Author
Females; Males; Vertebrae; Crashes; Human Tolerances; Injuries; Tomography; Quantitative Analysis; Anthropometry

20000032391 North Dakota State Univ., Impact Biomechanics Lab., Fargo, ND USA
Modes of Human Head/Neck Response to Vertical Impact
Ziejewski, Mariusz, North Dakota State Univ., USA; Obergefell, Louise, Air Force Research Lab., USA; Perry, Chris, Air Force Research Lab., USA; Anderson, Beth, Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 3-1 - 3-10; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Helmet-mounted systems can change the helmet's mass inertial properties such as weight, moment of inertia, and center of gravity location, this change may alter the head/neck response and possibly change the pattern of neck loading during the catapult phase of ejection (i.e. vertical impact phase). to define the specifications or criteria for allowable head mounted mass and center of gravity location that is safe for the crew members, identification of the head/neck responses and the factors influencing those responses is necessary. The objectives of this study were to identify the modes of head/neck response to vertical impacts, to determine and assess the parameters influencing head/neck response, and to determine a method of predicting mode of head/neck response for a given subject under given conditions. The data used in this study came from five test cells of the Female Impact Program (FIP) study performed at the Air Force Research Laboratory (AFRL) on their Vertical Deceleration Tower (VDT) facility at Wright Patterson Air Force Base, Dayton, Ohio. The subjects were exposed to acceleration levels comparable to those experienced in the catapult phase of ACES II ejections. The peak acceleration level for the tests used in this study was 10 G. Each of the subjects wore the same type of helmet. However, the inertial properties of the helmet were varied to simulate those of current helmet-mounted systems. Five modes of head/neck response for vertical impact were identified and characterized. Modes A and B represent forward neck and head rotation. Modes C and D represent forward neck rotation and rearward head rotation. Mode E of head/neck response represent no significant neck or head rotation. Two experimental parameters, namely, linear x-acceleration of the head at the mouthpiece and head pitch as measured by the motion of the mouthpiece LED with respect to the shoulder LED, were found to be sufficient to uniquely define the mode of head/neck response. Three categories of parameters have been identified and suggested to be the determining factors in a given subject's mode of response for a given condition. The

categories include initial position, anthropometry, and other factors such as helmet, weight, helmet center of gravity location and impact acceleration level.
Author
Anthropometry; Impact Acceleration; Physiological Responses; Helmets; Head (Anatomy); Neck (Anatomy); Injuries; Gravitational Effects; Crews

20000032392 Biodynamic Research Corp., San Antonio, TX USA
A PC-Based Head-Spine Model
Bomar, John B., Jr., Biodynamic Research Corp., USA; Pancratz, David J., Biodynamic Research Corp., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 4-1 - 4-11; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Biodynamic Research Corporation (BRC) of San Antonio, TX, completed a government-sponsored project to port the Air Force's Head-Spine Model (HSM) to a personal computer environment, improve certain features of the software, and add a user-friendly interface. The impetus for this project was the desire to have a software tool capable of modeling the internal forces and motions of the human head and spine during impulsive acceleration events, such as aircraft ejections. The HSM was originally developed in the 1970's over a period of several years. BRC re-coded the model using modern programming techniques and renamed the software HSM-PC. The HSM-PC is a collection of rigid inertial elements and massless deformable elements that represent the anatomy of the human spine. There are multiple versions of the model, with increasing levels of complexity, The HSM-PC simulation program consists of a graphical user interface, a computational module, and a database. The geometry and biomechanical data for the model are stored in Microsoft Access format, and can be viewed from the HSM-PC software or from Access directly. The user interface permits an operator to select different HSM models for a simulation; permits editing of the environment, or simulation parameters; and then allows the user to visually review the results of a simulation through an animation or graphs of desired data. The software stores element, environment, simulation, and other data in separate text files, so that additional simulations with a different environment, different forcing functions, or different body elements can be quickly accomplished. The software runs on Microsoft Windows 95, 98, or NT, and requires a Pentium CPU or equivalent for reasonable operation. It is BRC's belief that there are still sections of the HSM-PC that must be improved to create a validated biomechanical tool with commercial potential. For example, old input files for the original HSM software were noted to have different element properties than published technical reports and journal articles. In many cases, the differences were several orders of magnitude. In addition, the original HSM software did not provide for a way to pre-load the elements of the model. BRC has introduced the concept of "settling" into the HSM-PC, so that the elements of the model have realistic forces and moments acting on them at the start of the simulation. Finally, the element models can be improved significantly. In particular, the muscle and intervertebral disc model can be improved to be more realistic.
Author
Computerized Simulation; Personal Computers; Head (Anatomy); Biological Models (Mathematics); Biodynamics; Impact Acceleration; Spine; Environment Simulation

20000032393 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Crash-Safety Research Centre, Delft, Netherlands
Neck Performance of Human Substitutes in Frontal Impact Direction
Wismans, J. S. H. M., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; vandenKroonenberg, A. J., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Hoofman, M. L. C., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; vanderHorst, M. J., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 5-1 - 5-6; In English; See also 20000032388; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In the past several laboratories have conducted human subject tests in order to derive biofidelity performance requirements for crash dummies and computer models. Both human volunteer and human cadaver tests have been conducted. Particularly noteworthy are the human volunteer tests conducted at the Naval Biodynamics Laboratory (NBDL) in New Orleans. In an extensive test program a large number of human subjects were exposed to impacts in frontal, lateral, and oblique directions. Detailed analyses of these tests have been conducted and presented in various publications. Based on these results, a set of biofidelity performance requirements was developed. These requirements include trajectories and rotations of the head as well as acceleration requirements and data on the neck loads. The objective of this paper is to compare the performance of various human neck models with the observed response in the volunteer tests. Concerning mechanical models, the neck of the Hybrid III dummy, which is the dummy currently specified in motor vehicle safety regulations, as well as the neck of the new THOR dummy

will be evaluated. It will be shown that the neck of the THOR dummy offers more biofidelity than the Hybrid III dummy neck. Regarding mathematical neck models, a neck model developed in the MADYMO crash simulation program will be evaluated. It will be shown that the mathematical model which includes a representation of vertebrae, ligaments, and active muscle response is able to reproduce the observed human subject response more accurately than the available mechanical models.
Author
Biodynamics; Computerized Simulation; Neck (Anatomy); Impact Tests; Dummies; Mathematical Models; Human Beings; Impact Loads; Modal Response

20000032394 Simula Technologies, Inc., Phoenix, AZ USA
Validation of the MADYMO Hybrid II and Hybrid III 50th-Percentile Models in Vertical Impacts
Manning, J. E., Simula Technologies, Inc., USA; Happee, R., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 6-1 - 6-30; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes the results of a project conducted by Simula Technologies, Inc., and TNO to validate TNO computer models of 50th-percentile Hybrid II and Hybrid III test dummies when used in a vertical crash condition. Drop tests were conducted at Simula utilizing military impact conditions for helicopter seat certification. After the tests were conducted, computer models of the simulation were made using the MADYMO 3D Crash Victim Simulation program and the test results were compared. The model showed good correlation to the tests in the parameters of interest.
Author
Computerized Simulation; Dummies; Seats; Drop Tests; Crashes; Biological Models (Mathematics); Computer Programs; Dynamic Tests

20000032395 Air Force Research Lab., HEPA, Wright-Patterson AFB, OH USA
Strength of the Female Upper Extremity
Pellettiere, J. A., Air Force Research Lab., USA; Duma, S. M., Virginia Univ., USA; Bass, C. R., Virginia Univ., USA; Crandall, J. R., Virginia Univ., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 7-1 - 7-12; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A dynamic injury tolerance for the female upper extremity was derived from dynamic drop tests onto female cadaveric limbs. Twelve female humeri were tested at a strain rate of 3.7 +/- 1.3 strain/second. The ultimate failure moment (mass scaled to a 5% female) was measured to be 128 +/- 19 Nm. Ten female forearms were tested at a strain rate of 3.94 2.0 strain/second. The ultimate failure moment (mass scaled to a 50% female) was measured to be 58 +/- 12 Nm. A finite element model of the female forearm was constructed from computed tomography data. These data were the basis for the construction of the geometry of the female radius and ulna. A material model previously developed for modeling the mechanical behavior of bone under a variety of loading conditions was applied. Bending simulations of the radius and ulna, both quasi-static and dynamic, were computed, with the results comparing favorably with values available from the literature. Both the model and the testing show that the female forearm is stronger in a supinated (palm up) position than the pronated (palm down) position. The computer modeling demonstrates that with this material model, it is possible to create finite element models of human long bones for the purpose of using them in computational codes for predicting their strength.
Author
Females; Computerized Simulation; Strain Rate; Mathematical Models; Injuries; Dynamic Tests; Bones; Human Tolerances; Finite Element Method

20000032396 Air Force Research Lab., HESA, Wright-Patterson AFB, OH USA
Military Application of Biodynamics Models
Obergefell, Louise, Air Force Research Lab., USA; Rizer, Annette, Veridian, USA; Ma, Deren, Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 8-1 - 8-4; In English; See also 20000032388; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The Air Force Research Laboratory makes extensive use of biodynamics models to evaluate crew system designs and modifications, develop safe design criteria, and predict crewmember response. When special equipment is added to a cockpit for a test program, the Articulated Total Body (ATB) model is used to predict the crewmembers motion during an ejection. by simulating a large crewmember ejecting with his hands both on the firing control panel and on the side seat panel, the risk of significant arm contact is predicted. When the Army is concerned about detonating an item carried by a soldier during a fall from a truck or a parachute landing, the ATB model is used to predict the contact forces on the soldier if they land on a hard surface. When initial ejection seat tests with a new manikin have unusual results, biodynamics modeling is used to help sort out whether

the response is due to the seat design or the manikin. Simulations of the tests with possible seat and manikin modifications are used to determine which modifications are most likely to improve results and to narrow future testing requirements. When ejection tests result in extreme manikin leg flail, ATB simulations are used to determine the loads in the hips, which are not measured by the manikin. The process used within AFRL to apply biodynamics modeling to these applications is described and the results presented.
Author
Biodynamics; Biological Models (Mathematics); Computerized Simulation; Crews; Escape Systems; Safety Factors; Design Analysis; Crashes; Dynamic Models; Human Factors Engineering

20000032397 Veridian, Systems Analysis and Research, Dayton, OH USA
Continued Development of an Integrated EASY5/ACESII-ATB Model for Ejection Seat Simulation
Ma, Deren, Veridian, USA; Obergefell, Louise A., Air Force Research Lab., USA; Rogers, Lawrence C., Aeronautical Systems Div., USA; Rizer, Annette L., Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 9-1 - 9-9; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper presents continued development and validation of an integrated ejection/crewmember model, specifically the modeling of aerodynamic effects and the crewmember/seat separation process. In a previous study, an ejection seat model, EASY5/ACESII (Engineering Analysis SYstem/Advanced Concept Ejection Seat), was coupled with a crewmember model, the ATB (Articulated Total Body) model. In this study, newly developed algorithms were incorporated into the integrated model to simulate the aerodynamics and seat/crewmember separation. Wind tunnel data from the ejection seat module are used to obtain total aerodynamic forces on the seat/crewmember combination. The crewmember module then uses an analytical method, based on air pressure and the exposed surface area, to calculate the aerodynamic forces and torques applied to the crewmember's individual body segments. These body forces and torques are then subtracted from the total forces and torques to obtain the force components applied directly to the seat in the ejection seat module. Once the man/seat separation signal is initiated, the aerodynamic forces and torques are applied only to the crew member. Dynamic interaction between the seat and crewmember during the very short period of their separation is complex and critically important. In this study, the harness release and crewmember/seat separation process algorithms were designed and implemented. When the release signal of the harness restraint is generated in the ejection seat module, it is transferred to the crewmember module. The harness belt in the crewmember module is then cut off. Meanwhile, the recovery parachute force from the ejection seat module is sent to the crewmember module. The combined forces due to gravity, recovery parachute, and aerodynamics separate the ejection seat and crewmember. Simulations of F-16/ACESII sled tests were carried out to validate the newly developed features in the integrated model. Simulation results are reported and compared with results of ejection seat sled tests. The validation shows that the model successfully predicts the major features of the ejection seat motion and the crewmember biodynamic responses.
Author
Aerodynamic Forces; Ejection Seats; Escape Systems; Crews; Torque; Computerized Simulation; Mathematical Models; Physiological Responses; Biodynamics

20000032398 JAYCOR, San Diego, CA USA
Head Protection Against Windblast for Crew Escape
Chan, Philemon C., JAYCOR, USA; Yu, James H.–Y., JAYCOR, USA; Stuhmiller, James H., JAYCOR, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 10-1 - 10-15; In English; See also 20000032388
Contract(s)/Grant(s): F41624-95-C-6014; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A pilot ejecting from an aircraft at high speed faces the possibility of windblast head/neck injury. to establish a phenomenological understanding of windblast protection for the head, three stagnation concepts, the unvented fence, the hood and the brim have been evaluated. As tested in the wind tunnel, the unvented fence and hood produce overstagnation which may subject the head to unwanted oscillations. The vented hood and the brim can reduce the normal head force without overstagnation, but with a significant increase of side head force. The side head force increase is caused by windward headrest flow stagnation, as confirmed by computational fluid dynamics simulations and subscale water tunnel model testing. Studies were performed to reduce the head rest flow stagnation using the open brim concept.
Author
Head (Anatomy); Blasts; Ejection Injuries; Escape Systems; Safety Devices; Neck (Anatomy); Protection; Water Tunnel Tests; Scale Models

20000032399 George Washington Univ., National Crash Analysis Center, Ashburn, VA USA

The Use of Computer Finite Element Models of Humans and Crash Test Dummies for High Acceleration and Impact Biomechanics Studies

Digges, Kennerly H., George Washington Univ., USA; Bedewi, Paul G., George Washington Univ., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 11-1 - 11-14; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The application of computer finite element models provides a valuable method for the study of human injury. The ability to model the complete human body is currently impractical. However, it is possible to model elements of the human body. These elements may be used independently, or in conjunction with models of crash dummies. In the latter case, specific crash dummy elements are replaced with human elements. The resulting model increases the accuracy of the model in predicting human response in high acceleration impacts. The procedure for applying human elements to crash test dummy models is illustrated by substituting human lower limbs on a finite element model of the Hybrid III dummy. The model is validated by replicating tests of human cadaver lower limbs. The model is then applied to predict the effect of muscle activation.

Author

Biodynamics; Finite Element Method; Human Body; Mathematical Models; Crashes; Dummies; Impact Acceleration

20000032401 Technische Univ., Eindhoven, Netherlands

MADYMO Validation of Side Facing Sofa Sled Tests

Teulings, A. M. G. L., Technische Univ., Netherlands; Gowdy, V., Civil Aeromedical Inst., USA; Wismans, J. S. H. M., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Aljundi, B., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek-MADYMO North America, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 13-1 - 13-9; In English; See also 20000032388; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In order to investigate and ultimately improve the crash worthiness of side facing sofas a series of sled tests were performed. The EUROSID-1 dummy was used to measure various signals needed to assess injury potential. to facilitate a parametric study into injury potential related factors a MADYMO computer model of these tests was made and needed to be validated. The correlation between test and simulation signals warrents sufficient turst in the model for it to he used as a baseline model in a parametric study.

Author

Computerized Simulation; Crashworthiness; Injuries; Crashes; Seats; Impact Tests; Dummies; Safety Management

20000032406 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada

Hierarchical Modeling of the Baroreceptor Response to Gz Acceleration and Anti-Gz Protective Equipment

Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 19-1 - 19-5; In English; See also 20000032388; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The use of extended coverage anti-G suits and positive pressure breathing have enhanced the protection of aircrew exposed to high Gz and extreme altitudes. However, current systems do not provide optimal protection to the individual pilot during complex negative-to-positive Gz maneuvers nor do such systems adapt to changes in the physiological state of the pilot over the course of the mission, in part due to the hardware's inability to adapt to the complex response of the blood pressure regulating systems within the body. Current, medically relevant models of baroreceptor function are not suitable for the extreme changes in blood pressure and blood distribution in a body exposed to very high Gz levels of the tactical environment. Using a mix of first principle and data driven techniques, we are developing hierarchical models of baroreceptor function that include the interaction between the neuronal sub-components of the baroregulation centers of the central nervous system, the transient dynamics of pressure induced stretch in the baroreceptor organs, the effects of local pressure gradients within the aortic/carotid baroreceptor system, and the dynamic response of each of the subsystems during Gz exposures. All of these factors play a significant role in the individual's response to the Gz forces and the efficacy of the life support systems in preventing an adverse impact on cerebral blood flow and oxygenation of the brain.

Author

Baroreceptors; Acceleration Stresses (Physiology); Acceleration Protection; Pressure Breathing; Neurophysiology; Flight Crews; Acceleration Tolerance; Gravitational Effects; Pressure Suits

20000032407 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada

Modeling of the Physiological Responses to Non-Linear G-Suit and Positive Pressure Breathing Schedules

Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Lu, Z., Engineering Services, Inc., Canada; Askari, V., Engineering Services, Inc., Canada; Kapps, A., Engineering Services, Inc., Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 20-1 - 20-8; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Heart level blood pressure responses to G-suit pressures (2-8 psi) with and without Positive Pressure Breathing (5-60 mm Hg) at +1Gz were investigated in this paper for six test subjects. Various models were developed and tested to simulate these responses. The results show that a single-zero, two-pole, output-error model is suitable for characterizing the blood pressure responses to G-suit and Positive Pressure Breathing (PPB) pressures. A single-input model is used for the case of G-suit pressure with and without synchronized PPB, whereas a double-input model is used for the case of G-suit pressure with asynchronic PPB. The suitability of the models developed to high +Gz environment is investigated based on the data from a prior centrifuge test of one subject. Special dynamic indices are used to quantify the characteristics of the blood pressure responses. Significant variations in the dynamic indices of individual subjects and the same subject observed at different time instances are seen. These variations indicate that a fixed standard G-suit pressure schedule might not necessarily be capable of providing adequate Anti-G protection for all subjects and even for the same subject at different time instances. The models developed in this paper can be used in an adaptive feedback control system for real-time identification and update of subjects' Anti-G protection requirements. Consequently, the G-suit pressures can be adjusted based on these models to provide most adequate Anti-G protections and compensate the variations in subject's physiological state.

Author

Models; Pressure Breathing; Pressure Suits; Real Time Operation; Computerized Simulation; Gravitational Effects; Acceleration Stresses (Physiology); Aerospace Medicine; Physiological Responses

20000032409 Dayton Univ., OH USA

Model Derived Timing Requirements for Gz Protection Methods

Rogers, Dana B., Dayton Univ., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 22-1 - 22-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Studies of GLOC during Gz maneuvers highlight the need for further understanding of both orthostatic and transient behavior of blood pressure driven quantities in response to a variety of Gz profiles. Important in the analysis are duration, rates of change, direction and magnitude of transition and system memory (time at previous G level). The wide variety and number of profiles that need to be explored is intractable for human experimentation, indicating the need for functional models that provide a method for analyzing transient Gz equivalence under multiple profile conditions. The model used for this study uses a normalized set of Gillingham's data that is analyzed in a log amplitude and log frequency plot. The model is designed by the method of asymptotes for use in aircraft simulators.

Derived from text

Acceleration Stresses (Physiology); Models; Human Factors Engineering; Flight Crews; Computerized Simulation; Acceleration Tolerance

20000032412 Air Force Research Lab., Noise and Vibration Branch, Wright-Patterson AFB, OH USA

The Development of a Lumped-Parameter Model for Simulating the Vibration Response of the Human Body

Smith, S. D., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 25-1 - 25-11; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Seating systems provide a mechanism for minimizing the transmission of vehicle vibration to the occupant. Human vibration data has indicated that differences exist in the distribution of the mass, stiffness, and damping characteristics between the smaller female and larger male which may be important when designing seating systems. Mathematical models may provide a useful tool for the development and evaluation of seating systems for vibration mitigation. However, in order to be effective, these models must adequately simulate and predict the range of vibration response characteristics observed in the human body. A five degree-of-freedom (DOF) model was developed based on the dynamic response characteristics of major anatomical regions or structures in the human body. The model was recently modified to represent the legs as a two DOF system based on vibration response data collected in this laboratory. This paper summarizes the development, modification, and effectiveness of the five

DOF model in simulating the differences between representative female and male vibration responses. The model is also evaluated on its ability to predict the effects of seat cushions on human body vibration response.
Author
Human Body; Vibration; Biodynamics; Human Factors Engineering; Mathematical Models; Computerized Simulation; Occupational Diseases; Health

20000032688 Air Force Research Lab., HECP, Wright-Patterson AFB, OH USA
Pilot-Vehicle Interface
Calhoun, G. L., Air Force Research Lab., USA; Human Consequences of Agile Aircraft; March 2000, pp. 5 - 1 - 5 - 20; In English; See also 20000032683; Copyright Waived; Avail: CASI; A03, Hardcopy

Agile aircraft introduce new requirements and performance standards for the pilot-vehicle interface. This lecture will address these ergonomic issues as they pertain to agile aircraft. Specifically, controls and displays will be discussed, followed by design issues relevant to intelligent interfaces. The concepts and technologies proposed as candidate solutions for creating pilot-vehicle synergy are, for the most part, untested at present. It is hoped that this lecture will provide the impetus for the research required to realize a pilot-vehicle interface that will enhance the operation of agile aircraft, new capabilities, it is the multitude of systems that constitute agile aircraft that make the pilots' information management task the primary challenge and key determinant of successful deployment. Crew station design with the goal of pilot-cockpit synergy has the potential to provide the flexibility to maximum mission effectiveness.
Author
Human Factors Engineering; Flight Characteristics; Aircraft Pilots; Flight Fatigue; Flight Control; Display Devices; Flight Stress (Biology); Human-Computer Interface

20000033106 National Inst. for Occupational Safety and Health, Public Health Service, Pittsburgh, PA USA
Proposal for Certification Tests and Standards for Closed-Circuit Breathing Apparatus
Kyriazi, N.; Aug. 1999; 20p; In English
Report No.(s): PB2000-100638; NIOSH-IC-9449; DHHS/PUB/NIOSH-99-144; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Significant portions of the present Federal Regulations for certification of closed-circuit breathing apparatus (42 CFR 84) are not quantitative. The human-subject testing portion of the regulations specifies activities rather than metabolic work rates; however, heavy human subjects have higher oxygen consumption, CO2 production, and ventilation rates than lighter human subjects performing the same activies. This means that apparatus certified using different human subjects have effectively passed different tests. In addition, apparatus performance is monitored only during selected intervals of testing, and always during rest, rather than during the entire performance period. Further, testing is arbitrary terminated at specific rated durations, leaving unknown the performance during the remaining duration. Duration itself is misleading to users who believe that the apparatus will last a certain time no matter how much they weigh or how hard they work. The actual duration obtained from an apparatus, however, is highly variable, being inversely proportional to the work rate at which it is used.
NTIS
Breathing Apparatus; Certification

20000033210 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Analyzing of Interaction Specification In User Interface Design
Ishiyama, Keitaro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 421-422; In Japanese; Copyright; Avail: Issuing Activity

It is important to make sure of usability of a user interface to be designed, to do so, it is required that the designers analyze usability of the user interface in various aspects of a design process of efficient user interface. In this paper, from a viewpoint of user/task oriented method, we propose a method to analyze usability (consistency of interaction) of user interfaces based on the TID (Task-oriented Interaction Description) method which supports the interaction design of user interface.
Author
Human-Computer Interface; Computer Design

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

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

20000032501 Japan Atomic Energy Research Inst., Tokyo, Japan
Vectorization parallelization and porting of nuclear codes on the VPP500 system (parallelization) ***Progress Report***
Kawai, W.; Watanabe, H.; Nemoto, T.; Ishizuki, S.; Kawasaki, N.; Mar. 31, 1999; 176p; In Japanese; In English
Report No.(s): DE99-758365; JAERI-DATA/CODE-99-020; No Copyright; Avail: Department of Energy Information Bridge

Several computer codes in the nuclear field have been vectorized, parallelized and transported on the FUJITSU VPP500 system and/or the AP3000 system at Center for Promotion of Computational Science and Engineering in Japan Atomic Energy Research Institute. We dealt with 14 codes in fiscal 1997. These results are reported in 3 parts, i.e., the vectorization part, the parallelization part and the porting part. In this report, we describe the parallelization. In this parallelization part, the parallelization of cylindrical direct numerical simulation code CYLDNS44N, worldwide version of system for prediction of environmental emergency dose information code WSPEEDI, extension of quantum molecular dynamics code EQMD and three-dimensional non-steady compressible fluid dynamics code STREAM are described. In the vectorization part, the vectorization of multidimensional two-fluid model code ACE-3D for evaluation of constitutive equations, statistical decay code SD and three-dimensional thermal analysis code for in-core test section (T2) of HENDEL SSPHEAT are described. In the porting part, the porting of transient reactor analysis code TRAC-BF1 and Monte Carlo radiation transport code MCNP4A on the AP300 are described. In addition, a modification of program libraries for command-driven interactive data analysis plotting program IPLOT is described.

NTIS
Computer Programs; Computerized Simulation; Direct Numerical Simulation; Three Dimensional Models; Compressible Fluids; Fluid Dynamics; Two Fluid Models; Nuclear Electric Power Generation

20000032502 Japan Atomic Energy Research Inst., Tokyo, Japan
Subroutine library for error estimation of matrix computation (Ver. 1.0)
Ichihara, K.; Shizawa, Y.; Kishida, N.; Mar. 31, 1999; 195p; In Japanese; In English
Report No.(s): DE99-758364; JAERI-DATA/CODE-99-016; No Copyright; Avail: Department of Energy Information Bridge

Subroutine Library for Error Estimation of Matrix Computation is a subroutine library which aids the users in obtaining the error ranges of the linear system's solutions or the Hermitian matrices' eigenvalues. This library contains routines for both sequential computers and parallel computers. The subroutines for linear system error estimation calculate norms of residual vectors, matrices's condition numbers, error bounds of solutions and so on. The subroutines for error estimation of Hermitian matrix eigenvalues derive the error ranges of the eigenvalues according to the Korn-Kato's formula. The test matrix generators supply the matrices appeared in the mathematical research, the ones randomly generated and the ones appeared in the application programs. This user's manual contains a brief mathematical background of error analysis on linear algebra and usage of the subroutines.

NTIS
Subroutine Libraries (Computers); Error Analysis; Matrices (Mathematics); Hermitian Polynomial; Linear Systems; Eigenvalues

20000032795 Forschungszentrum Rossendorf e.V., Dresden, Germany
Dimensional analysis as a basis for composition of part models to a complete model
Hoppe, D.; Jun. 30, 1999; 48p; In German; In English
Report No.(s): DE99-772430; FZR-263; No Copyright; Avail: Department of Energy Information Bridge

The modelling approach reported in this publication is based on the idea that modelling of a given object will be easier when starting with defining and computing part models, and to later on compose those part models into an integral whole model describing the complete object. The study examines a systematic way of composition of defined part models to form the entire model by means of the dimensional analysis, with the structurization problem being reduced to solving a linear algebraic system of equations. Structural constraints are taken into account either through suitable problem formulation, or by defining constraints subsequent to modelling of the part model. The report discusses several examples of practical application of this approach.

NTIS
Dimensional Analysis; Mathematical Models

60
COMPUTER OPERATIONS AND HARDWARE

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

20000032354 New Mexico Highlands Univ., NASA Center for Autonomous Control Engineering, Las Vegas, NM USA
HARDWARE IMPLEMENTATION OF A DELTA-SIGMA DECODER-DIGITAL APPROACH
Winkles, Joseph, New Mexico Highlands Univ., USA; Johns–Kaysing, Loren, New Mexico Highlands Univ., USA; Petrovic, Zrilic G., New Mexico Highlands Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 422-425; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

A simplified realization of a digital delta-sigma decoder is presented. Digital realization consists of an N bit-shift register, up-down counter, and some additional logic. The proposed realization can serve as a DM-PCM converter as well.
Author
Hardware; Pulse Code Modulation; Signal Processing

20000032355 New Mexico Highlands Univ., NASA Center for Autonomous Control Engineering, Las Vegas, NM USA
Hardware Implementation of a Delta-Sigma Decoder-Analog Approach
Johns–Kaysing, Loren, New Mexico Highlands Univ., USA; Winkles, Joseph, New Mexico Highlands Univ., USA; Petrovic, Zrilic G., New Mexico Highlands Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 426-430; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

A simplified realization of the ordinary sigma-delta decoder is described. Analog realization consists of an N bit shift register, subtracter and integrator. Based on theoretical finding, proposed realization requires only subtraction of first and last bits from the shift register.
Author
Hardware; Pulse Code Modulation; Signal Processing

20000032674 Defence Clothing and Textiles Agency, Science and Technology Div., Colchester, UK
The Development of an Image Manipulation Facility for the Assessment of CCD
Houlbrook, A. W., Defence Clothing and Textiles Agency, UK; Search and Target Acquisition; March 2000, pp. 24-1 - 24-6; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

The assessment of CCD systems using photosimulation is the tried and tested alternative to performing live observer trials. The greater control over photosimulations allows an increased level of confidence in the results of any comparisons. It also requires less time in the field for a smaller number of personnel. The next step along this route would be a method that required no time in the field. Virtual reality systems, however, do not yet produce the level of realism required. An alternative, perhaps, is to place targets generated by VR software into a scene recorded photographically. Such a system would digitize a slide of a background scene in a controlled manner and allow the realistic implantation of an artificially created target. Reproduction would be achieved using a calibrated film printer. The majority of the reprinted scene would remain identical to the original slide. The methods used to enable the calibration of the equipment used, and the process of comparing information from digital rgb and Lab colour spaces are discussed in this paper. This image manipulation facility has the potential to bypass the field trial phase of CCD assessment. It could be used to assess CCD more thoroughly by using a variety of background scenes or the same scene at different times of the year. Targets created from CAD models could be assessed. It could be used to determine the effectiveness of potential CCD measures in areas which are not readily accessible. Overall, this system adds a new level of flexibility and completeness to photosimulation.
Author
Image Processing; Imagery; Charge Coupled Devices; Photographs; Simulation; Color

20000032916 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Research on Binary-Multivalued-Analog Merged Processor Using Neuron-MOS Technology
Ningmei, Yu, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 105-107; In Japanese; Copyright; Avail: Issuing Activity

This paper presents a newly-developed neuron-MOS(nu-MOS) processor that can merge binary-multivalued-analog data. The unique feature of the circuit is that it accepts analog or multivalued inputs without A/D conversion but produces binary

outputs, thus providing a very smooth interfacing between the real world and digital systems. Test circuits have been fabricated by a double-polysilicon/double-metal CMOS process and their operation has been experimentally demonstrated.
Author
Data Processing; Analog Data; Data Converters; Metal Oxide Semiconductors

20000033033 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Research on Novel Architecture of High-Speed Processor
Nozawa, Toshiyuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 327-328; In Japanese; Copyright; Avail: Issuing Activity

This paper presents a new vector quantization (VQ) algorithm exploiting the average value of vector elements. The number of distance calculation cycles in this algorithm can be reduced to one-tenth compared to full-search. The VQ processor based on this algorithm was also developed. The processor has lower hardware complexity compared to full-parallel processor. The processor can handle 2048 template vectors by one chip and can compress motion image (VGA size) in real-time.
Author
Algorithms; Parallel Processing (Computers); Vector Quantization; Architecture (Computers)

20000033074 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Three Dimensional High Density DRAM using Stacked-SGT DRAM Cell
Shinmei, Katsuhisa, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 375-376; In Japanese; Copyright; Avail: Issuing Activity

In this study, new three dimensional (3D) building memory array technology and Stacked-Suffounding Gate Transistor (S-SGT) Dynamic Random Access Memory (DRAM) by using this technology are proposed. Moreover, it is shown that the proposed S-SGT DRAM has smaller cell size and bit-line capacitance and larger signal voltage in comparison with conventional DRAMs. In conclusion, it is made clear quantitatively that 3D-building memory array techology, is suitable for future high density DRAM.
Author
Memory (Computers); Random Access Memory; Transistors

20000033089 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Adaptive Digital Filters Based on Evolutionary Computation
Abe, Masahide, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 108-110; In Japanese; Copyright; Avail: Issuing Activity

This paper proposes evolutionary digital filters (EDFS) as new adaptive digital filters based on evolutionary computation. The adaptive algorithm of EDFs controls and changes the coefficients of inner digital filters using the cloning method or the mating method. This adaptive algorithm of EDFs is of a non-gradient and multi-point search type. Thus, the EDF has following advantages: (1) the adaptive algorithm of the EDF is not susceptible to local minimum problems that arise from a multiple-peak surface, (2) the EDF can adopt the various error functions as the fitness function according to application, (3) the adaptive algorithm of the EDF has a self-stabilizing feature. The EDF has been implemented on parallel processors in order to reduce the total execution time. The partitioned EDF on four DSPs takes 7.15 msec per output sample to execute the adaptive filtering, and requires 1/3.97 times as long execution time as the EDF on the single DSP does.
Author
Digital Filters; Adaptive Filters; Algorithms; Parallel Processing (Computers)

20000033185 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study for Raising SN Ratio Perpendicular Storage Media
Sulistio, Pauvi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 489-490; In Japanese; Copyright; Avail: Issuing Activity

The effect of a Ti seed-layer on the magnetic properties and microstructures of CoCrTa was studied in CoCrTa/Ti/CoZrNb double-layered perpendicular recording media. It was revealed that a thin Ti film of 5 nm, deposited at a substrate temperature of 230 C, gave the most enhanced c-axis alignment perpendicular to the film plane, showing the greatest perpendicular anisotropy. This large anisotropy yielded the best magnetic and recording properties under the present experimental conditions. The read-back amplitude at this Ti thickness was 3 times larger than that without the Ti layer, resulting in a higher ratio of signal to media noise.

There was no significant loss in recording resolution due to the non-magnetic Ti space between the CoCrTa recording layer and the CoZrNb underlayer.
Author
Signal to Noise Ratios; Magnetic Storage; Magnetic Disks; Coercivity

20000033186 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Design Method of Ultra-Large Capacity Perpendicular Magnetic Storage Devices
Sasaki, Tamotsu, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 487-488; In Japanese; Copyright; Avail: Issuing Activity

Perpendicular magnetic recording utilizing a single pole writing head and a double-layered media has higher writing resolution for both linear density and track density with greater thermal stability than longitudinal magnetic recording. Recently we fabricated a novel single pole writing head on a flying slider for high frequency applications. However, design concept for high resolution and low noise perpendicular double-layered media has not been very clear. In this paper, design concept for perpendicular double-layered media using a single pole writing head was investigated by 2D-FEM and 3D computer simulations based on the curling magnetization reversal model. The effect of the recording layer thickness on double-layered media is discussed. It was found that the thickness of the recording layer significantly affected the recording capability of the media.
Author
Magnetic Recording; Magnetic Storage; Thickness

20000033211 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Support Environment for Task-Oriented User Interface Architecture Design
Isawa, Ken'ichi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 419-420; In Japanese; Copyright; Avail: Issuing Activity

With the diversity of requirements of user interfaces(UI), it is essential that effective UI design can reflect various user requirements. This paper proposes a method to support UI architecture design based on TIO (Task oriented Interaction Object) method proposed by author. This method-based supports designers to define TIO specifications using TIO repository and describe TIO structure based on rule-based mechanism. Then, this paper proposes a support environment of UI architecture design based on the proposed method.
Author
Human-Computer Interface; Architecture (Computers); Support Systems

20000033212 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Architecture for Flexible Application Gateway
Haga, Futoshi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 417-418; In Japanese; Copyright; Avail: Issuing Activity

With recent progress of computer networks and computers, video conference applications have been generally in use. In the context, for absolution of heterogeneous user environments, some researches of application gateway which relays the data of video conference applications have been done. But, because the connections between gateways are very static, the gateways are not enough in the point of flexibility. In this paper, we propose a Flexible Application Gateway which can realize more flexible performance by introduction of an agent-based technology. Moreover, we show the system architecture for the agent based design of the system which is base of prototype.
Author
Architecture (Computers); Computer Networks; Computer Conferencing

20000033216 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Compiler for Parallel Lisp Language PaiLisp
Miyakawa, Shinya, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 409-410; In Japanese; Copyright; Avail: Issuing Activity

PaiLisp is a parallel Lisp language with a rich set of concurrency constructs. The existing PaiLisp compiler is not efficient, because it is based on the PaiLisp/MT interpreter, using its data structure, and it is weak in code optimizations. CCS(Continuation Calling Style) is an efficient compilation technique for Scheme, introduced by Prof. T. Ito. The CCS uses let and call/cc to express control flow explicitly, so CCS codes are executable by Scheme systems and can be naturally extended as a compilation strategy

of parallel programs with P-continuation. This paper explains the outline of an efficient CCS-based PaiLisp compiler, and its experimental results.
Author
Compilers; Lisp (Programming Language)

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.

20000032188 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Pattern Recognition using Maximal Relation Principle
Suzuki, Akio, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 1-4; In Japanese; Copyright; Avail: Issuing Activity

In this paper, I propose a model that can separate arbitrary figures which include illusory contours from visual scene. Figure must be made to relation among features because it is impossible to distinguish signals from noise. to extract boundaries for segregating figures, symmetric and antisymmetric filters are required. Each filters constraint the other and can create structure of input. Furthermore, filters with various spatial frequency tunings are required as features to segregating spatial pattern. These filters are supported by psychophysics and physiological experience. In this model, these filters process input signals in parallel and arbitrary figures are flexibly and uniquely formed by integration outputs from filters using maximal relation principle.
Author
Pattern Recognition; Image Filters

20000032213 North Carolina Agricultural and Technical State Univ., NASA Center for Autonomous Control Engineering, Greensboro, NC USA
Trace Pattern Matching Using Knuth-Morris-Pratt String Pattern Matching Algorithm
Wang, Yabo, North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 533-538; In English; See also 20000032189
Contract(s)/Grant(s): ACE-48146; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The Trace Assertion Method is a formal method for software module interface specification. In this method, a software module is viewed as a finite state machine and the machine changes its state upon receiving an invocation of an access program of the module. A sequence of program invocations are called traces and a module's externally observable behavior is specified by a set of assertions, called trace assertions, about the traces of the module. In this paper we describe how to apply the symbol table technique and the Knuth-Morris-Pratt string pattern matching algorithm (hereafter, KMP algorithm) to accelerate the trace pattern matching process.
Derived from text
Computer Programs; Modules; Applications of Mathematics; Algorithms

20000032230 Texas Univ., Dept. of Computer Science, El Paso, TX USA
A Discussion of Issues in Integrity Constraint Monitoring
Fernandez, Francisco G., Texas Univ., USA; Gates, Ann Q., Texas Univ., USA; Cooke, Daniel E., Texas Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 595-599; In English; See also 20000032189
Contract(s)/Grant(s): NCCW-89; NAGW-1012; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

In the development of large-scale software systems, analysts, designers, and programmers identify properties of data objects in the system. The ability to check those assertions during runtime is desirable as a means of verifying the integrity of the program. Typically, programmers ensure the satisfaction of such properties through the use of some form of manually embedded assertion check. The disadvantage to this approach is that these assertions become entangled within the program code. The goal of the research is to develop an integrity constraint monitoring mechanism whereby a repository of software system properties (called integrity constraints) are automatically inserted into the program by the mechanism to check for incorrect program behaviors. Such a mechanism would overcome many of the deficiencies of manually embedded assertion checks. This paper gives an overview of the preliminary work performed toward this goal. The manual instrumentation of constraint checking on a series of

test programs is discussed, This review then is used as the basis for a discussion of issues to be considered in developing an automated integrity constraint monitor.
Author
Computer Programming; Computer Programs; Software Engineering; Program Verification (Computers); Software Development Tools

20000032273 New Mexico Univ., Autonomous Control Engineering, Albuquerque, NM USA
SoftLab: A Soft-Computing Software for Experimental Research with Commercialization Aspects
Akbarzadeh–T, M.–R., New Mexico Univ., USA; Shaikh, T. S., New Mexico Univ., USA; Ren, J., New Mexico Univ., USA; Hubbell, Rob, New Mexico Univ., USA; Kumbla, K. K., New Mexico Univ., USA; Jamshidi, M, New Mexico Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 182-187; In English; See also 20000032189; Original contains color illustrations
Contract(s)/Grant(s): NCCW-87; WERC/NMSU/DOE-Amd-35
Report No.(s): 98URC034; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
SoftLab is a software environment for research and development in intelligent modeling/control using soft-computing paradigms such as fuzzy logic, neural networks, genetic algorithms, and genetic programs. SoftLab addresses the inadequacies of the existing soft-computing software by supporting comprehensive multidisciplinary functionalities from management tools to engineering systems. Furthermore, the built-in features help the user process/analyze information more efficiently by a friendly yet powerful interface, and will allow the user to specify user-specific processing modules, hence adding to the standard configuration of the software environment.
Author
Computer Programs; Fuzzy Systems; Knowledge Bases (Artificial Intelligence); Genetic Algorithms; Commercialization; Computerized Simulation; Research and Development

20000032315 Puerto Rico Univ., Electrical and Computer Engineering Dept., Mayaguez, Puerto Rico
Near Lossless Iterated Block Matching Fractals Image Compression
Parsiani, Hamed, Puerto Rico Univ., Puerto Rico; Ortiz, Paul G. Roman, Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 306-311; In English; See also 20000032189
Report No.(s): 98URC056; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
The Iterated Block Matching Fractal encoding process exploits the fractal similarities within an image by coding the image using itself. A best match is obtained for every block to be coded from the pool of blocks generated from the image itself. The matching parameters are transmitted resulting in compression. This method is implemented with its most recent advances. Its encoder/decoder algorithm is complete with Variable Length encoder/decoder and pack-unpack algorithms. Test results were obtained for near lossless compression at high PSNR values.
Author
Coding; Data Compression; Images; Fractals; Real Time Operation; Algorithms

20000032335 New Mexico Univ., Dept. of Civil Engineering, Albuquerque, NM USA
Quantity, Revisited: An Object-Oriented Reusable Class
Funston, Monica Gayle, New Mexico Univ., USA; Gerstle, Walter, New Mexico Univ., USA; Panthaki, Malcolm, New Mexico Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 948-953; In English; See also 20000032189
Report No.(s): 98URC169; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
”Quantity”, a prototype implementation of an object-oriented class, was developed for two reasons: to help engineers and scientists manipulate the many types of quantities encountered during routine analysis, and to create a reusable software component to for large domain-specific applications. From being used as a stand-alone application to being incorporated into an existing computational mechanics toolkit, ”Quantity” appears to be a useful and powerful object. ”Quantity” has been designed to maintain the full engineering meaning of values with respect to units and coordinate systems. A value is a scalar, vector, tensor, or matrix, each of which is composed of Value Components, each of which may be an integer, floating point number, fuzzy number, etc., and its associated physical unit. Operations such as coordinate transformation and arithmetic operations are handled by member functions of ”Quantity”. The prototype has successfully tested such characteristics as maintaining a numeric value, an

associated unit, and an annotation. In this paper we further explore the design of ”Quantity”, with particular attention to coordinate systems.
Author
Applications Programs (Computers); Object-Oriented Programming; Software Engineering

20000032344 Puerto Rico Univ., ECE Dept., Mayaguez, Puerto Rico
Clustering Algorithm for Hyperspectral Data
Jimenez, Luis O., Puerto Rico Univ., Puerto Rico; Chaar, Yamil, Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 360-365; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

A big challenge is to discover the potentially increased number of different data patterns in a very high dimensional data. That will enable us to find labeled samples of the different clusters for supervised classification purposes. This paper will focus in unsupervised classification algorithms were the machine classifies the image with only a small amount of human intervention. Unsupervised classification algorithms are techniques to extract information from Remote Sensing imagery based on machine calculation without prior knowledge of labeled samples and the number of classes. The methodology is implemented by automatically discovering patterns in Remote Sensing data. The main advantage of unsupervised over supervised classification is that it does not require a high level of expertise from the analyst. Clustering is an attempt to find structure in a set of observations that we know a little about, is a form of segmentation. Its objective is to group the data in different clusters that have different statistical patterns. The best known program is the ISODATA algorithm. This program and most of the clustering algorithm only use first order statistics and the spectral response information. Present unsupervised classification algorithms have been developed for images with a small number of bands. They do not take into consideration the inherent hyperdimensional space characteristics. In order to overcome such problems a hyperspectral data clustering has been developed taking into consideration hyperspectral data characteristics and spatial information to discover more patterns with increased accuracy.
Author
Cluster Analysis; Classifications; Pattern Recognition; Algorithms

20000032439 NASA Johnson Space Center, Houston, TX USA
A Goal Seeking Strategy for Constructing Systems from Alternative Components
Valentine, Mark E., NASA Johnson Space Center, USA; May 1999; 25p; In English
Report No.(s): NASA/TM-1999-209265; NAS 1.15:209265; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes a methodology to efficiently construct feasible systems then modify feasible systems to meet successive goals by selecting from alternative components, a problem recognized to be n-p complete. The methodology provides a means to catalog and model alternative components. A presented system modeling Structure is robust enough to model a wide variety of systems and provides a means to compare and evaluate alternative systems. These models act as input to a methodology for selecting alternative components to construct feasible systems and modify feasible systems to meet design goals and objectives. The presented algorithm’s ability to find a restricted solution, as defined by a unique set of requirements, is demonstrated against an exhaustive search of a sample of proposed shuttle modifications. The utility of the algorithm is demonstrated by comparing results from the algorithm with results from three NASA shuttle evolution studies using their value systems and assumptions.
Author
Systems Engineering; Alternatives; Structural Members; Feasibility Analysis; Systems Analysis

20000032555 Georgia Inst. of Tech., CAE/CAD Lab., Atlanta, GA USA
Dynamic CATIA CATGEO Access: Powerful Interpretive Tools Based on Tk/tcl
Hale, Mark A., Georgia Inst. of Tech., USA; 1995; 9p; In English; CATIA Operators Exchange, 11 Oct. 1995, Los Angeles, CA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An overview of a presentation on ”Dynamic CATIA CATGEO Access: Powerful Interpretive Tools Based on Tk/tcl” is presented. Topics discusses include: Tool Command Language (tcl), X Toolkit for the Tool Command Language, CATIA & CATGEO, Interpretive CATGEO Load Module, CATIA Agent, and A Native Language Interface (ALAN). Examples on Aircraft Modeling System and WWW Modeler for CATIA is also included.
Author
Applications Programs (Computers); Programming Languages; Command Languages; Computer Techniques; Computer Aided Design

20000032556 Georgia Inst. of Tech., CAE/CAD Lab., Atlanta, GA USA

Demonstrating Preliminary Agent Technologies with CATIA

Hale, Mark, Georgia Inst. of Tech., USA; 1994; 14p; In English; CATIA Operators Exchange, Oct. 1994, Dallas, TX, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper contains an overview of a presentation on Agent technology with CATIA. topics discusses include: (1) Description of the Intelligent Multidisciplinary Aircraft Generation Environment that includes multidisciplinary robust design methodology (formal methodology for implementing Concurrent Engineering and integrated product/Process Development), Computational technologies (the Agent), and information infrastructure for an open architecture. (2)Program demonstrations on the toolkit / tool command language (Tk/tcl), interactive CATIA (Computer-graphics Aided Three-Dimensional Interactive Application system) and CATIA-CATIA Agent, FLight OPtimization System (FLOPS)(a modular aircraft sizing code and GEOFLOPS (a system that models FLOPS defined a system that models FLOPS aircraft configurations in CATIA), and Mosaic (a hypertext browser for the internet) and a WWW interface that uses the CATIA Agent. A conclusion of the presentation is also attached.

Author

Concurrent Engineering; Product Development; Computer Techniques; Computer Graphics; Systems Integration; Applications Programs (Computers)

20000032557 Georgia Inst. of Tech., Aerospace Systems Design and Systems Realization Labs., Atlanta, GA USA

DREAMS and IMAGE: A Model and Computer Implementation for Concurrent, Life-Cycle Design of Complex Systems

Hale, Mark A., Georgia Inst. of Tech., USA; Craig, James I., Georgia Inst. of Tech., USA; Mistree, Farrokh, Georgia Inst. of Tech., USA; Schrage, Daniel P., Georgia Inst. of Tech., USA; Concurrent Engineering: Research and Applications; [1995]; Volume 4, No. 2, pp. 171-186; In English

Contract(s)/Grant(s): NGT-51250; NGT-51102L; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Computing architectures are being assembled that extend concurrent engineering practices by providing more efficient execution and collaboration on distributed, heterogeneous computing networks. Built on the successes of initial architectures, requirements for a next-generation design computing infrastructure can be developed. These requirements concentrate on those needed by a designer in decision-making processes from product conception to recycling and can be categorized in two areas: design process and design information management. A designer both designs and executes design processes throughout design time to achieve better product and process capabilities while expanding fewer resources. In order to accomplish this, information, or more appropriately design knowledge, needs to be adequately managed during product and process decomposition as well as recomposition. A foundation has been laid that captures these requirements in a design architecture called DREAMS (Developing Robust Engineering Analysis Models and Specifications). In addition, a computing infrastructure, called IMAGE (Intelligent Multidisciplinary Aircraft Generation Environment), is being developed that satisfies design requirements defined in DREAMS and incorporates enabling computational technologies.

Author

Decision Making; Computer Aided Design; Design Analysis; Mathematical Models; Concurrent Engineering; Architecture (Computers); Life Cycle Costs

20000032558 Georgia Inst. of Tech., Woodruff (G. W.) School of Mechanical Engineering, Atlanta, GA USA

Integration of the Response Surface Methodology with the Compromise Decision Support Problem in Developing a General Robust Design Procedure

Chen, Wei, Georgia Inst. of Tech., USA; Tsui, Kwok–Leung, Georgia Inst. of Tech., USA; Allen, Janet K., Georgia Inst. of Tech., USA; Mistree, Farrokh, Georgia Inst. of Tech., USA; [1994]; 9p; In English

Contract(s)/Grant(s): NSF DDM-93-96503; NAG1-1564; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this paper we introduce a comprehensive and rigorous robust design procedure to overcome some limitations of the current approaches. A comprehensive approach is general enough to model the two major types of robust design applications, namely, robust design associated with the minimization of the deviation of performance caused by the deviation of noise factors (uncontrollable parameters), and robust design due to the minimization of the deviation of performance caused by the deviation of control factors (design variables). We achieve mathematical rigor by using, as a foundation, principles from the design of experiments and optimization. Specifically, we integrate the Response Surface Method (RSM) with the compromise Decision Support Problem (DSP). Our approach is especially useful for design problems where there are no closed-form solutions and system performance is computationally expensive to evaluate. The design of a solar powered irrigation system is used as an example. Our focus in this paper is on illustrating our approach rather than on the results per se.

Author

Systems Engineering; Robustness (Mathematics); Design Analysis; Computer Aided Design; Decision Support Systems

20000032559 Georgia Inst. of Tech., Systems Realization Lab., Atlanta, GA USA

On Modeling Multiple Objectives and Multi-Level Decisions in Concurrent Design

Mistree, Farrokh, Georgia Inst. of Tech., USA; Patel, Bharat, Georgia Inst. of Tech., USA; Vadde, Srinivas, Georgia Inst. of Tech., USA; Advances in Design Automation; [1993]; Volume 69, No. 2, pp. 151-161; In English

Contract(s)/Grant(s): NSF DDM-93-96503; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Modeling of multiple objectives in a decision and multi-level decisions are important in decision-based concurrent design. In this paper we address these twin issues in the context of a rotating disk. The initial mathematical description, referred to as the baseline model, of the rotating disk is independent of the strategies of modeling and solution, applied to it. Once the baseline model is established, it is modeled using two design strategies with different philosophical underpinnings, namely, one based on the notion of a unique optimum and the other on the notion of satisfying solutions. Our desire in writing this paper is to foster discussion rather than offering a prescription for solution.

Author

Mathematical Models; Rotating Disks; Systems Engineering; Decision Theory; Design Analysis

20000032671 California Univ., San Diego, Computer Vision and Robotics Research Lab., La Jolla, CA USA

Computational Models for Search and Discrimination: An Integrated Approach

Copeland, Anthony C., California Univ., San Diego, USA; Trivedi, Mohan M., California Univ., San Diego, USA; Search and Target Acquisition; March 2000, pp. 21-1 - 21-12; In English; See also 20000032651; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper presents an experimental framework for evaluating metrics for the search and discrimination of a natural texture pattern from its background. Such metrics could help identify preattentive cues and underlying models of search and discrimination, and to evaluate and design camouflage patterns and automatic target recognition systems. Human observers were asked to view image stimuli consisting of various target patterns embedded within various background patterns. These psychophysical experiments provided a quantitative basis for comparison of human judgments to the computed values of target distinctness metrics. Two different experimental methodologies were utilized. The first methodology consisted of paired comparisons of a set of stimuli containing targets in a fixed location known to the observers. The observers were asked to judge the relative target distinctness for each pair of stimuli. The second methodology involved stimuli in which the targets were placed in random locations unknown to the observer. The observers were asked to search each image scene and identify suspected target locations. Using a prototype eye tracking testbed. the Integrated Testbed for Eye Movement Studies, the observers' fixation points during the experiment were recorded and analyzed. For both experiments. the level of correlation with the psychophysical data was used as the basis for evaluating target distinctness metrics. Overall, of the set of target distinctness metrics considered, a metric based on a model of image texture was the most strongly correlated with the psychophysical data.

Author

Visual Perception; Target Recognition; Human Performance; Performance Prediction; Target Acquisition; Mathematical Models; Visual Discrimination; Pattern Recognition

20000032675 Defence Evaluation Research Agency, Protection and Performance Dept., Farnborough, UK

A Physics Based Broadband Scene Simulation Tool for CCD Assessment

Moorhead, I. R., Defence Evaluation Research Agency, UK; Gilmore, M. A., Defence Evaluation Research Agency, UK; Oxford, D., Defence Evaluation Research Agency, UK; Filbee, D., Hunting Engineering Ltd., UK; Stroud, Colin, Hunting Engineering Ltd., UK; Hutchings, G., Hunting Engineering Ltd., UK; Kirk, A., Hunting Engineering Ltd., UK; Search and Target Acquisition; March 2000, pp. 25-1 - 25-8; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

Assessment of Camouflage, Concealment and Deception (CCD) methodologies is a non trivial problem; conventionally the only method has been to carry out field trials, which are both expensive and subject to the vagaries of the weather. In recent years computing power has increased, such that there are now many research programmes using synthetic environments for CCD assessments. Such an approach is attractive; the user has complete control over the environment parameters and many more scenarios can be investigated. The UK Defence Evaluation and Research Agency is currently developing a synthetic scene generation tool for assessing the effectiveness of air vehicle camouflage schemes. The software is sufficiently flexible to allow it to be used in a broader range of applications, including full CCD assessment. The synthetic scene simulation system (CAMEO-SIM) has been developed, as an extensible system, to provide imagery within the 0.4 - 14 micron spectral band with as high a physical fidelity as possible. It consists of a scene design tool, an image generator, which incorporates both radios and ray-tracing processes, and an experimental trials tool. The scene design tool allows the user to develop a three-dimensional representation of the scenario of interest from a fixed view-point. Target(s) of interest can be placed anywhere within this 3-D representation and may be either static or moving. Different illumination conditions and effects of the atmosphere can be modelled

together with directional reflectance effects. The user has complete control over the level of fidelity of the final image. The output from the rendering tool is a sequence of radiance maps which may be used by sensor models, or for experimental trials in which observers carry out target acquisition tasks. The software also maintains an audit trail of all data used to generate a particular image, both in terms of material properties used and the rendering options chosen.
Author
Camouflage; Target Acquisition; Charge Coupled Devices; Scene Generation; Imagery; Target Recognition; Simulation; Deception

20000032676 Defence Clothing and Textiles Agency, Science and Technology Div., Colchester, UK
An Investigation Into the Applicability of Computer-Synthesised Imagery for the Evaluation of Target Detectability
Ashforth, M., Defence Clothing and Textiles Agency, UK; Search and Target Acquisition; March 2000, pp. 26-1 - 26-4; In English; See also 20000032651; Copyright Waived; Avail: CASI; A01, Hardcopy

In the course of an earlier study of the influences on an observer's performance in target detectability assessments, the statistical analysis of the data suggested that there was a difference in the influences at work on an observer between the detection of targets in a real scene and the detection of targets in computer-generated (synthetic) images. Since synthetic imagery is increasingly used in this field, this is an important result. The work described in this report is a further analysis of the original data with the aim of studying more closely this difference. Analysis showed that there is indeed a marked difference between the influence of the observers' visual acuity on their performance in the two types of detection task. The reason is that there is less detailed clutter in synthetic images, which alleviates much of the decision-making an observer has to undergo in detecting a target in a real-scene image. In the synthetic case, the target is either seen or not seen and there is much less uncertainty. This uncertainty, which attends real target detection, swamps any measurable influences on an observer's relative performance in the real-scene case. The conclusion is that computer-generated images used for the evaluation of low-contrast target detection should contain much more clutter detail than at present.
Author
Target Acquisition; Camouflage; Imagery; Computer Techniques; Target Recognition; Visual Acuity; Visual Perception

20000032868 NASA Lewis Research Center, Cleveland, OH USA
Rotorcraft Damage Tolerance Evaluated by Computational Simulation
Chamis, Christos C., NASA Lewis Research Center, USA; Minnetyan, Levon, Clarkson Univ., USA; Abdi, Frank, Alpha Star Corp., USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 12 - 1 - 12 - 13; In English; See also 20000032859; Copyright Waived; Avail: CASI; A03, Hardcopy

An integrally stiffened graphite/epoxy composite rotorcraft structure is evaluated via computational simulation. A computer code that scales up constituent micromechanics level material properties to the structure level and accounts for all possible failure modes is used for the simulation of composite degradation under loading. Damage initiation, growth, accumulation, and propagation to fracture are included in the simulation. Design implications with regard to defect and damage tolerance of integrally stiffened composite structures are examined. A procedure is outlined regarding the use of this type of information for setting quality acceptance criteria, design allowables, damage tolerance, and retirement-for-cause criteria.
Author
Composite Structures; Crack Initiation; Cylindrical Shells; Damage; Simulation; Tolerances (Mechanics); Graphite-Epoxy Composites; Rotary Wing Aircraft; Computer Programs; Failure Modes; Micromechanics

20000032924 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Network Fault Diagnosis Supporting System Based on Integrated Management Information
Hashimoto, Sadamu, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 459-460; In Japanese; Copyright; Avail: Issuing Activity

Network traffic contains many symptoms caused by various network faults. In the fault management and diagnosis on wide area network, it is difficult for a manager to handle many symptoms by traffic monitor, because of large number of symptoms. So the effective classification of symptom is necessary. In this paper, I propose a method for effective classification. For the classification, organization and route information are integrated with symptom. Experimental results show that the method is useful for supporting fault diagnosis on wide area network.
Author
Management Information Systems; Wide Area Networks; Fault Detection

20000032926 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Evolutionary Synthesis of Arithmetic Circuits
Homma, Naofumi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 449-450; In Japanese; Copyright; Avail: Issuing Activity

This paper presents a new approach to designing arithmetic circuits by using a graph-based evolutionary optimization technique called Evolutionary Graph Generation (EGG). The key idea of the proposed method is to introduce a higher level of abstraction for arithmetic algorithms, in which arithmetic circuit structures are modeled as data-flow graphs associated with specific number representation systems. The EGG system employs evolutionary operations to transform the structure of graphs directly, which makes it possible to generate the desired circuit structure efficiently. The potential capability of EGG is demonstrated through an experiment of generating constant-coefficient multipliers.
Author
Graph Theory; Genetic Algorithms; Adding Circuits

20000032927 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Algorithm Reporting of Disjoint Paths in Graphs
Takahashi, Daishiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 447-448; In Japanese; Copyright; Avail: Issuing Activity

A k-path query on a graph consists of computing k vertex-disjoint paths between two given vertices of the graph, whenever they exist. In this paper, we study the problem of performing 4-path query in a planar graph G with n vertices. We present a data structure for G that can be constructed in O(n) time and executes 4-path querys in output-sensitive 0(l) time, where l is the total length or the paths reported.
Author
Algorithms; Data Structures; Graph Theory; Paths

20000032929 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Algorithm for Finding Generalized Vertex-Colorings
Kanari, Yasuaki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 443-444; In Japanese; Copyright; Avail: Issuing Activity

A l-vertex-coloring of a graph G is a coloring of all vertices, so that no two vertices which are distant at most l each other, have the same color (l is a positive integer). The l-vertex-coloring problem is to find a l-vertex coloring of a given graph G with the minimum number of colors. Since the ordinary vertex-coloring problem is NP-complete, the l-vertex-coloring problem is also NP-complete. Therefore it, is very unlikely that there exists an algorithm which solves efficiently this problem. It is known that many combinatorial problems can be solved efficiently for partial k-trees. However, it has not been known whether the l-vertex-coloring problem can be efficiently solved for partial k-trees or not. In this paper we give a polynomial-time algorithm to solve the l-vertex-coloring problem for trees and partial k-trees.
Author
Combinatorial Analysis; Graph Theory; Algorithms

20000032930 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Algorithms for Total-Coloring Graphs
Isobe, Shuji, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 441-442; In Japanese; Copyright; Avail: Issuing Activity

A total coloring of a graph G is a coloring of all elements of G, i.e. vertices and edges, in such a way that no two adjacent, or incident elements receive the same color. Many combinatorial problems can be efficiently solved for partial k-trees, that is, graphs of treewidth bounded by a constant k. However, no polynomial-time algorithm has been known for the problem of finding a total coloring of a given partial k-tree with the minimum number of colors. This paper gives such a first polynomial-time algorithm.
Author
Algorithms; Combinatorial Analysis; Graph Theory

20000032938 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Reinforced Learning for Non-Markovian Environment
Lee, Hae Yeon, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 243-244; In Japanese; Copyright; Avail: Issuing Activity

Recent research on reinforcement learning algorithms has concentrated on the partially observable Markov decision problem (POMDP). The most useful solution to overcome partial observability is to use memory to estimate state. In this paper, we present a new memory architecture of reinforcement learning algorithms, called Labeling Q-learning (L Q-learning), to solve certain type of POMDPs. The agent's task in this paper is to discover a path leading from start position to goal in a partially observable maze. In the LQ-learning, a function h for labeling plays an important role. At each step, the function h maps recent observations of finite and fixed width to an integer in the set M=0,1,m-1. This integer is attached to the current observation as a label, and then the conventional RL is applied to the observation with the label, i.e., Q values on labeled observations are learned as if labeled observations have the Markov property. Thus, LQ-learning produces m tables of Q values at most.
Author
Algorithms; Architecture (Computers); Memory (Computers); Maze Learning

20000033002 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Efficient Algorithms for Drawing Planar Graphs
Rahman, Saidur, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 177-180; In English; Copyright; Avail: Issuing Activity

This thesis presents efficient algorithms for drawing planar graphs. Graph drawing addresses the problem of constructing geometric representation of information and finds applications in almost every branch of science and technology. In this thesis we study rectangular drawings, orthogonal drawings, convex drawings and our newly defined box-rectangular drawings.
Author
Graph Theory; Algorithms; Drawings; Representations

20000033003 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Adaptive Information Searching on Internet Based on User Personal Information
Shimoe, Okada, Tohoku Univ., Japan; Sadaaki, Roberto, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 173-176; In English; Copyright; Avail: Issuing Activity

With the explosion in the amount of electronically available information on the network, it is becoming more and more difficult for a user to find his desired information. Intelligent software agents will provide this necessary help to navigate in the world-wide network of information. In this thesis, we first review the agent-based information locating systems and present our view of the trends of agent technologies supporting users in finding information on distributed heterogeneous environments. Next, we tackle the problem of customization of information gathering results to user personal tastes. For this, we propose a new method to customize the information searching on Internet. Finally, we investigate the issues associated with the exchange of information learned by agents belonging to different users, in order to improve the slow initial learning curve problem for the learning systems.
Author
Information Retrieval; Internets; Information Adaptive System; Knowledge Based Systems

20000033006 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Parallel Lisp System with Multiple Evaluation Strategies
Kawamoto, Shin–ichi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 158-160; In Japanese; Copyright; Avail: Issuing Activity

PaiLisp is a parallel Lisp language based on Scheme, and it has a rich set of parallel constructs like pcall, pbegin, plet, par-and, pif, and future. Eager Task Creation (ETC) is a traditional evaluation strategy of parallel constructs. ETC incurs considerable overhead caused by excessive creation of processes. The Steal-Help Evaluation strategy, proposed by T.Ito, is an efficient evaluation strategy, which suppresses excessive process creation. In this paper we give an implementation of an efficient, parallel Lisp system, called PaiLisp/MT, using multi-thread mechanism under the shared memory multi-processor. PaiLisp/MT is implemented so as to realize ETC, Steal-Help Evaluation and LTC. The experimental results of PaiLisp/MT using these multiple evaluation strategies show that Steal-Help Evaluation is the most efficient evaluation strategy among them.
Author
Lisp (Programming Language); Parallel Processing (Computers); Computer Systems Performance

20000033015 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Image Matching Based on Phase Only Correlation and Its Applications
Sasaki, Kouki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 455-456; In Japanese; Copyright; Avail: Issuing Activity

This paper presents an image matching technique based on Phase Only Correlation, which is suitable for implementing on VLSI digital signal processors. The phase-only correlation exhibits sharp discrimination capability sensitive to image features, and is useful for image recognition and various image-based measurements. This paper demonstrates the potential of the proposed image matching technique in various applications: examples include facial image recognition, distance measurement from stereo images, and rotation/translation-invariant object recognition.
Author
Pattern Recognition; Image Processing

20000033056 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Algorithm of Extraction of Character Images
Hirayama, Masatsugu, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 253-254; In Japanese; Copyright; Avail: Issuing Activity

In document image analysis, it is an essential problem to extract character strings. In this paper, a method of extracting characters from document images is proposed. First, a document image is labeled using local multilabel thresholding by analysis of histogram for various gray-scale images. Then, character strings are extracted from the labeled image by verification of local linearity of a pair of adjacent bounding boxes covering single labeled pixels. The validity of the method is verified by experiments which show that almost all character strings are extracted from complex document images.
Author
Image Analysis; Character Recognition

20000033061 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Design and Implementation of a Parallel Object-Oriented Language: PaiObject
Ebina, Taku, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 405-406; In Japanese; Copyright; Avail: Issuing Activity

PaiObject is a parallel object-oriented language based PaiLisp. Its interpreter on Alliant/FX is not efficient, because it uses ETC(Eager Task Creation) as the evaluation strategy of parallel constructs. The latest version of PaiLisp interpreter is PaiLisp/MT on DEC7000, which uses the Steal-Help Evaluation strategy for efficient evaluation of parallel constructs. In this study, to increase the expressibility of parallel processes, we introduce several new constructs like condsync for conditional synchronization, and pmapply for parallel method application into PaiObject. The PaiObject system with powerful extended constructs is designed and implemented on the basis of PaiLisp/MT.
Author
Object-Oriented Programming; Programming Languages; Synchronism

20000033069 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Approximation Algorithms for Some Optimization Problems for Graphs
Nakajima, Ayahiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 385-386; In Japanese; Copyright; Avail: Issuing Activity

We consider two combinatorial optimization problems, the minimum vertex cover problem and the maximum independent set problem, which are complementary to each other in the sense that the complement of a solution to one problem is a solution to the other. As for the former problem, we give an approximation algorithm for ”dense” graphs G = (V, E), i.e., G has absolute value of E is greater than c((absolute value of V))exp 2 edges for some constant c. Our algorithm achieves the approximation ratio 2/(2 - ((1-2m/n(exp 2))exp 1/2), in which n = absolute value of V, m = absolute value of E. This improves the ratio of the best known approximation algorithm due to [1]. As for the later problem, when the maximum degree delta of input graphs is 4 or greater, we show that no algorithm with ”minimul greedly select rule” can achieve an approximation ratio less than (delta + 1)/3 - O(I/delta) - O(poly(delta)/absolute value of V).
Author
Approximation; Combinatorial Analysis; Optimization; Algorithms

20000033174 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
High-Speed Logic LSI System with Eliminating Redundant Calculation
Imai, Makoto, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 77-80; In Japanese; Copyright; Avail: Issuing Activity

We have developed two kind of novel architectures to decrease the redundant calculations automatically. The first architecture employs new digit-serial algorithm which eliminate the redundant lower digit calculations by Most-significant-digit-first

(MSD-first) digit-serial calculation scheme. Basic components based on this architecture, which employ redundant number system to limit carry propagation, have been developed. MSD-first sequential vector quantization processor (VQP) exhibits 3.7 times faster than ordinary digital system by eliminating redundant lower-bit calculation. 16 X 16-bit MSD-first digit-serial multiplier has been also fabricated and its operation is experimentally confirmed. The second architecture decreases the complex calculation steps by excluding the useless data before executing the complex calculations according to the characterized value of data. About 90% of Manhattan-distance (MD) calculations in VQP are excluded by estimating the MD from average-distance. Author

Large Scale Integration; Vector Quantization; Digital Techniques

20000033178 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on Accurate Character Recognition Considering the Distribution of Feature Vectors

Sun, Fang, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 28-31; In Japanese; Copyright; Avail: Issuing Activity

Dictionary construction and discriminant function are very important factors of character recognition system. In this paper, by considering the distribution of feature vectors, new algorithms to construct a multi-template dictionary for character recognition are presented. Moreover, Simplified Mahalanobis distance and Divided Mahalanobis distance are proposed as the discriminant functions that can approximate the Mahalanobis distance in the case of small size of training samples. The effectiveness of these two functions are investigated by simulations. The effectiveness of the proposed methods based on these discriminant functions are shown with the experimental results on ETL9B.
Author

Character Recognition; Discriminant Analysis (Statistics)

20000033183 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on VLSI-Oriented Redundant Complex Arithmetic Circuits

Hoshi, Ken–ichi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 451-452; In Japanese; Copyright; Avail: Issuing Activity

This paper presents a class of complex number representations Called Redundant Complex Number Systems, which are useful for designing VLSI signal processors with complex arithmetic capability. A redundant complex number system - (RCNS) is defined as an imaginary-radix number system having a redundant integer digit set. The use of the imaginary radix with the redundant digit set makes possible the construction of high-speed complex arithmetic circuits exhibiting highly regular structure. This paper discusses elementary arithmetic algorithms of RCNSs and their implementations. The result of experimental fabrication of the RCNS-based complex-number multiplier in 0.5 micron CMOS technology is also presented.
Author

Algorithms; CMOS; Complex Numbers; Very Large Scale Integration; Arithmetic and Logic Units

20000033191 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on Discrete-Time Queueing Analysis of Leaky Bucket Algorithm in ATM Networks

Pinai, Linwong, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 465-466; In Japanese; Copyright; Avail: Issuing Activity

In this paper, we propose a new theoretical analysis method of Geo/D/1/K and IBP/D/1/K queueing systems for evaluating the performance of the well-known Leaky Bucket (LB) mechanism, when the arrival is assumed to be Bernoulli process and Interrupted Bernoulli Process (IBP). As a result, we can find extremely useful formulae for calculating the loss probability and other measures of effectiveness of Geo/D/1/K and IBP/D/1/K systems.
Author

Algorithms; Queueing Theory; Communication Networks

20000033198 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on Authentication System Based on Continual Check on User Inputs

Takai, Hideki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 429-430; In Japanese; Copyright; Avail: Issuing Activity

Traditionally, authentication is based on passwords, which has some problems, i.e. continual authentication can’t be done. This paper proposes a continual authentication system. The proposed system enables continual authentications with user model which reflects user’s habits, characteristics and tendencies of tasks at the use of computer systems. The process of authentication has

following three steps: 1) A logical method based on a configuration file; 2) A syntax analytic method assuming the combination of commands or tasks follows to the context-free-grammar; 3) A statistical method using the data of frequencies, etc.
Author
Computer Information Security; Access Control

20000033215 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Java Language with Locations and Regions
Watanabe, Masahiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 411-412; In Japanese; Copyright; Avail: Issuing Activity

Java is a compact object oriented language widely used as an internet language. to describe behaviors of distributed computing it is often convenient and necessary to use the notion of places in which objects reside. From such a standpoint, we propose introducing ”location” and ”region” and their related operations into Java. ”location” is a place where objects are located, and ”region” is a set of locations which are accessible with permissions by the region manager. Operations like migration, remote operation and failure mechanism can be explicitly described with use of locations and regions. ”Region” is designed in such a way that operations like migration and remote operation for an object become effective only when such operations are approved by the region manager. We designed and implemented a subset of Java with locations and regions, called ”mJava/LR”. This paper explain its language features, giving several program examples.
Author
Java (Programming Language); Position (Location); Object-Oriented Programming; Data Storage

20000033265 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
A Compositional Approach to Statecharts Semantics ***Final Report***
Luettgen, Gerald, Institute for Computer Applications in Science and Engineering, USA; vonderBeeck, Michael, Ludwig-Maximilians-Univ., Germany; Cleaveland, Rance, State Univ. of New York, USA; March 2000; 20p; In English
Contract(s)/Grant(s): NAS1-97046; F49620-95-I-0508; NSF CCR-92-57963; NSF CCR-95-05662; NSF CCR-98-04091; NSF INT-96-03441; ARO-P-38682-MA
Report No.(s): NASA/CR-2000-210086; NAS 1.26:210086; ICASE-2000-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Statecharts is a visual language for specifying reactive system behavior. The formalism extends traditional finite state machines with notions of hierarchy and concurrency, and it is used in many popular software design notations. A large part of the appeal of Statecharts derives from its basis in state machines, with their intuitive operational interpretation. The traditional semantics of Statecharts, however, su ers from a serious defect: it is not compositional, meaning that the behavior of system descriptions cannot be inferred from the behavior of their subsystems. Compositionality is a prerequisite for exploiting the modular structure of Statecharts for simulation, verification, and code generation, and it also provides the necessary foundation for reusability. This paper suggests a new compositional approach to formalizing Statecharts semantics as flattened transition systems in which transitions represent system steps. The approach builds on ideas developed for timed process calculi and employs structural operational rules to de ne the transitions of a Statecharts expression in terms of the transitions of its subexpressions. It is first investigated for a simple dialect of Statecharts, with respect to a variant of Pnueli and Shalev’s semantics, and is illustrated by means of a small example. to demonstrate its flexibility, the proposed approach is then extended to deal with practically useful features available in many Statecharts variants, namely state references, history states, and priority concepts along state hierarchies.
Author
Semantics; Formalism; Software Engineering; Natural Language Processing

20000033376 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Integrated Case-Based Reasoning and Expert System Techniques for Solving Experience-Oriented Problems
Yang, Jyh–Bin, Chung-Hua Polytechnic Inst., Taiwan, Province of China; Yau, Nie–Jia, National Central Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; 2000; ISSN 0253-3839; Volume 23, No. 1, pp. 83-95; In English; Copyright; Avail: Issuing Activity

Experience-oriented problems can be solved based on previous cases or an expert’s experience, but cannot be solved by conventional algorithms. Effectively managing knowledge acquisition and problem-solving tasks is crucial in the construction domain in which experience accumulation is at a retarded pace. While Expert Systems are extensively employed to solve complex problems in the construction domain, the Case-Based Reasoning technique provides a valuable when previous cases can be properly modeled. However, use of a single technique alone may not yield optimum solutions. This paper presents a hybrid model,

capable of integrating Case-Based Reasoning and Expert System techniques, for knowledge acquisition and problem-solving of experience-oriented problems. The proposed model is implemented and demonstrated by estimating the slurry wall's duration at the project planning stage. Test results indicate that solutions generated by the proposed hybrid model are better than those generated by using a single technique.
Author
Expert Systems; Problem Solving; Procedures

20000033430 Feng Chia Univ., Dept. of Information Engineering, Taichung, Taiwan, Province of China
A Unidirectional CORDIC Algorithm for Angle Computation and Rotation
Lo, Hao–Yung, Feng Chia Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Nov. 1997; ISSN 0253-3839; Volume 20, No. 6, pp. 693-700; In English
Contract(s)/Grant(s): NSC-85-2213-E-035-027; Copyright; Avail: Issuing Activity

An innovative approach to CORDIC(Coordinate Rotation Digital Computer) computing is presented. This method features unidirectional rotation, unlike most other more conventional methods, which are bidirectional. A specified angle z(o) is approached by this method so that the cos(z(o)) and sin(z(o)) are computed. Since no additional hardware components are required to decide the rotation direction for each iteration, the architecture is thus simple, and is expected to be reduced 20% of the area compared with conventional CORDIC techniques. Latency time is also reduced. Although a variable scaling factor should be used, only the first two or three iterations are required because after that, the scaling factor, cos(alpha(i)), approaches 1 as alpha(i)is less than 2(exp -8). This method guarantees rapid acceleration toward convergence in one direction during trigonometric function computation.
Author
Algorithms; Computation; Convergence; Rotation; Digital Computers; Real Time Operation

20000033444 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Decision Tree Pruning Algorithm
Tada, Seiji, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 387-388; In Japanese; Copyright; Avail: Issuing Activity

The decision tree pruning algorithm due to Kearns and Mansour is the only one that has a theoretically proved performance guarantee for the generalization error of the resultant pruned tree. But the pruning algorithm which works based on the local uniform convergence theorems produces much worse pruning than the best pruning. This is because the algorithm tends to overprune decision trees due to the pruning condition that they introduced. In this paper we introduce a new pruning algorithm by replacing the pruning condition with new ones, and show empirically that the new algorithm performs much better than the original algorithm.
Author
Decision Theory; Trees (Mathematics); Algorithms

20000033449 National Yun-Lin Univ. of Science and Technology, Graduate School of Mechanical Engineering, Touliu, Taiwan, Province of China
On the Stability of Discrete Takagi-Sugeno Fuzzy Dynamic Model
Chou, Jyh–Horng, National Yun-Lin Univ. of Science and Technology, Taiwan, Province of China; Chen, Shinn–Horng, National Kaohsiung Inst. of Tech., Taiwan, Province of China; Liao, Wen–Hwei, National Yun-Lin Polytechnic Inst., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Nov. 1997; ISSN 0253-3839; Volume 20, No. 6, pp. 709-713; In English
Contract(s)/Grant(s): NSC-86-2212-E-224-001; Copyright; Avail: Issuing Activity

In this paper, we present a new time domain stability criterion to analyze the stability of the discrete TS (Takagi-Sugeno) fuzzy dynamic model by which nonlinear systems can be precisely identified. Unlike recently reported sufficient stability criteria in which it is obligatory to find a common positive definite matrix solution of a set of Lyapunov equations, this proposed stability criterion does not require the solving of any Lyapunov equation. It is also not necessary to find a common positive definite matrix solution of a set of Lyapunov equations. Therefore, this stability criterion enables us to check the stability of the discrete TS fuzzy dynamic model with less computation. Two examples are included to illustrate the applications of the proposed method.
Author
Mathematical Models; Fuzzy Systems; Systems Analysis; Nonlinear Systems; Dynamic Models; Design Analysis; Stability Tests

20000033452 National Remote Sensing Agency, Hyderabad, India

A Hybrid Technique for Onboard Image Data Compression

Mittal, M. L., National Remote Sensing Agency, India; Singh, V. K., National Remote Sensing Agency, India; Krishnan, R., Advanced Data Processing Research Inst., India; Journal of Spacecraft Technology; Jan. 1998; Volume 8, No. 1, pp. 83-87; In English; Copyright; Avail: Issuing Activity

This paper presents a hybrid compression technique in which lossless and lossy techniques have been combined. This technique can be used to compress 10 bit data. The 8 LSBS are compressed using the Joint Photographic Expert Group (JPEG) compression technique and the 2 MSBS are coded using run length encoding. This compressed data is merged in the JPEG specified format and transmitted to the receiver. The decoder process splits the compressed data into two data sets and decodes them accordingly, using the associated technique. The software has been developed for this scheme in 'C' under UNIX OS on SGI 02 machine. Future Remote Sensing Missions are planned to carry payloads with higher spectral and spatial resolutions (1m/2m). This hybrid technique can be used to compress this data onboard with reduced onboard hardware and better performance. This technique can also be used for storage and transmission of data on ground.

Author

Data Compression; Image Processing; Decoders; Decoding; Onboard Data Processing

20000033629 NASA Goddard Space Flight Center, Greenbelt, MD USA

Managing the Software Development Process

Lubelczky, Jeffrey T., NASA Goddard Space Flight Center, USA; Parra, Amy, Computer Sciences Corp., USA; [1999]; 9p; In English; 9th; Astronomical Data Analysis Software and Systems (ADASS) Conference, 5 Oct. 1999, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goal of any software development project is to produce a product that is delivered on time, within the allocated budget, and with the capabilities expected by the customer and unfortunately, this goal is rarely achieved. However, a properly managed project in a mature software engineering environment can consistently achieve this goal. In this paper we provide an introduction to three project success factors, a properly managed project, a competent project manager, and a mature software engineering environment. We will also present an overview of the benefits of a mature software engineering environment based on 24 years of data from the Software Engineering Lab, and suggest some first steps that an organization can take to begin benefiting from this environment. The depth and breadth of software engineering exceeds this paper, various references are cited with a goal of raising awareness and encouraging further investigation into software engineering and project management practices.

Author

Engineering Management; Software Engineering; Project Management; Computer Programming; Programming Environments

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.

20000032207 Puerto Rico Univ., Lab. of Applied Remote Sensing and Image Processing, Mayaguez, Puerto Rico

An Image Retrieval and Processing Expert System for the World Wide Web

Rodriguez, Ricardo, Puerto Rico Univ., Puerto Rico; Rondon, Angelica, Puerto Rico Univ., Puerto Rico; Bruno, Maria I., Puerto Rico Univ., Puerto Rico; Vasquez, Ramon, Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 518-522; In English; See also 20000032189

Contract(s)/Grant(s): NCC2-52; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

This paper presents a system that is being developed in the Laboratory of Applied Remote Sensing and Image Processing at the University of P.R. at Mayaguez. It describes the components that constitute its architecture. The main elements are: a Data Warehouse, an Image Processing Engine, and an Expert System. Together, they provide a complete solution to researchers from different fields that make use of images in their investigations. Also, since it is available to the World Wide Web, it provides remote access and processing of images.

Author

Data Retrieval; Expert Systems; Image Processing; World Wide Web; On-Line Systems

20000033053 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Design Methods of Parallel Processing with Uniform Networks Structure
Takahara, Hideki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 259-260; In Japanese; Copyright; Avail: Issuing Activity

Systolic array is known as a highly parallel processing device architecture. How to construct systolic array has been considered when a concrete problem is given. But, it is necessary to know the problem that can be solved by a systolic array. The problems that can be solved by n-dimensional mesh-connected array are already almost identified. But, for the case of other topology of network, any condition for problems is not known yet. In this paper, the conditions that can be solved by binary tree systolic array or hypercube systolic array are revealed.
Author
Parallel Processing (Computers); Systolic Arrays; Architecture (Computers)

20000033057 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Method for Load Balancing on Parallel Network
Endo, Takayuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 251-252; In Japanese; Copyright; Avail: Issuing Activity

Load balancing can improve the utilization of processors and the efficiency of parallel computation. Especially, the iterative algorithm is a fully distributed load balancing method. In this paper, we investigate load balancing for parallel networks of tree and Cube-Connected Cycle(CCC) and derive optimal conditions which lead to the fastest convergence of the load balancing by simulation of the balancing algorithm and by numerical analysis. Moreover, we consider a feature of load balancing which depends on network topologies.
Author
Convergence; Computer Networks; Parallel Processing (Computers); Algorithms

20000033060 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on a Parallel Logic Language System
Matsuzawa, Tomohiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 407-408; In Japanese; Copyright; Avail: Issuing Activity

A number of concurrent logic languages have been proposed, but their languages do not support an explicit parallel logic construct and OR-parallelism. A parallel logic language pKLIC introducing the parallel logic constructs (parallel-and and parallel-or) into KL1 is designed and the pKLIC system based on the Steal-Help evaluation is implemented. This report explains the outline of the pKLIC system supporting parallel-and and parallel-or, and it shows the effectiveness of p KLIC system and parallel logic constructs.
Author
Parallel Programming; Logic Programming; Logic Design; Architecture (Computers); Programming Languages

20000033062 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Study on a Digital-Parallel Mutilple-Valued CAM Based on Pass-Gate Logic
Teranishi, Kaname, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 403-404; In Japanese; Copyright; Avail: Issuing Activity

A new high-density digit-parallel CAM based on pass-gate logic is proposed to realize fully parallel magnitude comparison. Multiple-valued stored data are represented by the threshold voltage of a floating-gate MOS transistor, so that a single floating-gate MOS transistor can be used as a functional pass gate which merges threshold operation and pass-switch functions. Since, the word circuit is realized by functional pass-gate network, it can be designed compactly by using floating-gate MOS transistors. The performance of the proposed multiple-valued CAM is about 6 times higher than that of a typical binary CAM under a 0.5-micron flash EEPROM technology. Moreover its effective chip area and power dissipation are reduced to about 42 and 92 percents, respectively, in comparison with those of binary implementation.
Author
Threshold Voltage; Memory (Computers); Transistor Logic; Threshold Gates; Computer Storage Devices

20000033064 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Study on Design of Highly Parallel Digital System Based on Matrix Representation
Shimohure, Kensuke, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 399-400; In Japanese; Copyright; Avail: Issuing Activity

This paper presents a design method for a high-performance arithmetic and logic circuit from a symbol-level specification. The purpose of the design is to find a code assignment such that the designed circuit becomes highly parallel and simple. Reed-Muller expansion is introduced to design the high-performance circuit based on the property of a finite field. The complexity of a circuit i.e., the number of product terms in a Reed-Muller expansion corresponds to the number of non-zero elements in a coefficient matrix. We develop a new transformation technique to get a sparse matrix without changing the input-output symbol-level mapping relationship.
Author
Digital Systems; Logic Circuits; Matrices (Mathematics); Parallel Processing (Computers); Arithmetic and Logic Units

20000033209 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Research Activity Support System using the Network Environment
Katsumata, Makoto, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 423-424; In Japanese; Copyright; Avail: Issuing Activity

Recently, there are a lot of systems to support our research activities. But almost all their systems have supported our research activities partially, such as creativity support. It is important to support our research activities totally. In this paper, to support our research activities totally, I describe a model of our total research activities, which I proposed. and I design and implement a system to accumulate the research information and to show those information, named Research Note System.
Author
Information Systems; Research; Information Transfer; Information Management

20000033465 Naval Postgraduate School, Monterey, CA USA
Dynamically Determining Distribution Statistics for Resources in a Distributed Environment
Cook, Thomas S.; Dec. 1999; 140p; In English
Report No.(s): AD-A374163; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Currently, the Department of Defense runs its special purpose applications on dedicated hardware (i.e., on ”stovepipe systems”). Such hardware has inherent disadvantages. They have an inability to handle the resource contention that often occurs upon the influx of a large number of applications. A new application needing to use a given resource must typically wait for any preceding applications to first finish their use instead of searching out another capable resource. An even worse scenario is when the system fails and no applications can run until the system is repaired and brought back on-line. In all the cases, important decisions can potentially be delayed or made without important information. The Management System for Heterogeneous Networks (MSHN) will mitigate these deficiencies. The goal of MSHN is to manage several different types of applications across a changing heterogeneous network. MSHN determines the best resource on which to run an application based on both the applications and overall system’s Quality of Service (QoS). The focus of this thesis is to write and demonstrate for MSHN the worth of an algorithm that can determine and update distribution statistics for the end-to-end QoS resource usage of an application program. These distributions are vital in assisting MSHN in the scheduling and rescheduling of applications across a network.
DTIC
Distributed Processing; Client Server Systems; On-Line Systems; Resources Management

20000033469 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Impact of Actual Facilitator Alignment, Co-Location and Video Intervention on the Efficacy of Distributed Group Support Systems
Heberlie, Brian J.; Tolbert, Mary O.; Dec. 1999; 284p; In English
Report No.(s): AD-A374229; AFIT/GIR/LAL/99D-4; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

The growth of distributed group support systems (GSS) suggests that organizations will continue to bring dispersed groups of people together to make decisions over computer networks. In many instances those groups are temporarily assembled to address a task and then summarily disbanded never to work together again. In order for users to effectively use the GSS issues of trust and control need to be addressed within the GSS design. Users have perceptions about the fairness of structural and social determinants of the GSS design. These perceptions influence both the decision making process and process outcomes. This article shows the negative impacts that facilitator alignment and co-location with a single meeting member has on the other group members’ perception of GSS fairness and equality of power distribution. This study also demonstrated how video could effectively reduce or mitigate the negative justice perceptions that users experience from facilitator alignment and co-location.

The findings suggest that the increased communications capabilities available from video can help users overcome limitations that would otherwise be present from the design.
DTIC
Decision Support Systems; Distributed Processing; Video Communication

20000033470 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Power, Performance, and Perception (P3): Integrating Usability Metrics and Technology Acceptance Determinants to Validate a New Model for Predicting System Usage
Fiorello, Alan P.; Dec. 1999; 134p; In English
Report No.(s): AD-A374228; AFIT/GIR/LAS/99D-3; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
Currently, there are two distinct approaches to assist information technology managers in the successful implementation of office automation software. The first approach resides within the field of usability engineering, while the second approach is derived from the discipline of management information systems (MIS). However, neither approach has successfully produced conclusive evidence that explains what characteristics facilitate system use as well as influence user acceptance of the system. This study reports on the validity of a new model, entitled the Power, Performance, Perception (P3) model, that links the constructs of usability engineering to user acceptance. Additionally, speech recognition software (SRS) was used in an experimental setting to validate the P3 model. This research also examined the viability of employing SRS in an Air Force office environment. The results of this study failed to validate the P3 model. However, an alternate model for predicting user acceptance, the Usability Acceptance Model, did emerge from the research which showed that the usability metric of user satisfaction can explain 53% of the variance of user intention to use a new technology. Additionally, the results of this study indicate that users in a typical Air Force office environment would utilize SRS for text processing.
DTIC
Speech Recognition; Management Information Systems; Data Processing; Texts; Mathematical Models; Human Performance; Perception

20000033471 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Implementation of Speech Recognition Software for Text Processing: An Exploratory Analysis
Abell, Sean P.; Dec. 1999; 76p; In English
Report No.(s): AD-A374225; AFIT/GIR/LAS/99D-1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The rationale behind implementing new information technologies is often to gain productivity improvements associated with the substitution of machinery for labor. However, the literature shows little direct evidence of a positive relationship between information technology investment and subsequent productivity benefits. This thesis reports on the examination into the productivity implications of implementing speech recognition software in a text processing environment. More specifically, research was conducted to compare text processing speeds and error rates using speech recognition software versus the keyboard and mouse. of interest was the time required to input and proofread text processing tasks as well as the number of errors generated using both methods of text input. The empirical data offer somewhat mixed results. While users initially entered text faster using speech recognition software (p is less than .05), they generated more errors and consequently performed proofreading and error corrections slower using speech. These results suggest that, in terms of accurate text processing, speech recognition software is still not a practical alternative to the keyboard. Therefore, implementation of speech recognition software is unlikely to result in any gains in productivity that would serve to justify its cost.
DTIC
Speech Recognition; Texts; Data Processing; Computer Programs

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.

20000032190 North Carolina Agricultural and Technical State Univ., Dept. of Electrical Engineering, Greensboro,NC USA
Elements of Robust Control: With Examples
Tillery, Willie, North Carolina Agricultural and Technical State Univ., USA; Kumar, CR. Ashok, North Carolina Agricultural and Technical State Univ., USA; Homaifar, A., North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global

Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 457-462; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; C01, CD-ROM

In this paper, we provide a simple procedure to understand the contemporary robust control literature. In particular, we focus on uncertainty types, and by examples, we discuss the evolution of H infinity design from the Small Gain Theorem. The paper is organized in single input single output setting for better understanding of the subject.

Author

Mathematical Models; Automatic Control; Procedures

20000032192 North Carolina Agricultural and Technical State Univ., NASA Center for Aerospace Research, Greensboro,NC USA

Advancements on the Control of the Longitudinal Motion of the Space Shuttle During Re-entry

Marsh, Roland Reynard, North Carolina Agricultural and Technical State Univ., USA; Bikdash, Marwan, North Carolina Agricultural and Technical State Univ., USA; Homaifar, Abdollah, North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 463-467; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; C01, CD-ROM

A controller is used to serve as expert guidance in an environment where precision is necessary. In the case of a space shuttle orbiter, millions of dollars of equipment and human life dictate that accurate measurements be taken to ensure the safe arrival of the space orbiter during re-entry into the Earth's atmosphere. In previous work, several Sugeno fuzzy approximators used for the guidance of the orbiter re-entry were designed. The primary concept was to maintain the drag acceleration and the heating loads within design constraints to ensure safe arrival. As an extension of this work we will examine the effects of wind gusts on the performance and robustness of the fuzzy engines designed in there-entry system. For more realistic evaluation, we will include the effect of wind in the simulation. These gusts will be modeled as Rayleigh-type perturbations of the Mach number. We will also discuss the effect of multiple trajectory tracking. This is helpful in providing several acceptable options for choosing a re-entry path in fear time.

Author

Automatic Control; Gusts; Reentry; Simulation; Space Shuttle Orbiters; Trajectories; Safety

20000032233 North Carolina Agricultural and Technical State Univ., Dept. of Electrical Engineering, Greensboro, NC USA

Using Genetic Algorithms for Optimal Crane Control

Kimiaghalam, Bahrain, North Carolina Agricultural and Technical State Univ., USA; Homaifar, Abdollah, North Carolina Agricultural and Technical State Univ., USA; Bikdash, Marwan, North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 600-605; In English; See also 20000032189

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The nonlinear dynamics of a crane makes it a good test case for most of the available methods in control and motion planning, specially the relatively new methods such as Genetic Algorithm (GA). There are several approaches to solve a dock mounted container crane control problem using optimal control methods. Usually the necessary conditions for solving this problem require finding the initial costate vector. In this paper real value GA is used to the initial values of the costates of the system. Each individual gene has its own fitness value based on its ability to move the system to desired final states after a given time. In order to evaluate the fitness, we need to have a simulator of the system which keeps to simulate system trajectory. Here we will briefly cover the dynamics of the crane and present some initial results on the performance of GA.

Author

Genetic Algorithms; Optimal Control; Control Systems Design; Control Theory; Trajectory Control; Cranes

20000032234 North Carolina Agricultural and Technical State Univ., NASA Autonomous Control Engineering Center, Greensboro, NC USA

DESIGN OF A FAST FUZZY CONTROLLER

Vainstein, F., North Carolina Agricultural and Technical State Univ., USA; Curtis, C. V., North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 606-611; In English; See also 20000032189

Contract(s)/Grant(s): ACE-48146; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The paper presents a new approach to designing a fast fuzzy controller. We propose to use modular arithmetic for computation of the controller's output. The theoretical foundation provided by the Chinese Remainder Theorem, shows that some modular rings are isomorphic to the direct sum of smaller modular rings. In this case, no carry is produced during the process of addition and multiplication, thus making parallel computations feasible. Genetic Algorithms is used for hardware minimization.
Author
Fuzzy Systems; Controllers; Control Systems Design; Genetic Algorithms

20000032238 North Carolina Agricultural and Technical State Univ., Electronics and Computer Technology Dept., Greensboro, NC USA
Application of Model Identification in Robust Controller Design for System Damping NASA-Autonomous Control Engineering Center
Fatehi, Fereshteh, North Carolina Agricultural and Technical State Univ., USA; Homaifar, Abdolah, North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 623-628; In English; See also 20000032189
Contract(s)/Grant(s): ACE-48146; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
This paper presents recent results on investigation into the use of model identification methods for the design of robust controllers to enhance the damping of interarea oscillations in multimachine power systems. This method of model identification and reduction is called Prony model identification method. The linear reduced model which can be obtained by this method will be used to design the controller, mu-synthesis, which produces a robust controller satisfactory for a range of operating conditions, is suggested as a control design technique.
Author
Damping; Oscillations

20000032254 Texas A&M Univ., Dept. of Mechanical Engineering, College Station, TX USA
Multi-Objective Decision Making and the Motion Control of an Autonomous Mobile Robot
Smith, Earl B., Texas A&M Univ., USA; Langari, Reza, Texas A&M Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3143-145, pp. 143-145; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM
When a mobile robot is moving through an unstructured site, a premium must be put on it avoiding obstacles. In addition to that the robot must move efficiently through the site. A teleoperated robot can be used to control its velocity through a site. However, this can be very fatiguing, especially mentally, to a person. Therefore, researchers have been working more with autonomous mobile robots. In fuzzy logic IF-THEN rules can be used where the antecedent is the distance the robot is from the obstacles. The consequent would be the speed of the robot. In this project, multi-objective decision making is being explored to obtain the speed. Multi-objective decision making has several alternatives or decisions where each alternative satisfies an objective to a certain degree, and each objective has a preference. The alternatives, for this case, will represent difference speeds that the robot is to move. The process of selecting the speed, via multi-objective decision making, will commence when the optimum path is selected. The optimum path will also be selected by use of multi objective decision making. The process in selecting the speed is to be used when the vehicle has chosen a path while in the presence of multiple obstacles. Fuzzy logic control will be used, along with multi objective decision making, in getting to the desired speed.
Author
Decision Making; Autonomy; Automata Theory; Robots; Robot Control

20000032256 Texas A&M Univ., Dept. of Mechanical Engineering, College Station, TX USA
Multi-Objective Decision Making and the Navigation of an Autonomous Mobile Robot
Smith, Earl B., Texas A&M Univ., USA; Langari, Reza, Texas A&M Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 146-149; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM
Mobile Robots have been used in working in unstructured environments like hazardous waste sites and lunar surfaces. Advantages of using robots are that humans will not be exposed to the harsh conditions and the use of them is cheaper. Teleoperated robots have been used where the operator controls every movement of the robot. However, the method can be fatiguing to a person. Therefore, researchers have been working on building autonomous mobile robots, so a person will have as little interaction with

the robot as possible. In order for a robot to move through a site, a premium must be put on it avoiding obstacles. In fuzzy logic membership functions and the linguistic terms have been used in making a robot autonomous by use of IF-THEN rules. Fuzzy decision making can give the robot another tool for it to be autonomous. For this project, multi-objective decision making is being explored for the optimum path selection. Multi-objective decision making has several decisions or alternatives where each alternative will accomplish a particular objective to a certain degree, and each objective has a preference. At the end of the process, the alternative with the optimum value will be chosen.
Author
Decision Making; Navigation; Autonomy; Automatic Control; Remote Control; Robotics; Robot Control; Robots; Teleoperators

20000032258 Tennessee Univ., NASA Center for Automated Space Science, Nashville, TN USA
Modal Parameter Identification of a Flexible Arm System
Barrington, Jason, Tennessee Univ., USA; Lew, Jiann–Shiun, Tennessee Univ., USA; Korbieh, Edward, Tennessee Univ., USA; Wade, Montanez, Tennessee Univ., USA; Tantaris, Richard, Tennessee Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 150-155; In English; See also 20000032189
Contract(s)/Grant(s): NCC5-228
Report No.(s): 98URC028; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
In this paper an experiment is designed for the modal parameter identification of a flexible arm system. This experiment uses a function generator to provide input signal and an oscilloscope to save input and output response data. For each vibrational mode, many sets of sine-wave inputs with frequencies close to the natural frequency of the arm system are used to excite the vibration of this mode. Then a least-squares technique is used to analyze the experimental input/output data to obtain the identified parameters for this mode. The identified results are compared with the analytical model obtained by applying finite element analysis.
Author
Parameter Identification; Mathematical Models; System Identification; Experiment Design; Vibration Mode

20000032262 New Mexico Univ., Electrical and Computer Engineering Building, Albuquerque, NM USA
Autonomous Mobile Platform for Research in Cooperative Robotics
Daemi, Ali, New Mexico Univ., USA; Pena, Edward, New Mexico Univ., USA; Ferguson, Paul, New Mexico Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 156-159; In English; See also 20000032189
Contract(s)/Grant(s): NCCW-87
Report No.(s): 98URC029; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM
This paper describes the design and development of a platform for research in cooperative mobile robotics. The structure and mechanics of the vehicles are based on R/C cars. The vehicle is rendered mobile by a DC motor and servo motor. The perception of the robot's environment is achieved using IR sensors and a central vision system. A laptop computer processes images from a CCD camera located above the testing area to determine the position of objects in sight. This information is sent to each robot via RF modem. Each robot is operated by a Motorola 68HC11E micro-controller, and all actions of the robots are realized through the connections of IR sensors, modem, and motors. The intelligent behavior of each robot is based on a hierarchical fuzzy-rule based approach.
Author
Autonomy; Robotics; Artificial Intelligence; Design Analysis; Computer Vision; Servomechanisms

20000032269 North Carolina Agricultural and Technical State Univ., Dept. of Electrical Engineering, Greensboro,NC USA
Hybrid Fuzzy PID Controller Design for PEBB Controlled DC Motor with Optimized Coefficients
Kunchithapadam, V., North Carolina Agricultural and Technical State Univ., USA; Bikdash, M., North Carolina Agricultural and Technical State Univ., USA; Homaifar, A., North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 739-744; In English; See also 20000032189
Contract(s)/Grant(s): N00014-96-1-1123
Report No.(s): 98URC132; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
We propose a Hybrid Fuzzy Linear controller for a PEBB (Power Electronics Building Blocks) controlled DC motor. We have developed a nonlinear model of a DC Shunt Motor that includes the effect of magnetization saturation and field excitation. The three states considered here are the armature current, the field current and the angular velocity. The control input is the terminal

voltage. We characterized the equilibrium state for any demanded power level. Fuzzy logic provides an accurate and efficient approach for systems which are difficult to model, have a strong nonlinearity, or are embedded in a changing environment with uncertainty. The input to the Fuzzy Logic Controller is the aggregate error between the required and the actual rpm. The output of the Fuzzy Engine is the control (terminal voltage). The design of the rules and membership functions are conducted using heuristic arguments and extensive simulation. The Fuzzy Logic Controller is designed to approximate a Bang-Bang Controller which is the usual solution for minimum-time control problem. We have also done a parametric study of the effect of overlap in the membership functions on the response in order to find the optimum tradeoff between short rise time, small steady state errors and control chattering. The performances of the openloop and closedloop systems are simulated in the presence of sinusoidal disturbances of different amplitudes. The Fuzzy controller is modified into a hybrid Fuzzy PID Controller to control the motor even in the presence of the disturbances. The best coefficients of the PID (Proportional Integral Derivative) controller are obtained by an optimization process in MATLAB.
Author
Fuzzy Systems; Hybrid Circuits; Optimization; Coefficients; Heuristic Methods; Proportional Control; Direct Current

20000032275 New Mexico Univ., Dept. of Electrical and Computer Engineering, Albuquerque, NM USA
Soft Computing Based Approach to Cooperative Autonomous Robotics
Delgado, Shannon M., New Mexico Univ., USA; Padilla, Denise D., New Mexico Univ., USA; DeOliveira, Marco A. A., New Mexico Univ., USA; Morris, Rene, New Mexico Univ., USA; Garcia, Oracio, New Mexico Univ., USA; Pages, Olivier, New Mexico Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 188-193; In English; See also 20000032189
Report No.(s): 98URC035; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
A hierarchical fuzzy system, optimized through evolutionary methods, is investigated as a controller for multiple cooperative autonomous robots. The use of multiple agents as opposed to one monolithic robot has the main advantages of lower production cost, robustness through redundancy, and reduced size and weight. Multiple robots offer a higher degree of operational robustness by ensuring the completion of all or most of the assigned tasks under unforeseen (adverse or otherwise) conditions. Such conditions may include robot hardware failure or loss of mission capability. The robot agents employ a hierarchical fuzzy system that consists of several layers of interconnected fuzzy logic controllers. This fuzzy system will consist of primitive behaviors, social behaviors, an advisory program, and a training program. The primitive behaviors consist of motion, obstacle avoidance, navigation, and telemetry. The social behaviors are generated by the interaction among robots and include identification, communication, and cooperative goal reaching. The advisory program is responsible for facilitating the execution of the task of the robot and the training program determines near-optimal or optimal social behaviors using genetic algorithms. The system is validated in a benchmark problem which incorporates many of the real-world issues confronting autonomous mobile robots in dynamic and unstructured applications such as terrain exploration and hazardous site maintenance.
Author
Autonomy; Fuzzy Systems; Robotics; Genetic Algorithms; Controllers; Computer Programs

20000032276 Tennessee State Univ., NASA Center for Automated Space Science, Nashville,TN USA
The Design of Stable Nonlinear Controllers for a Class of Nonlinear Plants Based on Neutral Networks
Adetona, Olawale, Tennessee State Univ., USA; Garcia, Ephrahim, Vanderbilt Univ., USA; Sathananthan, Sivapragasm, Tennessee State Univ., USA; Keel, Lee H., Tennessee State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 194-198; In English; See also 20000032189
Contract(s)/Grant(s): NCC5-228
Report No.(s): 98URC036; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM
Extensive empirical evidence has been published in the literature to demonstrate the enormous potential of multilayer neural network controllers. In spite of these results, practical implementation of these control schemes has been held back by the lack of an analytical proof of the stability of the controlled system. The objective of this paper is to present a nonlinear control scheme based on multilayer neural networks for the control of a class of nonlinear plants. The stability of the closed loop system will be rigorously established.
Author
Control Systems Design; Nonlinearity; Neural Nets; Stability; Controllers; Algorithms

20000032288 North Carolina Agricultural and Technical State Univ., Dept. of Electrical Engineering, Greensboro,NC USA
Mobile Robot Navigation Enhancement Using Genetic Programming
Battle, D., North Carolina Agricultural and Technical State Univ., USA; Baghdadchi, J., North Carolina Agricultural and Technical State Univ., USA; Homaifar, A., North Carolina Agricultural and Technical State Univ., USA; Tunstel, E., North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 235-240; In English; See also 20000032189
Contract(s)/Grant(s): ACE-48146
Report No.(s): 98URC043; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The use of the genetic programming (GP) paradigm has shown the potentiality of computers possibly programming themselves. When in combination with fuzzy logic, GP becomes a favorable tool for automated learning in intelligent control systems. A coding scheme in the port of C is introduced and applied to the problem of discovering a controller for mobile robot path tracking. An improvement in execution speed will be highlighted in comparison to the existing scheme developed in the LISP domain.
Author
Lisp (Programming Language); Robots; Navigation; Augmentation; Adaptive Control; Artificial Intelligence

20000032290 New Mexico Univ., NASA Center for Autonomous Control Engineering, Albuquerque, NM USA
Adaptive Fuzzy Control of a Direct Drive Motor: Experimental Aspects
Medina, E., New Mexico Univ., USA; Akbarzadeh–T, M.–R., New Mexico Univ., USA; Kim, Y. T., New Mexico Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 241-246; In English; See also 20000032189
Contract(s)/Grant(s): NCCW-87
Report No.(s): 98URC044; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

This paper presents a state feedback adaptive control method for position and velocity control of a direct drive motor. The proposed control scheme allows for integrating heuristic knowledge with mathematical knowledge of a system. It performs well even when mathematical model of the system is poorly understood. The controller consists of an adaptive fuzzy controller and a supervisory controller. The supervisory controller requires only knowledge of the upper bound and lower bound of the system parameters. The fuzzy controller is based on fuzzy basis functions and states of the system. The adaptation law is derived based on the Lyapunov function which ensures that the state of the system asymptotically approaches zero. The proposed controller is applied to a direct drive motor with payload and parameter uncertainty, and the effectiveness is experimentally verified. The real-time performance is compared with simulation results.
Author
Adaptive Control; Fuzzy Systems; Motors; Computerized Simulation; Feedback Control

20000032292 North Carolina Agricultural and Technical State Univ., Dept. of Electrical Engineering, Greensboro,NC USA
Hybrid Fuzzy-PD Control for a Dock Mounted Pantry Crane
Kimiaghalam, Bahrain, North Carolina Agricultural and Technical State Univ., USA; Homaifar, Abdollah, North Carolina Agricultural and Technical State Univ., USA; Bikdash, Marwan, North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 247-251; In English; See also 20000032189
Contract(s)/Grant(s): N00014-96-1-1123
Report No.(s): 98URC045; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

We study in this paper the performance of a hybrid fuzzy/Proportional-Derivative controller used to control and plan the motion of a heavy payload carried by a dock-mounted pantry-type crane. The fuzzy controller decides about the desired speeds of the load based on its present location and the PD controller translates the desired speeds to necessary torques to get to the desired speeds. by changing the shape and range of the membership functions and /or rules using common sense and trial and error, we can adjust the performance of controller to get to a reasonably acceptable result.
Author
Fuzzy Systems; Cranes; Control Systems Design; Controllers

20000032295 New Mexico Univ., Autonomous Control Engineering, Albuquerque, NM USA
Fuzzy Control of Flexible-Link Manipulators: A Review
Akbarzadeh–T, M.–R., New Mexico Univ., USA; Quintana, S., New Mexico Univ., USA; Jamshidi, M., New Mexico Univ., USA;

NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 252-256; In English; See also 20000032189
Contract(s)/Grant(s): NCCW-87; WERC/NMSU/DOE-Amd-35
Report No.(s): 98URC046; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Several recent research efforts are reviewed here which have applied fuzzy logic in control of flexible-link manipulators. A flexible robot is a distributed parameter system represented by complex nonlinear dynamics, its actuator and the control parameters are non-colocated, and lastly, unstructured/unknown parameters play a significant role in model dynamics of a flexible robot operating in the real world. As a result, control of flexible robots is considered a promising area for application of intelligent control methodologies such as fuzzy logic, genetic algorithms, and neural networks.
Author
Fuzzy Systems; Control Theory; Robots; Manipulators; Computerized Simulation

20000032298 North Carolina Agricultural and Technical State Univ., Dept. of Computer Science, Greensboro,NC USA
Fuzzy Versions of Epistemic and Deontic Logic
Gounder, Ramasamy S., North Carolina Agricultural and Technical State Univ., USA; Esterline, Albert C., North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 813-818; In English; See also 20000032189
Contract(s)/Grant(s): NAG5-4102; NAG2-1150
Report No.(s): 98URC145; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Epistemic and deontic logics are modal logics, respectively, of knowledge and of the normative concepts of obligation, permission, and prohibition. Epistemic logic is useful in formalizing systems of communicating processes and knowledge and belief in AI (Artificial Intelligence). Deontic logic is useful in computer science wherever we must distinguish between actual and ideal behavior, as in fault tolerance and database integrity constraints. We here discuss fuzzy versions of these logics. In the crisp versions, various axioms correspond to various properties of the structures used in defining the semantics of the logics. Thus, any axiomatic theory will be characterized not only by its axioms but also by the set of properties holding of the corresponding semantic structures. Fuzzy logic does not proceed with axiomatic systems, but fuzzy versions of the semantic properties exist and can be shown to correspond to some of the axioms for the crisp systems in special ways that support dependency networks among assertions in a modal domain. This in turn allows one to implement truth maintenance systems. For the technical development of epistemic logic, and for that of deontic logic. to our knowledge, we are the first to address fuzzy epistemic and fuzzy deontic logic explicitly and to consider the different systems and semantic properties available. We give the syntax and semantics of epistemic logic and discuss the correspondence between axioms of epistemic logic and properties of semantic structures. The same topics are covered for deontic logic. Fuzzy epistemic and fuzzy deontic logic discusses the relationship between axioms and semantic properties for these logics. Our results can be exploited in truth maintenance systems.
Derived from text
Fuzzy Systems; Logic Programming; Semantics; Axioms; Knowledge Based Systems

20000032303 New Mexico Univ., NASA Center for Autonomous Control Engineering (ACE), Albuquerque, NM USA
Vision Algorithms to Determine Shape and Distance for Manipulation of Unmodeled Objects
Montes, Leticia, New Mexico Univ., USA; Bowers, David, New Mexico Univ., USA; Lumia, Ron, New Mexico Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 824-829; In English; See also 20000032189
Contract(s)/Grant(s): NCCW-87
Report No.(s): 98URC147; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

This paper discusses the development of a robotic system for general use in an unstructured environment. This is illustrated through pick and place of randomly positioned, un-modeled objects. There are many applications for this project, including rock collection for the Mars Surveyor Program. This system is demonstrated with a Puma560 robot, Barrett hand, Cognex vision system, and Cimetrix simulation and control, all running on a PC. The demonstration consists of two processes: vision system and robotics. The vision system determines the size and location of the unknown objects. The robotics part consists of moving the robot to the object, configuring the hand based on the information from the vision system, then performing the pick/place operation. This work enhances and is a part of the Low Cost Virtual Collaborative Environment which provides remote simulation and control of equipment.
Author
Algorithms; Computer Vision; Robotics; Computerized Simulation; Shapes; Distance

20000032307 Puerto Rico Univ., Dept. of Electrical Engineering, Mayaguez, Puerto Rico

Neutral Networks for Subpixel Classification of Multispectral Images

Figueroa, Ricardo R., Puerto Rico Univ., Puerto Rico; Hunt, Shawn D., Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 286-289; In English; See also 20000032189

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In this work, the implementation and use of AVHRR (Advanced Very High Resolution Radiometer) images for subpixel analysis is studied. The work consists of two parts, the first is making training data, the second is using the training data to design a neural net subpixel analyzer. Most work on subpixel analysis has been done with images with more spectral bands. AVHRR images were chosen because of their easy acquisition, and because the five spectral bands allow investigation into the development of training data. The first step in subpixel analysis is the development of training data. This consists of image to be classified, and the classification of each pixel. In order to do the classification, a high spatial resolution image is typically needed in order to manually create a classified image. It is difficult to have both the image of interest, and a high spatial resolution image of the same area taken at the same time. Thus it was studied whether a subsampled image taken from the image of interest could serve as the training data. Statistical work has been done showing the unusefulness of this approach. In the second part of the analysis, a feedforward neural net was trained and used to classify the AVHRR images. Results of these tests, comparing the neural net with typical statistical based schemes are shown.

Author

Neural Nets; Pixels; Spectral Bands; Advanced Very High Resolution Radiometer; Imaging Techniques; Image Classification

20000032308 North Carolina Agricultural and Technical State Univ., Dept. of Computer Science, Greensboro,NC USA

The Deontic Transaction Model in Multi-Agent Normative Systems

Huang, Yonghua, North Carolina Agricultural and Technical State Univ., USA; Esterline, Albert, North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 842-847; In English; See also 20000032189

Contract(s)/Grant(s): NAG5-4102; NAG2-1150

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In the area of multi-agent systems, much research is devoted to the coordination of the agents. There exist several issues, two of which are summarized. The first is that, although agents are said to be autonomous, they always react in a predictable way to each message, and they cannot decide to violate the conventions that are hard-wired into the protocol. In fact, there might be circumstances in which the agent violates a convention in order to realize a private goal that it considers to be more important. Another issue is that, if the protocols that agents use to react to the environment are fixed, they have no way to respond to changes. However, an important characteristic of agents is that they eon react to a changing environment. Although transaction models ([BOH92], [GR93]) evolved from the database domain, they establish a general execution paradigm that ideally covers all the subsystems invoked in a sequence of transactions. So transaction models apply to multi-agent systems. Recently, some research has been devoted to overcoming the limitations of the traditional transaction models which are suitable for conventional systems and focus on system integrity, e,g., [SJ97]. Here we solve above issues by turning to a deontic concept: obligation. In multi-agent systems, agents interact with each other according to norms, We use deontic logic ([And58], [Aqv84], [B C96], [JS94], [MW93]) to model norms. Here the norms prescribe how the agents ought to behave, but-- and this is essential-- they do not exclude the possibility of ”bad” behavior (i.e., the actual behavior may deviate from the ideal), and so they also prescribe what should be done in circumstances of norm violation. Thus, we propose a new approach --- a deontic transaction model for multi-agent normative systems. Our approach improves the protocol of ”abort/commit” of traditional transaction models to a protocol of ”abort/exception/commit”. In multi-agent normative systems, we can see the violation of a norm as an exception and how the other agents react to the violation as exception handling. This paper concentrates on our formal model.

Derived from text

Mathematical Models; Protocol (Computers); Autonomy; Artificial Intelligence; Norms; Software Development Tools

20000032318 Tennessee State Univ., NASA Center for Automated Space Science, Nashville, TN USA

Sufficient Conditions for the Stability of a Lur’e System With Two Nonzero Inputs Based on Lyapunovs Direct Method

Adetona, Olawale, Tennessee State Univ., USA; Sathananthan, Sivapragasm, Tennessee State Univ., USA; Garcia, Ephrahim, Vanderbilt Univ., USA; Keel, Lee H., Tennessee State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes

2 and 3, pp. 312-317; In English; See also 20000032189
Contract(s)/Grant(s): NCC5-228
Report No.(s): 98URC057; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The Lur'e problem is a famous problem in nonlinear control theory. The analysis of this system is usually restricted to Lur'e systems in which the external input is zero. One form of this problem involves the stability analysis of the Lur'e system with two nonzero inputs. The stability analysis of this type of system is traditionally performed based on L stability theory. The objective of this paper is to present sufficient conditions for the stability of this system based on Lyapunov's direct method. This is a conceptually simpler approach to the existing analysis based on L stability theory and it provides some additional information about the stability of the system.

Author

Control Theory; Nonlinear Systems; Liapunov Functions; Stability Tests

20000032352 New Mexico Highlands Univ., Dept. of Engineering, Las Vegas, NM USA

Experiment with Robust Fuzzy Controller using Delta-Sigma Modulation

Payton, Jeremy, New Mexico Highlands Univ., USA; Peterson, Tim, New Mexico Highlands Univ., USA; Zrilic, Djuro, New Mexico Highlands Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 406-410; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

An experiment, which combines a fuzzy logic controller and proportional controller with delta-sigma modulation, was performed. to demonstrate the robust performance of the proposed system, we have built an experimental model to control the temperature of a plant chamber. Set point responses were plotted for system response with and without disturbances. It was proven that the combined system of fuzzy and proportional control with delta-sigma modulation has a significant advantage over conventional control in the presence of external disturbances.

Author

Fuzzy Systems; Proportional Control; Controllers; Delta Modulation

20000032353 BEI Sensors and Systems Co., Sylmar, CA USA

General Solutions for a Carrier Based Phase-Locked Loop Servo Normalized for Type II and Type III Systems

Jumper, John M., BEI Sensors and Motion Systems Co., USA; Madni, Asad M., BEI Sensors and Systems Co., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 411-421; In English; See also 20000032189; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche; C01, CD-ROM

The carrier based phase-locked loop system is unique in it's ability to provide accurate rate control over a wide range of velocities including zero. The design of this type of servo system if viewed as a unique application is a complex and formidable design problem. However, there are an infinite number of general solutions to the phase-locked loop design problem. Presented in this paper are normalized general solutions that apply to all cases of "idealized" carrier based phase-locked loop type II and type III systems, referred to as the Ultra-Loco. A detail hardware design and principle of operation of this system was presented by the authors at the 1997 NASA URC Technical Conference held in February in Albuquerque, New Mexico. This system was the basis of the extremely slow motion servo control technique used in the Hubble Space Telescope's (HST) Star Selector Servo Subsystem (SSSS).

Author

Phase Locked Systems; Phase Control; Control Theory; Servomechanisms

20000032356 Texas Univ., Pan-American Center for Earth and Environmental Studies, El Paso, TX USA

Visualizing and Classifying Satellite Imagery with Neural Networks

Penn, Brian S., Texas Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and3, pp. 431-436; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Circa 1980 satellite technology such as NASA's LANDSAT 4 & 5's Thematic Mapper (TM) imagery is restricted in spectral, spatial, and radiometric resolution to is less than 1 micrometer 30 m, and 8-bits; respectively. At the time of their launches, these multispectral sensors were "state-of-the-art" with seven bands, or slices, of the electromagnetic spectrum. Plans for new satellites include resolutions of 10 nm spectrally, 1 m spatially, and 12-bits radiometrically. These types of sensors will gather Gigabytes of data. Current analytical approaches, especially those requiring human interaction, are inadequate to process and analyze these

quantities of data as evidenced by the fact that greater than 95% of the more than 3 million LANDSAT images have not been seen by human eyes (Augusteijn and Dimalanta, 1992).
Derived from text
Satellite Imagery; LANDSAT 4; LANDSAT 5; Thematic Mappers (LANDSAT); Thematic Mapping

20000032360 Tennessee State Univ., NASA Center for Automated Space Science, Nashville, TN USA
Robust Control Design for Flexible Structures with Identified Parameter Uncertainty
Ahmad, Samir S., Tennessee State Univ., USA; Lew, Jiann–Shiun, Tennessee State Univ., USA; Keel, Lee H., Tennessee State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 451-456; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

This paper presents a robust control synthesis for large flexible structures with identified parameter uncertainty. The identified parameters are obtained by applying system identification algorithms to analyze the time-domain response data. The uncertainty of the identified parameters can be from environmental changes, equipment noise, and unmodeled dynamics, etc. The system with parameter uncertainty is modeled as an interval transfer function, which is a model set of bounded transfer function coefficients. The robust control algorithm is based on a mu-synthesis control technique for the interval transfer function. The effect of the identified parameter uncertainty on the performance of the designed controller is discussed. A 20-bay truss structure is used for the study.
Author
Robustness (Mathematics); Control Theory; Control Systems Design; Design Analysis; Controllers

20000032579 NASA Langley Research Center, Hampton, VA USA
Robust Control of Uncertain Systems via Dissipative LQG-Type Controllers
Joshi, Suresh M., NASA Langley Research Center, USA; March 2000; 18p; In English
Contract(s)/Grant(s): RTOP 706-11-21-02
Report No.(s): NASA/TM-2000-209866; NAS 1.15:209866; L-17961; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Optimal controller design is addressed for a class of linear, time-invariant systems which are dissipative with respect to a quadratic power function. The system matrices are assumed to be affine functions of uncertain parameters confined to a convex polytopic region in the parameter space. For such systems, a method is developed for designing a controller which is dissipative with respect to a given power function, and is simultaneously optimal in the linear-quadratic-Gaussian (LQG) sense. The resulting controller provides robust stability as well as optimal performance. Three important special cases, namely, passive, norm-bounded, and sector-bounded controllers, which are also LQG-optimal, are presented. The results give new methods for robust controller design in the presence of parametric uncertainties.
Author
Linear Quadratic Gaussian Control; Convexity; Linear Systems; Invariance

20000032943 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Optimal Control with an Autonomous Distributed System for an Insect Walking Robot
Akimoto, Kazushi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 47-50; In Japanese; Copyright; Avail: Issuing Activity

Based on the principle of biological control system, we designed a walking control system of a hexapod-walking robot which can generate gait patterns optimizing energy efficiency depending on walking velocity and external load. This system was hypothesized to have the rule that each leg autonomously optimized its own energy efficiency, and have the cooperative and/or competitive interaction among legs. The principle of the autonomous distributed system proposed here will be the new dynamic method to solve the optimization problem that an objective function is undefined in advance, and it may be applicable to various optimal control system working in the real world.
Author
Optimal Control; Robots; Control Systems Design; Distributed Parameter Systems

20000032997 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on a Variable Step-Size Algorithm Using Fuzzy Logic for an Acoustic Echo-Canceler
Muto, Kenji, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 197-200; In Japanese; Copyright; Avail: Issuing Activity

A new algorithm for achieving fast adaptation of echo-canceler to be used in a teleconference system and a hand-free telephone system to a sudden change in an impulse response from a loudspeaker to a microphone was proposed in this paper. In this algorithm a step-size for gain is sequentially controlled based on the fuzzy logic where the square error and its changing rate are used for estimating the amount of alteration of the step-size. In addition, a method for automatically designing a fuzzy set appropriate for fast adaptation of the system were also proposed. The results of computer simulation show that the proposed methods can provide faster convergence of the system against a sudden change in an impulse response from a loud-speaker to a microphone than the existing methods.
Author
Echo Suppressors; Fuzzy Systems; Impulses; Loudspeakers; Sound Waves

20000033031 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Parallel Optical Neural Computing using Liquid Crystal
Kushara, Akihiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 333-334; In Japanese; Copyright; Avail: Issuing Activity
In this paper, the incoherent light system with liquid crystal devices designed the shift and rotation invariant recognition systems which composed the neural network. It can be achieved according to an easy composition and practicable accuracy. It can be said that this system which can do invariable recognition of the shift and the rotation recognition in real time has enough superiority for the electronic computer or the coherent light system.
Author
Liquid Crystals; Neural Nets; Optical Computers; Coherent Light

20000033043 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
An Optimal Control Method for a Hyper-Multi-Joint Manipulator using Genetic Algorithm
Nishimura, Tsunehiko, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 283-284; In Japanese; Copyright; Avail: Issuing Activity
A control method for a multi-joint manipulator whose workspace includes several obstacles is proposed. The control of manipulators requires motion planning which can be divided into two parts, 'Path planning' and 'Collision-free sequence generation'. In general, motion planning for multi-joint manipulators is difficult because multi-joint manipulators can take various orientations. We apply Genetic Algorithm(GA) to 'Collision-free sequence generation' and obtain the sequence of the movement. Not only does the sequence of movement lead the tip of a manipulator to the target point, but also it avoids any collisions with obstacles. The effectiveness of the proposed method is evaluated through computer simulations.
Author
Genetic Algorithms; Manipulators; Optimal Control; Computerized Simulation

20000033058 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Complexity Control Methods for Recurrent Neural Networks
Sakai, Masao, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 249-250; In Japanese; Copyright; Avail: Issuing Activity
This paper presents that a dynamical complexity of recurrent neural networks can be controlled by our gradient-based method. An essential core of our method is calculation of the complexity and its partial derivative of the network parameters such as connection weights. The complexity, i.e., the largest Lyapunov exponent, is computed by observing the state transition for a long-term period. Simulation results show that the proposed method can make the exponent converge to desired values. In addition the networks can learn not only the target time series, but also the exponent of the target by a combination method which is incorporated the proposed control method into the conventional learning algorithm.
Author
Neural Nets; Liapunov Functions; Dynamical Systems

20000033071 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Learning Ability of Boltzmann Machine with Clock Neurons
Matsumoto, Yoshiyuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 381-382; In Japanese; Copyright; Avail: Issuing Activity
We define a new artificial neural network with clock neurons. Learning ability for the Boltzmann machine of the network is investigated by using a mean field approximation. Computer simulations are performed in order to learn two kinds of mappings: a continuous function and a function with a discontinuous point. We find that the performance of the network with the clock

neurons is better than that of the network with rotor neurons. The clock neuron is generalized to a d-dimensional clock neurons for d is greater than or = 3. Robot motion planning problems are investigated by using a network with the clock neurons and a network with 3-dimensional clock neurons. The generalization ability is also discussed.
Author
Machine Learning; Neural Nets; Neurons; Robot Dynamics; Trajectory Planning

20000033136 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Enhancing Method of Nonlinear Characteristics of Neural Networks
Nakagawa, Tomoyuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 281-282; In Japanese; Copyright; Avail: Issuing Activity
This paper presents a method to develop neural networks having nonlinear characteristics without many neurons. We propose a multi-modal neural network (MNN) which consists of preprocessing module and multilayer neural network module. The first module transforms input signals into spectra by Chebyschev polynomials. The outputs of the first module are used for inputs of the second module. We have two experiments to confirm the effectiveness of the proposed method. One is functional approximation and the other is pattern recognition. The results show that the preprocessing module is effective to reduce the number of neurons for MNN. As an application to control, we apply MNN to making controllers for cart-pole balancing system The results show that MNN is useful for making controllers compared with conventional neural networks.
Author
Method of Characteristics; Neural Nets; Pattern Recognition; Preprocessing; Transformations (Mathematics); Nonlinearity

20000033145 Eidgenoessische Technische Hochschule, Zurich, Switzerland
Workshop: Future Directions in Systems and Control Theory, Volume 3, Viewgraphs
Morari, Manfred; Bemporad, Alberto; Ferrari–Trecate, Giancarlo; Mignone, Domenico; Torrisi, Fabio Danilo; Jun. 23, 1999; 188p; In English
Report No.(s): AD-A373776; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
This report contains several reports concerning future directions in systems and control theory.
DTIC
Control Theory; Mathematical Models; Hybrid Computers; Artificial Intelligence; Adaptive Control

20000033146 Porto Univ., Portugal
Workshop: Future Directions in Systems and Control Theory, Volume 4, Viewgraphs
Brockett, Roger; Jun. 23, 1999; 120p; In English, 22-25 Jun. 1999, Cascais, Portugal
Report No.(s): AD-A373777; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
This report contains several reports concerning future directions in systems and control theory.
DTIC
Control Theory; Adaptive Control; Artificial Intelligence; Mathematical Models; Neural Nets

20000033187 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Spatiotemporal Memorization Using a Neural Network
Ishida, Fumihiko, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 487-488; In Japanese; Copyright; Avail: Issuing Activity
We propose a spatiotemporal memorization model 'episode-prediction model', to realize 'prediction' of the external world, which is one of the important brain function. This model has three components, two spatial learning parts and one temporal learning part. For the temporal learning part we present a new learning algorithm in continually running fully recurrent neural networks(RNN) to make dynamics of the network approximate vector field that dynamics of a teacher signal gives. We show fundamental features of the algorithm by computer simulation.
Author
Mathematical Models; Neural Nets; Memory; Spatial Dependencies; Temporal Distribution

20000033445 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Study on Mobile Robot Localization Using Ultrasonic Sensors
Zhao, Feng–Ji, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 9-12; In English; Copyright; Avail: Issuing Activity

A fundamental task for an autonomous mobile robot is that of localization. Determining the position of the robot in the environment is known as a robot localization problem. In present study, three methods are considered for a mobile robot to localize itself in an indoor environment. These methods are that the robot localizes itself using a matching technique, and compares the response data with a priori map containing the geometric elements.
Author
Robots; Ultrasonics; Position (Location)

20000033458 National Tsing Hua Univ., Dept. of Power Mechanical Engineering, Hsinchu, Taiwan, Province of China
Robust Adaptive Fuzzy Control for Nonlinear Systems with Non-Minimum Phase
Chen, Chaio–Shiung, National Tsing Hua Univ., Taiwan, Province of China; Chen, Wen–Liang, National Tsing Hua Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Nov. 1997; ISSN 0253-3839; Volume 20, No. 6, pp. 681-691; In English; Copyright; Avail: Issuing Activity

This paper presents a robust adaptive fuzzy control scheme for the stabilization of nonlinear systems with non-minimum phase. Generally, while straightforward application of the feedback linearization technique to a non-minimum phase system results in a linear input-output response, the associated internal dynamics are unstable. The proposed scheme employs a fuzzy system to adaptively compensate for the plant nonlinearities and forces the plant output to asymptotically track the output of a prespecified reference model, which can stabilize the internal dynamics. When matching with the model occurs, the plant output will converge to the origin and the internal dynamics can be simultaneously stabilized. The stability and the tracking error asymptotically convergent to a predetermined boundary are established via Lyapunov's stability theorem. Experiments on an inverted wedge system are given to show the effectiveness of the proposed scheme.
Author
Adaptive Control; Nonlinear Systems; Fuzzy Systems; Feedback; Linearization; Liapunov Functions

20000033467 Massachusetts Univ., Multimedia Indexing and Retrieval Group, Amherst, MA USA
Approximating Action-Value Functions: Addressing Issues of Dynamic Range
Harmon, Mance E.; Dec. 17, 1998; 34p; In English
Report No.(s): AD-A374186; AFIT-FY00-18; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Function approximation is necessary when applying RL to either Markov decision processes (MDPs) or semi-Markov decision processes (SMDPs) with very large state spaces. An often overlooked issue in approximating Q-functions in either framework arises when an action value update in a given state causes a large policy change in other states. Another way of stating this is to say that a small change in the Q-function results in a large change in the implied greedy policy. We call this sensitivity to changes in the Q-function the dynamic range problem and suggest that it may result in greatly increasing the number of training updates required to accurately approximate the optimal policy. We demonstrate that Advantage Learning solves the dynamic range problem in both frameworks and is more robust than some other RL algorithms on these problems. For an MDP, the Advantage Learning algorithm addresses this issue by re-scaling the dynamic range of action values within each state by a constant. For SMDPs the scaling constant can vary for each action.
DTIC
Artificial Intelligence; Markov Processes; Machine Learning

64
NUMERICAL ANALYSIS

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

20000032291 California State Univ., Dept. of Mechanical Engineering, Los Angeles, CA USA
Development of Multi-Disciplinary Finite Element Method Analysis Courses at California State University, Los Angeles
McKinney, John, California State Univ., USA; Wu, Chivey, California State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 789-794; In English; See also 20000032189
Report No.(s): 98URC141; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The NASA Dryden Flight Research Center (DFRC) Partnership Awards Grant to California State University, Los Angeles (CSULA) has two primary goals that help to achieve NASA objectives. The overall objectives of the NASA Partnership Awards are to create opportunities for joint University NASA/Government sponsored research and related activities. One of the goals of the grant is to have university faculty researchers participate and contribute to the development of NASA technology that supports

NASA goals for research and development (R&D) in Aeronautics and Astronautics. The other goal is technology transfer in the other direction, where NASA developed technology is made available to the general public and more specifically, targeted to industries that can profit from utilization of government developed technology. This years NASA Dryden Partnership Awards grant to CSULA entitled, "Computer Simulation of Multi-Disciplinary Engineering Systems", has two major tasks that satisfy overall NASA objectives. The first task conducts basic and applied research that contributes to technology development at the Dryden Flight Research Center. The second part of the grant provides for dissemination of NASA developed technology, by using the teaching environment created in the CSULA classroom. The second task and how this is accomplished is the topic of this paper. The NASA STARS (Structural Analysis Routines) computer simulation program is used at the Dryden center to support flight testing of high-performance experimental aircraft and to conduct research and development of new and advanced Aerospace technology.
Derived from text
Finite Element Method; Multidisciplinary Research; Computerized Simulation; Systems Engineering; NASA Programs; Aeronautics

20000032317 North Carolina Agricultural and Technical State Univ., Dept. of Computer Science, Greensboro, NC USA
Formal Modeling of Multi-Agent Systems using the Pi-Calculus and Epistemic Logic
Rorie, Toinette, North Carolina Agricultural and Technical State Univ., USA; Esterline, Albert, North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 872-877; In English; See also 20000032189
Contract(s)/Grant(s): NAG5-4102; NAG2-1150
Report No.(s): 98URC155; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
Multi-agent systems have become important recently in computer science, especially in artificial intelligence (AI). We allow a broad sense of agent, but require at least that an agent has some measure of autonomy and interacts with other agents via some kind of agent communication language. We are concerned in this paper with formal modeling of multi-agent systems, with emphasis on communication. We propose for this purpose to use the pi-calculus, an extension of the process algebra CCS. Although the literature on the pi-calculus refers to agents, the term is used there in the sense of a process in general. It is our contention, however, that viewing agents in the AI sense as agents in the pi-calculus sense affords significant formal insight. One formalism that has been applied to agents in the AI sense is epistemic logic, the logic of knowledge. The success of epistemic logic in computer science in general has come in large part from its ability to handle concepts of knowledge that apply to groups. We maintain that the pi-calculus affords a natural yet rigorous means by which groups that are significant to epistemic logic may be identified, encapsulated, structured into hierarchies, and restructured in a principled way. This paper is organized as follows: Section 2 introduces the pi-calculus; Section 3 takes a scenario from the classical paper on agent-oriented programming [Sh93] and translates it into a very simple subset of the n-calculus; Section 4 then shows how more sophisticated features of the pi-calculus may bc brought into play; Section 5 discusses how the pi-calculus may be used to define groups for epistemic logic; and Section 6 is the conclusion.
Author
Mathematical Models; Formalism; Knowledge Bases (Artificial Intelligence); Calculus; Communicating

20000032321 NASA Lewis Research Center, Cleveland, OH USA
Acceleration of Logarithmic Convergence
Gaskin, J. G., State Univ. of New York, USA; Ford, W. F., NASA Lewis Research Center, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 318-321; In English; See also 20000032189
Report No.(s): 98URC058; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM
In this paper, we shall give a characterization of all monotonically decreasing sequence of positive terms, whose sum converge and then introduce a Transformation which can be used to accelerate the convergence of a large class of logarithmically convergent series.
Author
Convergence; Theorems; Nonlinearity; Logarithms

20000032345 North Carolina Agricultural and Technical State Univ., Center for Aerospace Research, Greensboro, NC USA
Eigenvalue Eigenvector Constraint based Sufficient Bound for Root Clustering in Circular Regions
Kumar, Ashok, North Carolina Agricultural and Technical State Univ., USA; Ferguson, Frederick, North Carolina Agricultural

and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 366-369; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

In eigenvalue analysis with real parametric uncertainties in a matrix, robust root clustering focus on finding bounds on real parametric uncertainties which preserve the perturbed eigenvalues in specific subregions of our interest in complex plane. Such bounds analyzed in literature evolves from different strategies. In this paper, we present eigenvalue-eigenvector constraint based bounds for root clustering in circular regions. The bounds presented here are less conservative than the existing bounds.
Author

Eigenvalues; Eigenvectors; Cluster Analysis; Pattern Recognition

20000032346 Agricultural and Technical Coll. of North Carolina, NASA Autonomous Control Engineering Center, Greensboro, NC USA

Approximation of Multi-Valued Inverse Functions Using Clustering and Sugeno Fuzzy Inference

Walden, Maria A., Agricultural and Technical Coll. of North Carolina, USA; Bikdash, Marwan, Agricultural and Technical Coll. of North Carolina, USA; Homaifar, Abdollah, Agricultural and Technical Coll. of North Carolina, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 369-375; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Finding the inverse of a continuous function can be challenging and computationally expensive when the inverse function is multi-valued. Difficulties may be compounded when the function itself is difficult to evaluate. We show that we can use fuzzy-logic approximators such as Sugeno inference systems to compute the inverse on-line. to do so, a fuzzy clustering algorithm can be used in conjunction with a discriminating function to split the function data into branches for the different values of the forward function. These data sets are then fed into a recursive least-squares learning algorithm that finds the proper coefficients of the Sugeno approximators; each Sugeno approximator finds one value of the inverse function. Discussions about the accuracy of the approximation will be included.
Author

Least Squares Method; Inversions; Functions (Mathematics)

20000032578 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Nondestructive evaluation using a reduced order computational methodology *Final Report*

Joyner, Michele L., Institute for Computer Applications in Science and Engineering, USA; Banks, H. T., Institute for Computer Applications in Science and Engineering, USA; Wincheski, Buzz, NASA Langley Research Center, USA; Winfree, William P., NASA Langley Research Center, USA; March 2000; 22p; In English

Contract(s)/Grant(s): NAS1-97046; F49620-98-I-0430; F49620-98-I-0180; NGT-1-52196; RTOP 505-90-52-01

Report No.(s): NASA/CR-2000-209870; NAS 1.26:209870; ICASE-2000-10; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper uses eddy current based techniques and reduced order modeling to explore the feasibility of detecting a subsurface damage in structures such as air foils and pipelines. to identify the geometry of a damage, an optimization algorithm is employed which requires solving the forward problem numerous times. to implement these methods in a practical setting, the forward algorithm must be solved with extremely fast and accurate solution methods. Therefore, our computational methods are based on the reduced order Karhunen-Loeve or Proper Orthogonal Decomposition (POD) techniques. For proof-of-concept, we implement the methodology on a 2-D problem and the methods to be efficient and robust even with data containing 10% relative noise. Furthermore, the methods are fast; our findings suggest we can reduce the computational time on average by a factor of 3000.
Author

Nondestructive Tests; Computation; Eddy Currents; Damage; Detection; Surface Defects

20000032620 Saitama Inst. of Tech., Saitama, Japan

On the Degree of Elements of Periodic Semigroups

Sato, Shun, Saitama Inst. of Tech., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 69-71; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The notion of the degree of elements of periodic semigroups is defined. We describe several results about related properties of periodic semigroups.
Author
Group Theory; Subgroups; Field Theory (Algebra)

20000032928 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on a Noncrossing Forest in Plane Graphs
Masubuchi, Daisuke, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 445-446; In Japanese; Copyright; Avail: Issuing Activity
Given a biconnected plane graph G = (V,E) and a family U of k disjoint vertex sets {U(sub 1),U(sub 2),....U(sub k)} our algorithm finds a noncrossing Steiner forest which is a set T of k Steiner trees {T(sub 1),T(sub 2),....T(sub k)} such that each T(sub i) in T has all vertices of U(sub i) and every two trees in T do not cross each other. This algorithm runs in O(n log n) time in the case that all vertices of U(sub i) in U are on at most two faces of G.
Author
Algorithms; Graph Theory; Trees (Mathematics)

20000033005 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Multiple Scaling Processes Describing Dynamical Properties of Complex Systems
Lee, Sang Seok, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 161-164; In English; Copyright; Avail: Issuing Activity
In this thesis, we deal with dynamical behaviors of complex systems and consider multiple scaling processes to describe their dynamical behaviors. The multiple scaling processes consist of the same form of a set of equations under the scale transformation and iterated rules. With the aid of multiple scaling processes, we investigate a long time tail behavior of fault systems and serial position effect of neural network systems. We expect that multiple scaling processes will be a useful method to understand dynamics of complex systems.
Author
Complex Systems; Dynamical Systems; Scaling; Fail-Safe Systems

20000033137 NASA Goddard Inst. for Space Studies, New York, NY USA
Single-Expansion EBCM Computations for Osculating Spheres
Mishchenko, Michael I., NASA Goddard Inst. for Space Studies, USA; Videen, Gorden, Army Research Lab., USA; Journal of Quantitative Spectroscopy and Radiative Transfer; 1999; ISSN 0022-4073; Volume 63, pp. 231-236; In English
Report No.(s): GCN-99-37; Copyright; Avail: Issuing Activity
We show that the standard, single-expansion extended boundary condition method provides convergent scattering results for osculating dielectric spheres and discuss the implications of this result.
Author
Boundary Conditions; Expansion; Matrices (Mathematics); S Matrix Theory

20000033193 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Drawing of Plane Graphs with Prescribed Face Areas
Hada, Kazuyoshi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 439-440; In Japanese; Copyright; Avail: Issuing Activity
In this thesis we consider a drawing of a plane graph G in which the contour of each inner face of G is drawn as a rectilinear polygon with prescribed area, and the contour of the outer face of G is drawn as a rectangle with area equal to the sum of the prescribed areas of all inner faces of G. We want to keep the shape of each rectilinear polygon as simple as possible. Such a drawing has practical applications in VLSI floorplanning. We give a linear time algorithm to find such drawings of cyclically 5-edge connected cubic plane graphs where a rectilinear polygon corresponding to an inner face has at most eight corners.
Author
Algorithms; Graph Theory; Polygons

20000033701 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Parallel performance investigations of an unstructured mesh Navier-Stokes solver ***Final Report***
Mavriplis, Dimitri J., Institute for Computer Applications in Science and Engineering, USA; March 2000; 46p; In English
Contract(s)/Grant(s): NAS1-97046; B347882; AF-AFOSR-0005-99; RTOP 505-90-52-01

Report No.(s): NASA/CR-2000-210088; NAS 1.26:210088; ICASE-2000-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A Reynolds-averaged Navier-Stokes solver based on unstructured mesh techniques for analysis of high-lift configurations is described. The method makes use of an agglomeration multigrid solver for convergence acceleration. Implicit line-smoothing is employed to relieve the stiffness associated with highly stretched meshes. A GMRES technique is also implemented to speed convergence at the expense of additional memory usage. The solver is cache efficient and fully vectorizable, and is parallelized using a two-level hybrid MPI-OpenMP implementation suitable for shared and/or distributed memory architectures, as well as clusters of shared memory machines. Convergence and scalability results are illustrated for various high-lift cases.
Author

Navier-Stokes Equation; Unstructured Grids (Mathematics); Multigrid Methods; Reynolds Averaging; Parallel Processing (Computers); Aerodynamic Configurations; Finite Volume Method

65
STATISTICS AND PROBABILITY

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

20000032983 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of Sort-Term Prediction in Nonlinear Systems by a Methodology of Synchronization

Hasegawa, Takeshi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 239-240; In Japanese; Copyright; Avail: Issuing Activity

This paper demonstrates that time series of chaotic systems can be estimated with sufficient accuracy by new methodology of synchronization in chaotic systems. An essential core of this methodology is to use intermittent driving signals. The average of permissible intervals, after which the series can not be estimated with desired accuracy without driving signals, is given by the Lyapunov exponent of the systems. Simulation results show that our methodology can estimate the series for longer time periods than conventional one.
Author

Nonlinear Systems; Synchronism; Chaos; Prediction Analysis Techniques; Dynamical Systems

20000033068 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

On-Line Estimation of Hidden Markov Models

Ueki, Kazuya, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 389-390; In Japanese; Copyright; Avail: Issuing Activity

The hidden Markov model has been used to build efficiently and automatically statistical representations of related sequences. In this study, we present a new on-line algorithm, based on Baum-Welch batch algorithm, for parameter estimation of hidden Markov models and evaluate the algorithm experimentally. We show that our on-line algorithm has a good performance comparable to the one due to Baum-Welch batch algorithm. We also show experimentally that, by observing output sequences produced by an hidden Markov model, the algorithm is able to adapt to the performance of the underlying hidden Markov model that may change its performance.
Author

Algorithms; On-Line Systems; Sequencing; Markov Processes

20000033070 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Edge Detection by Using Mean Field Approximation and its Evaluation

Yamakawa, Hideki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 383-384; In Japanese; Copyright; Avail: Issuing Activity

In the present paper, we investigate the edge detection within a framework of statistical mechanics and propose a quantity eta which is a measure of evaluating the edge detection. We define an energy function for the edge detection as a constrained optimal problem. The edge is detected by using a mean-field approximation annealing method and also by using a cluster approximation annealing method. We find that the quantity eta works well as the measure of evaluating the edge detection.
Author

Edge Detection; Statistical Mechanics; Simulated Annealing; Approximation

20000033152 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Computer Generation of Statistical Distributions ***Final Report, Oct. 1998-Aug. 1999***
Saucier, Richard; Mar. 2000; 122p; In English
Report No.(s): AD-A374109; ARL-TR-2168; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report presents a collection of computer-generated statistical distributions which are useful for performing Monte Carlo simulations. The distributions are encapsulated into a C++ class, called ”Random”, so that they can be used with any C++ program. The class currently contains 27 continuous distributions, 9 discrete distributions, data-driven distributions, bivariate distributions, and number-theoretic distributions. The class is designed to be flexible and extensible, and this is supported in two ways: (1) a function pointer is provided so that the user-programmer can specify an arbitrary probability density function, and (2) new distributions can be easily added by coding them directly into the class. The format of the report is designed to provide the practitioner of Monte Carlo simulations with a handy reference for generating statistical distributions. However, to be self-contained, various techniques for generating distributions are also discussed, as well as procedures for estimating distribution parameters from data. Since most of these distributions rely upon a good underlying uniform distribution of random numbers, several candidate generators are presented along with selection criteria and test results. Indeed, it is noted that one of the more popular generators is probably overused and under what conditions it should be avoided.
DTIC
Probability Distribution Functions; Monte Carlo Method; Computer Techniques; Probability Theory; Random Numbers

20000033411 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Robust Regional Eigenvalue-Clustering Analysis for Linear Perturbed Discrete Time-Delay Systems
Hsieh, Chen–Huei, National Yun-Lin Univ. of Science and Technology, Taiwan, Province of China; Chou, Jyh–Horng, National Kaohsiung Inst. of Tech., Taiwan, Province of China; Wu, Ying–Jeng, National Yun-Lin Univ. of Science and Technology, Taiwan, Province of China; Journal of the Chinese Institute of Engineers; 2000; ISSN 0253-3839; Volume 23, No. 1, pp. 125-130
Contract(s)/Grant(s): NSC-88-2213-E224-029; Copyright; Avail: Issuing Activity

In this work, under the assumption that all the eigenvalues of the linear nominal discrete time-delay system lie within certain specified regions, a sufficient condition is proposed to preserve the assumed property when structured parameter perturbations are added into the linear nominal discrete time-delay system. No restriction is imposed on the shapes of the specified region. When all the eigenvalues are required to locate in stable regions, the proposed criterion will become the stability robustness criterion. For the case of a circular region, two examples are given to show, numerically, that the proposed criterion may obtain better results than those reported recently.
Author
Robustness (Mathematics); Eigenvalues; Cluster Analysis; Linear Systems; Time Lag

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

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

20000032382 Turkish Naval Academy, Istanbul, Turkey
Flight Optimization in Reconnaissance Missions
Oner, Adalet, Turkish Naval Academy, Turkey; Kayaligil, Sinan, Middle East Technical Univ., Turkey; Modelling and Analysis of Command and Control; June 1999, pp. 22-1 - 22-15; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

There are multiple surface units (targets) detected earlier by radars in a particular sea area. An observer (an air vehicle) will try to identify those moving targets by passing them within the specified identification range of its sensors to maximize the flow rate of information coming from identification. A Branch and Bound algorithm is proposed to optimize the flight pattern of the observer.
Author
Command and Control; Reconnaissance; Detection; Target Recognition; Surveillance; Flight Optimization

20000033150 Electronics Research Lab., Salisbury Australia
Military Information Operations Analysis Using Influence Diagrams and Coloured Petri Nets
Staker, R. J.; Dec. 1999; 78p; In English
Report No.(s): AD-A373934; DSTO-TR-0914; DODA-AR-011-162; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report describes how Influence Diagrams, Coloured Petri Net models and related techniques may be used to analyse certain aspects of Military Information Operations. An example is employed to demonstrate these techniques. The example used is a very simplified representation of a Military Command Organization dealing with a decision problem. The objective of the report is to provide theory, methods and techniques to support the assessment of the effect of Military Information Operations on such organisations. The simplicity of the example permits the basic concepts to be clearly conveyed. They may readily be extended to the analysis of more complex examples as required. The most fundamental and significant concept developed in this report is that of a common quantitative measure of effectiveness that encompasses all types of Information Operations relevant to Information Warfare. This permits the direct comparison of the effectiveness of alternative Information Operation options with one another and also with conventional operations options. This latter ability is essential if Information Operations are to be employed appropriately as part of a broader range of military options.
DTIC
Military Operations; Petri Nets

20000033464 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Towards a Game Theory Model of Information Warfare
Burke, David A.; Nov. 1999; 116p; In English
Report No.(s): AD-A374162; AFIT/GSS/LAL/99D-1; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The repeated game of incomplete information model, a subclass of game theory models, was modified to include aspects of information warfare. The repeated game of incomplete information model was first developed to analyze nuclear weapons disarmament negotiations. The central role of information in this model suggested its applicability to IW, which focuses on the defense and acquisition of information. A randomized experimental design was utilized to determine how people behave in a laboratory IW setting and to test the IW game model's basic predictions. The impact of experience and learning on IW performance was also assessed during the experiment. IW experience and devices that support learning during an IW engagement improved performance in some situations. The IW game theory model was shown to have some predictive capability and, with further development, could support further IW analysis and simulation.
DTIC
Game Theory; Nuclear Weapons; Information Theory; Warfare

67
THEORETICAL MATHEMATICS

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

20000032347 Alabama A & M Univ., Dept. of Computer Science, Huntsville, AL USA
Efficient Computation of Binomial Coefficients and Applications
Zhang, Xiao–Ying, Alabama A & M Univ., USA; Li, Yong–Ming, Intergraph Corp., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 376-381; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
Binomial coefficients can be computed very efficiently by the construction of Pascal triangle. Analogous to this construction, we shall derive efficient methods to compute b(sub k) = SIGMA(sup k, sub i=0) C(sup i, sub k)a(sub i) etc. Practical applications of such methods include polynomial basis conversion, reparameterization, and sub division.
Author
Binomial Coefficients; Factorials

20000032942 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Binocular Stereopsis Including a Global Constraint
Sato, Naoyuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 51-54; In Japanese; Copyright; Avail: Issuing Activity
The binocular correspondence problem was solved by implementing the uniqueness constraint and the continuity constraint, as proposed by Marr et al. However, these constraints are not sufficient to define the proper correspondence uniquely. With these constraints, random-dot-stereograms (RDSs), consisting of the periodic textures in each image, are treated as a correspondence of surfaces composed of patches of alternating values of disparity. This is quite different from the surface we perceive through the RDSs, that is a surface characterized by a single depth. Because these constraints are local, they cannot produce the global

optimum of correspondence. To obtain the global optimum of correspondence, we propose a model of binocular stereopsis in which a global measure of correspondence is explicitly employed. The model consists of two hierarchical systems. First, the lower system processes various correspondences based on the uniqueness constraint. Second, the higher system provides a global measure of correspondence for the disparity in question. The higher system uniquely determines the global optimum of correspondence in the lower system through the recurrent loop between hierarchical systems. The convergence of the recurrent loop is determined by the consistency between the hierarchical systems. The condition is termed the 'global consistency constraint.'
Author
Binocular Vision; Stereoscopic Vision; Uniqueness

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.

20000032100 Analex Corp., Cleveland, OH USA
Three-Dimensional Simulations of Electron Beams Focused by Periodic Permanent Magnets
Kory, Carol L., Analex Corp., USA; [1999]; 16p; In English; International Conference on Plasma Sciences (ICOPS), 20-24 Jun. 1999, Monterey, CA, USA; Sponsored by Institute of Electrical and Electronic Engineers, USA
Contract(s)/Grant(s): NAS3-27600; RTOP 632-50-5D; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A fully three-dimensional (3D) model of an electron beam focused by a periodic permanent magnet (PPM) stack has been developed. First, the simulation code MAFIA was used to model a PPM stack using the magnetostatic solver. The exact geometry of the magnetic focusing structure was modeled; thus, no approximations were made regarding the off-axis fields. The fields from the static solver were loaded into the 3D particle-in-cell (PIC) solver of MAFIA where fully 3D behavior of the beam was simulated in the magnetic focusing field. The PIC solver computes the time-integration of electromagnetic fields simultaneously with the time integration of the equations of motion of charged particles that move under the influence of those fields. Fields caused by those moving charges are also taken into account; thus, effects like space charge and magnetic forces between particles are fully simulated. The electron beam is simulated by a number of macro-particles. These macro-particles represent a given charge Q amounting to that of several million electrons in order to conserve computational time and memory. Particle motion is unrestricted, so particle trajectories can cross paths and move in three dimensions under the influence of 3D electric and magnetic fields. Correspondingly, there is no limit on the initial current density distribution of the electron beam, nor its density distribution at any time during the simulation. Simulation results including beam current density, percent ripple and percent transmission will be presented, and the effects current, magnetic focusing strength and thermal velocities have on beam behavior will be demonstrated using 3D movies showing the evolution of beam characteristics in time and space. Unlike typical beam optics models, this 3D model allows simulation of asymmetric designs such as non- circularly symmetric electrostatic or magnetic focusing as well as the inclusion of input/output couplers.
Author
Computerized Simulation; Electron Beams; Focusing; Magnetostatics; Permanent Magnets; Three Dimensional Models; Electron Optics

20000033175 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Microstructure and Magnetic Properties of Spin Valves Fabricated Under the Extremely Clean Sputtering Process
Uneyama, Kazuhiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 73-76; In Japanese; Copyright; Avail: Issuing Activity

Areal density of hard disks has grown rapidly by 60% per year. In order to induce adequate magnetic properties of the metallic thin-film devices such as recording media and heads, it becomes more and more important to control the microstructure of them. Since the impurities in the sputtering atmosphere affect strongly on the initial film growth, the highly purified atmosphere will be required for the thin-film device fabrication, in order to improve the microstructural controllability of sputter deposition process. In the present study, we developed a specialized multi-sputtering system and fabricated ultra-thin spin valve GMR films by using this system. The newly developed sputtering system enables to realize 10(exp -1)2 Torr vacuum condition and to supply ultra clean processing gases; the impurity level in the sputtering atmosphere was less than 10(exp -4) times, comparing with that

of the sputtering systems normally used. The MR ratio of an optimized spin valve, sub./Ta/Ni-Fe/Co/Cu/Co/Mn-Ir/Ta, achieved to 9.7%, even in the total thickness of 148 Angstroms except for the capping Ta layer. When the same structure was fabricated by degrading the base pressure of chamber to 10(exp -7) Torr, the exchange biasing effect was no longer observed and the MR ratio suddenly dropped to 0.9 %. The extremely clean sputtering process is concluded to be greatly effective to realize ultra-thin-film devices with excellent magnetic properties.
Author
Magnetic Properties; Sputtering; Ferromagnetic Films

20000033378 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
A Model for Elastic-Plastic Contact of Ellipsoids with Work-Hardening Effect
So, Hon, National Taiwan Univ., Taiwan, Province of China; Liu, Dar Chyuan, National Taiwan Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; 2000; ISSN 0253-3839; Volume 23, No. 1, pp. 1-8; In English; Copyright; Avail: Issuing Activity

Based on experiments, a semi-empirical model is proposed for the elastic-plastic contact of ellipsoids. The model predicts the total contact area of two separated parts, namely, the plastic and elastic parts. The prediction of the plastic area is achieved by an empirical formula, in which, a representative contact stress is, in terms of the plastic contact area, in the form of a power law. The power index, satisfying the relation between the representative contact stress and the plastic contact area, is obtained with the flattened areas of a contacting body completely unloaded from specified loads in the experiment. The power index is also called the work-hardening index. The elastic part of the contact area is obtained from the Hertzian contact result. With such a model, when either the nominal interference (or approach) between two metallic bodies or the normal load on the contact is known, all other quantities, such as total load or interference, plastic and elastic parts of contact area, etc., can be found. In order to confirm the model, a series of contact experiments for different metallic ellipsoids was conducted. It was found that the results from the model agree with the experiments very well.
Author
Experimentation; Numerical Analysis; Ellipsoids; Elastic Scattering

71
ACOUSTICS

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

20000032109 Army Construction Engineering Research Lab., Champaign, IL USA
CERL Noise Monitoring and Warning System 98
Sachs, Daniel; Benson, Jonathan W.; Schomer, Paul D.; Dec. 1999; 184p; In English
Contract(s)/Grant(s): MIPR-6MCER50063H16
Report No.(s): AD-A373526; CERL-TR-99/99; No Copyright; Avail: CASI; A02, Microfiche; A09, Hardcopy

The present CERL Noise Monitoring and Warning System, designed in the mid-1980s, has difficulty separating blast noise sounds from wind-induced pseudonoise. A new noise monitor was designed that would be more wind noise resistant and would use more modern electronics and methods than those available in 1985. This report documents the design and construction of this new noise monitor. The heart of wind-noise resistance is a two-microphone array and special signal processing to identify and separate blast sounds from pseudo- wind noise. The results are quite encouraging. it appears that the new monitor improves the signal-to-noise ratio by about 10 dB. It is recommended that this monitor be transferred to the field by a demonstration validation program such as the Environmental Security Technology Certification Program (ESTOP).
DTIC
Noise (Sound); Warning Systems

20000032357 Florida Agricultural and Mechanical Univ., Fluid Mechanics Research Lab., Tallahassee, FL USA
Visualization in a Mach 2 Jet of Mach Wave Radiation
Barber, Edward, Florida Agricultural and Mechanical Univ., USA; Buzyna, G., Florida Agricultural and Mechanical Univ., USA; Krothapalli, A., Florida Agricultural and Mechanical Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 437-439; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Since Lighthill introduced his general theories on sound generated aerodynamically (1952,1954), later to become the field of Aeroacoustics, people have been seeking ways to reduce jet noise. The latest driving force behind reducing jet noise is the interest in the development of a High Speed Civil Transport project (HSCT). This vehicle would be a supersonic successor to the present commercial airliner. In order to make the HSCT a viable project, the aircraft noise must be reduce to acceptable limits. There are many noise factors, such as the structural noise and engine combustion noise, but the noise produced by the turbulent jet, as studied by Lighthill (1954) and Ffowcs-Williams (1963) is our primary concern.
Derived from text
Aerodynamic Noise; Aircraft Noise; Aeroacoustics; Engine Noise; Noise Reduction

20000032919 NASA Glenn Research Center, Cleveland, OH USA
Accuracy Study of the Space-Time CE/SE Method for Computational Aeroacoustics Problems Involving Shock Waves
Wang, Xiao Yen, Taitech, Inc., USA; Chang, Sin–Chung, NASA Glenn Research Center, USA; Jorgenson, Philip C. E., NASA Glenn Research Center, USA; December 1999; 16p; In English; 38th; 38th Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS3-97186; RTOP 522-81-11
Report No.(s): NASA/TM-1999-209659; NAS 1.15:209659; E-12030; AIAA Paper 2000-0474; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The space-time conservation element and solution element(CE/SE) method is used to study the sound-shock interaction problem. The order of accuracy of numerical schemes is investigated. The linear model problem.govemed by the 1-D scalar convection equation, sound-shock interaction problem governed by the 1-D Euler equations, and the 1-D shock-tube problem which involves moving shock waves and contact surfaces are solved to investigate the order of accuracy of numerical schemes. It is concluded that the accuracy of the CE/SE numerical scheme with designed 2nd-order accuracy becomes 1st order when a moving shock wave exists. However, the absolute error in the CE/SE solution downstream of the shock wave is on the same order as that obtained using a fourth-order accurate essentially nonoscillatory (ENO) scheme. No special techniques are used for either high-frequency low-amplitude waves or shock waves.
Author
Shock Wave Interaction; Shock Waves; Space-Time Functions; Conservation Equations; Shock Tubes

20000032989 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Influence of the Waves Reflected from the Back Surface of Solid Specimen on Material Characterization by Line-Focus-Beam Acoustic Microscopy
Ohashi, Yuji, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 217-218; In Japanese; Copyright; Avail: Issuing Activity

When line-focus-beam (LFB) acoustic microscopy is applied to thin specimens for material characterization, waves reflected from the back surface of the specimen cause a serious problem in measurement accuracy of measured propagation characteristics of leaky surface acoustic waves (LSAWs). For resolving the problem, the method of eliminating the influence is proposed, then a material characterization procedure is established. According to this procedure, measurements for a thin specimen are demonstrated, and the possibility of accurate characterization is confirmed.
Author
Sound Waves; Structural Analysis; Wave Reflection; Microscopy

20000032998 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Distance Localization of a Sound Image
Kim, Hai–Young, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 193-196; In Japanese; Copyright; Avail: Issuing Activity

This study aims at getting knowledge of the perception of sound images, especially focusing our eyes on the role of information provided by Head-Related Transfer Function (HRTF). In order to clarify the cues and perceptual process for the auditory distance perception, two conventional models named Hirsch-Tahara model and auditory parallax model were examined. As a result, it was shown that both models have limitations in explaining universally the auditory distance perception. Hence, the auditory parallax model was modified so as to apply in broader cases of auditory distance perception. The results of the experiment by simulating HRTFs based on the modified parallax model showed that the cues provided by the model were almost sufficient to interpret the perception of auditory distance from an actual sound source located within about 2 m. Furthermore, the relative distance perception with multiple sound sources were also examined in order to investigate the role of HRTFs in more detail. A comparison between the experimental results of absolute and relative auditory distance perceptions indicated that the relative

judgment is superior in distance perception to the absolute judgment. This may be attributable to a short-term memory of distance provided by comparison among those of multiple sound images.
Author
Auditory Perception; Space Perception; Transfer Functions

20000033008 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Wide-Band Surface Acoustic Wave Filters and Their Applications
Yatsuda, Hiromi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 150-153; In Japanese; Copyright; Avail: Issuing Activity

This paper examines wide-band surface acoustic wave (SAW) filters on IF and RF stages, respectively. For IF stages, some design techniques to realize wide-band SAW filters using slanted finger interdigital transducers (SFITs) have been presented. For RF stages, some design methods to increase stop-band attenuation for low-loss SAW filters using interdigitated interdigital transducers (IIDTs) have been shown. A flip-chip assembly technique for RF SAW filters is also proposed. A miniature SAW filter with 2.5 mm x 2.0 mm x 0.9 mm in size is realized by using this technique.
Author
Interdigital Transducers; Filters; Surface Acoustic Wave Devices; Broadband

20000033045 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Broadband Ultrasound Transducers Using Graded Piezoelectric Materials
Sakamura, Jun–ichi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 277-278; In Japanese; Copyright; Avail: Issuing Activity

In this paper, broadband ultrasound transducers using piezoelectrically graded materials are studied. An equivalent network representation is presented for thickness modes in a plate that has a graded piezoelectric parameter. By using this equivalent network, it is shown that a graded transducer is broadband. Based on this analysis, transducers are constructed that utilize piezoelectric materials having an effectively graded piezoelectric parameter and/or applied electric field. These transducers have a number of fine V-grooves on one surface of a piezoelectric plate. Broadband frequency characteristic of the proposed transducers is demonstrated through experiments of wave generation in water.
Author
Piezoelectricity; Transducers; Ultrasonics; Broadband

20000033046 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of a Piezoelectric Thin Film Resonator with Acoustic Quarter-Wave Multilayers
Kanbara, Hirofumi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 275-276; In Japanese; Copyright; Avail: Issuing Activity

The resonator consisting of a piezoelectric film on alternately laminated low and high acoustic impedance, layers seems to be useful as a piezoelectric resonator for use in a very high frequency range above 500 MHz. This resonator is theoretically analysed using an equivalent circuit model taking account of acoustic loss and electrode thickness. It is shown that the Q approaches to that of the piezoelectric film with increasing layer number of multilayers. Even if the layer number is large enough, the admittance response disagrees with that of the piezoelectric film with traction-free surfaces and K(sub eff) is somewhat lower than that of the traction-free case. The simulation on the scatter of resonator properties due to layer thickness deviation shows that the Q is hardly degraded by the layer thickness deviation. As low and high acoustic impedance layers, SiO2 and Al2O3 films were fabricated on LiTaO3 Z-cut plates by ECR assisted electron beam deposition and their acoustic properties were evaluated from the shift of higher overtone resonance frequencies of the LiTaO3 plate.
Author
Resonators; Piezoelectricity; Thin Films; Silicon Dioxide; Aluminum Oxides

20000033055 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Noise Modeling using Hidden Markov Model
Muraki, Kiyotaka, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 255-256; In Japanese; Copyright; Avail: Issuing Activity

It is well known that the introduction of acoustic background noise into speech causes same bad influence for existing speech recognition systems which assume a noise-free tranquil environment. to obtain good performance of speech recognition in practical noisy environment, a good model for various kind of noise is required. However, a study on noise model is not sufficient. In this paper, we consider various kind of noise model using hidden Markov model in order to achieve robust speech recognition

against acoustic background noise. As we make effective use of noise HMM, the robustness of speech recognition in unfavorable condition will be realized.
Author
Mathematical Models; Speech Recognition; Background Noise; Markov Processes

20000033097 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on GHz-Range Surface Acoustic Wave Propagation and Low Loss Filter Measured at Low Temperature
Nakagawa, Hideyuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 357-358; In Japanese; Copyright; Avail: Issuing Activity

The 10 GHz-range surface acoustic wave (SAW) is important in the field of physical acoustics and application of SAW devices. In this study, the temperature dependency of the propagation attenuation at 10 GHz-range is measured using the three-transducer system. The results show that the attenuation at room temperature on 128 degree Y-X LiNbO3 is about 1.5 dB/100 lambda at 10 GHz. Next, the temperature dependency of the insertion loss of a lambda/10 type floating electrode reflection type unidirectional transducer (FEUDT) whose electrodes are respectively fabricated from Al and the superconductor Nb, is investigated experimentally. In the case of Al-lambda/10 type FEUDT at 8 GHz, the minimum insertion loss at a low temperature is about 8.5 dB, which is 3.4 dB lower than the minimum insertion loss at room temperature. The main cause of decrease in the insertion loss is the decrease in the resistivity of the very thin and narrow metal electrodes. In the case of Nb-lambda/10 type FEUDT at 5 Ghz-range, the minimum insertion loss shows a marked decrease around the critical temperature T(sub c) = 9.23K.
Author
Insertion Loss; Lithium Niobates; Wave Propagation; Electrical Resistivity; Electromagnetic Wave Filters

20000033188 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Basic Research on an Auditory Model Based on Time-Domain Representation
Sugai, Ichirou, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 481-482; In Japanese; Copyright; Avail: Issuing Activity

This paper proposes an auditory peripheral model, which simulates basic characteristics of organs of auditory peripheral system. The propriety of this model was examined by simulation of two types of masking phenomena indicating fine structures in time domain: (1) phase dependence of masked thresholds of pure tones at frequencies 1.5 times as high as the frequency of a pure tone masker, (2) dependence of thresholds of a high-frequency signal with short duration masked by a low-frequency masker upon timing of the signal presence.
Author
Auditory Signals; Auditory Perception; Models; Time Domain Analysis

20000033189 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on the Effect of Head Movement on Sound Localization
Peng, Tai–Ching, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 477-478; In Japanese; Copyright; Avail: Issuing Activity

This paper examined the effect of head movement on sound localization under the situation close to that of normal listening. In order to investigate that effect, a hearing experiment on directional localization was conducted using actual sound sources. The results of the experiment showed that the rate of front-back confusion was decreased under the condition that the head movement was allowed. Accuracy of localization was also improved with the aid of dynamic cues caused by head movement. Furthermore, from the recorded head movement of each subject, it was shown that the patterns of subjects' head movement consist of smooth pursuit and converging movements, and that the converged direction of head movement were almost the half of the angle between sound source and front direction.
Author
Head Movement; Sound Localization

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.

20000032245 New Mexico Highlands Univ., Dept. of Physical Sciences, Las Vegas, NM USA
Molecular Modeling of the Compounds with Nonlinear Optical Properties
Timofeeva, Tatiana V., New Mexico Highlands Univ., USA; Cardelino, Beatriz H., New Mexico Highlands Univ., USA; Clark, Ronald D., New Mexico Highlands Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 656-662; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The molecular polarizability characteristics for a large series of naphthoquinone and quinoline derivatives have been calculated. The dependence of calculated hyperpolarizability on the positions and the number of donor and acceptor substituents is discussed.
Author
Molecular Structure; Chemical Compounds; Nonlinearity; Optical Properties

20000032330 NASA Marshall Space Flight Center, Huntsville, AL USA
Fabrication and Atomic Force Microscopy Characterization of Molecular Composites of Fullerenes in Aerogel Matrix for Optical Limiting
Lu, W. J ., Fisk Univ., USA; Sunkara, H. B., Du Pont de Nemours (E. I.) and Co., USA; Shi, D., Fisk Univ., USA; Morgan, S. H., Fisk Univ., USA; Penn, B., NASA Marshall Space Flight Center, USA; Frazier, D., NASA Marshall Space Flight Center, USA; Collins, W. E., Fisk Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 921-926; In English; See also 20000032189
Contract(s)/Grant(s): NAGW-2925; NAG3-1430
Report No.(s): 98URC164; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

An optical limiter is a device which exhibits a decrease in the transmittance in a material with an increase in intensity of light. Sol-gel techniques offer many advantages in the fabrication of materials. These materials possess many desirable properties for nonlinear optical (NLO) device applications which include transparency, high thermal and chemical stabilities, very low refractive index and dielectric constants. C60 shows a higher excited state absorption cross section than the ground state absorption cross section over the complete visible spectrum, and the spectrum of the excited state absorption of C60 has the same general shape as the ground state absorption. This fact suggests that fullerenes are ideal optical limiting materials. Aerogels are fabricated by sol-gel processing. One of the key issues is the dispersion of fullerenes into small and uniform pores of silica aerogel host matrices. The aerogel network was characterized by Raman spectroscopy. Atomic force microscopy is a technique with many advantages to characterize the aerogel materials. The morphology of the cleaved surface for a C60/aerogel sample shows that there are long paralleled shaped stripes with 20-30 nm in width and about 500 nm in length on the cleaved surface. The cleaved surface also was etched by 5% HF solution for one minutes, and it became smoother after HF etching. The main feature in on the surface is the spherical particles with the size of few nanometers, and no aggregated fullerenes appear. The fullerenes are well dispersed in the aerogel matrices.
Author
Optical Materials; Atomic Force Microscopy; Fullerenes; Fabrication; Optical Equipment; Sol-Gel Processes; Transmittance

20000032334 Puerto Rico Univ., Dept. of Chemistry, Rio Piedras, Puerto Rico
Dynamics and Mechanisms of O(P-3) Atom Reactions With Sulfur-Containing Compounds
Ravichandran, K., Puerto Rico Univ., Puerto Rico; Chen, Xirong, Puerto Rico Univ., Puerto Rico; Wu, Fei, Puerto Rico Univ., Puerto Rico; Gong, Yuchuan, Puerto Rico Univ., Puerto Rico; Cheng, Yuying, Puerto Rico Univ., Puerto Rico; Han, Jiande, Puerto Rico Univ., Puerto Rico; Ayala, Idelisa, Puerto Rico Univ., Puerto Rico; Weiner, Brad R., Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 942-947; In English; See also 20000032189
Report No.(s): 98URC168; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Reactions of atoms and radicals play a central role in controlling the overall chemistry of the atmosphere and in combustion systems. Our understanding of these complex chemical environments has resulted from detailed kinetics and dynamics studies of elementary reactions that are involved in these systems. Interest in the reactions of oxygen atoms (D-1 and P-3) with

hydrocarbons and hydrogen containing molecules are two fold: (1) O(D-1) reactions are known to produce hydroxyl (OH) radicals that determine in part, the ozone concentration level in the stratosphere, and (2) O(P-3) reactions with unsaturated hydrocarbons, both olefins and alkynes, play an important role in combustion chemistry. Oxidation of naturally occurring reduced sulfur compounds, such as hydrogen sulfide (H2S), carbonyl sulfide (OCS), and carbon disulfide (CS2) by oxygen atoms, initiate a chain of reactions in the troposphere that produce sulfur dioxide (SO2), and ultimately result in acid precipitation. Previous kinetics measurements of these systems are in good agreement, but the mechanisms are complex, and perhaps even dependent upon the conditions of the experiments. Therefore, considerable uncertainty still exists in the mechanistic interpretation of these elementary reactions. Mechanistic details, such as the transition state structures, possible intermediates, and the nature of energy flow due to atomic rearrangements, can be revealed for a chemical reaction by measuring the nascent energy disposed to the products. Energy partitioned to the products? vibrational degrees of freedom, particularly to the newly formed bonds, provides a wealth of information on the reaction mechanism. In addition, product rotational energy disposal studies can give a handle on the structure of reaction intermediates and transition states. We report here our detailed dynamics study on the O(P-3) atom reactions with sulfur compounds from the nascent SO(X(sup 3)Sigma(-)) product rovibrational energy distributions.
Derived from text
Chemical Reactions; Sulfur Compounds; Atmospheric Chemistry; Phosphorus Isotopes; Oxygen Atoms; Atmospheric Effects; Reaction Kinetics; Hydroxyl Radicals

20000032451 Yamagata Univ., Faculty of Engineering, Japan
Electron Energy Distribution Function and Electron Temperature in Rare Gas Positive Columns
Sato, Masumi, Yamagata Univ., Japan; Bulletin of Yamagata University (Engineering); 2000; ISSN 0085-834X; Volume 26, No. 1, pp. 41-46; In Japanese; Copyright; Avail: Issuing Activity

The electron energy distribution function (EEDF) in rare gas positive columns which lacks the distribution of electrons in the high energy tail can be adequately approximated by a bi-generalized Druyvesteyn distribution. Using the Langmuir probe curve simulated based on the approximated EEDF, the conventional probe technique for the electron temperature diagnostic is examined. The average electron energy <E(L) obtained with the semi-log plot method may be necessarily underestimated compared with that of <E(D) found from the Druyvesteyn technique. Published data for measured <E(L) and <E(D) in He and Ne positive columns are compiled, and it is shown that <E(I) is greater than <E(I) holds over a wide range of the gas pressure-tube radius product.
Author
Distribution Functions; Electron Energy; Rare Gases

20000032498 Japan Atomic Energy Research Inst., Tokyo, Japan
Zeeman effect of U atoms measured by two step laser induced fluorescence spectroscopy
Oba, M.; Miyabe, M.; Wakaida, I.; Akaoka, K.; Mar. 31, 1999; 19p; In Japanese; In English
Report No.(s): DE99-758373; JAERI-RESEARCH-99-028; No Copyright; Avail: Department of Energy Information Bridge

We measured the J-value and g-factor of uranium atom by Zeeman effect measurement. Two step excitation with two ring dye lasers were used to measure the levels lying between 32000 cm(sup -1) to 35000 cm(sup -1) and J-value and g- factor of 27 levels were measured.
NTIS
Zeeman Effect; Uranium; Laser Induced Fluorescence; Spectroscopy

20000032754 NASA Goddard Space Flight Center, Greenbelt, MD USA
Rydberg States of Lithium and Other Systems
Drachman, Richard J., NASA Goddard Space Flight Center, USA; [1999]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The interesting calculation of retardation corrections to excited atomic state energies is facilitated by the existence of good calculations of the nonrelativistic and nonretarded energies, to which retardation corrections can be added. Here I describe a perturbation method, applicable when the angular momentum is high enough which generates an asymptotic series for the energy. It makes use of generalized polarizabilities of the atomic or ionic core (numerically obtained) but otherwise is completely analytic. It is applied here to the lithium atom in detail, and its application to hydrogen molecular ions is outlined.
Author
Retarding; Correction; Excitation; Perturbation Theory; Lithium

20000032995 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Ion Fluctuations Excited by a Positivity Biased Electrode in a Plasma

Takada, Kenichi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 205-206; In Japanese; Copyright; Avail: Issuing Activity

Properties of the instabilities which induce ion fluctuations in a plasma are investigated systematically. Two types of the fluctuations are observed by applying positive bias voltage to an electrode in a plasma. The one is so-called ion acoustic instability (IAI) and the other is potential relaxation instability (PRI). The fluctuations of the former type reveal a broad frequency spectrum with multiple harmonic peaks, in which the frequency difference between neighbor peaks decreases with an increase of the frequency like ion acoustic waves. It is clarified that the fluctuations of the former type are localized near the biased electrode and the phase difference against a grounded grid current is nearly out of phase, which is in consistent with a static relation of those current variations. The generation mechanisms of the harmonic peaks are discussed.

Author

Electrodes; Ion Acoustic Waves; Magnetohydrodynamic Stability; Plasmas (Physics); Ion Distribution

20000033079 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Investigation of Single Electron Devices

Shimano, Satoshi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 365-366; In Japanese; Copyright; Avail: Issuing Activity

Single electron transistor (SET) based on Coulomb blockade phenomena in ultra small tunnel junctions is expected for low power circuit application. In this paper, room temperature operation of SET circuits has been investigated from the viewpoint of practical use. At first, realistic SET circuit layout was designed taking account with the stray capacitance effect. Furthermore, it has been shown that the operation reliability of SET is dominated by the universal E(sub b)/N(sub o)-BER characteristics. For room temperature operation, we have proposed a new matched filter type SET circuit.

Author

Matched Filters; Transistors; Tunnel Junctions; Circuits

20000033117 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on Alignment Mechanism of Liquid Crystal Molecules on the Surface of Polymer Alignment Films

Oshima, Takahiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 335-336; In Japanese; Copyright; Avail: Issuing Activity

Rubbing method is commonly used to align liquid crystal molecules widely. However, the alignment mechanism on the rubbed polymer surface has not been clarified. It is significant to clarify the mechanism for the high performance liquid crystal devices in the next generation. Then, I have investigated the order parameter of liquid crystal in three dimensions by using polarized FT-IR to measure anisotropy of infrared absorbance as a function of a cell thickness. From the results, it was found that the order parameter at the surface is smaller than that at the bulk in the azimuthal direction. It was also found that the distribution of molecular of orientation of liquid crystal at the surface reveals biaxiality.

Author

Alignment; Anisotropy; Liquid Crystals; Polymeric Films

20000033498 Queens Univ., Dept. of Applied Mathematics and Theoretical Physics, Belfast, UK

Multiphoton Ionization of He and H2

Glass, D. H., Queens Univ., UK; Colgan, J., Queens Univ., UK; Burke, P. G., Queens Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 66-67; In English; See also 20000033474; Copyright; Avail: Issuing Activity

For a number of years the R-matrix-Floquet theory of multiphoton processes has been used to study multi-electron atoms and atomic ions in intense laser fields. Use of this approach has led to a greater understanding of a number of phenomena, such as laser-induced degenerate states (LIDS), which have been discussed in previous reports. Although Much progress has been made it has been difficult to study realistic laser parameters for atoms such as He due to the large numbers of photons which must be absorbed for ionization to occur. In the present report this problem is considered by studying the multiphoton ionization of He at the KrF laser wavelength of 248 nm and intensities up to 6 X 10(exp 14) W/sq cm. Recently the R-matrix-Floquet theory and computer programs have been extended to treat the multiphoton ionization of diatomic molecules. This area of work is of particular interest due to the extra degrees of freedom arising from the nuclear motion which introduces new processes not found in atoms, such as dissociation and bond-softening. to date most other theoretical work on molecules in intense laser fields has focussed on H2(+) but given (he power of R-matrix theory in its application to multi-electron systems the present approach will

enable more complex molecules to be-studied. An illustration of this is given by results obtained for H2. Since an outline of the theory, has been given previously and more details can be found elsewhere only the present calculations will be discussed below. Author

Helium; Hydrogen; Photoionization; Multiphoton Absorption; Laser Outputs; Gas Ionization; Computer Programs

20000033500 York Univ., Dept. of Physics, UK

Fokker-Planck Coefficients for Ion-Electron Collisions in an Electro-Magnetic Field

Pert, G. J., York Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 70-71; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Fokker-Planck modelling provides a convenient method for calculating the electron distribution function following ionisation by a strong electro-magnetic Field. In contrast to Monte-Carlo simulation the method allows a more accurate calculation of the distribution in the high velocity tail without unacceptably high computational overheads, a condition important for the investigation of electron excitation and ionisation. The calculation of electron-electron elastic collisions follows the usual MacDonald,-Judd-Rosenbluth form. However unless the simulation is to be performed on the time scale of the Field oscillation, some averaging over the ion collision rate is required. This report shows how this requirement can be met when the electron distribution is isotropic, and yields (yet again) the high Field inverse bremsstrahlung heating rate.
Author

Ionic Collisions; Collision Rates; Electromagnetic Fields; Fokker-Planck Equation; Simulation

20000033506 Glasgow Univ., Dept. of Physics and Astronomy, UK

Unusual Angular Distribution Anisotropies of Fragment Ions from the Dissociation of N2O and H2S

Graham, P., Glasgow Univ., UK; Ledingham, K. W. D., Glasgow Univ., UK; Singhal, R. P., Glasgow Univ., UK; McCanny, T., Glasgow Univ., UK; Fang, X., Glasgow Univ., UK; Langley, A. J., Rutherford Appleton Lab., UK; Taday, P. F., Rutherford Appleton Lab., UK; Kosmidis, C., Ioannina Univ., Greece; Tzallas, P., Ioannina Univ., Greece; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 89-91; In English; See also 20000033474; Copyright; Avail: Issuing Activity

As lasers have become increasingly more intense, and able to provide power in pulses of shorter duration, so the highly nonlinear processes induced by the laser/matter interaction such as bond-softening, Above Threshold Ionisation (ATI), and alignment of molecules can be studied. This last topic has become the focus of much recent research activity as the spatial control (if molecules has very deep and wide-ranging implications in a variety of different fields. by utilising chirped-pulse amplification (CPA) Astra provides strong E-fields which distort the molecular structure and which may align the molecule with the field. Such distortions may polarise a molecule, which induces a dipole moment. The field interacts with the Molecule via the dipole to produce a torque which tends to align the molecule. As the polarisability increases with charge-state of the parent ion, the torque is increased also and thus aligns the molecule more tightly. This narrows the angular distribution of the exploding fragments from these highly charged transient parent ions. Furthermore, in an ensemble of molecules with randomly orientated dipoles, those molecules which lie along the direction of the ToF axis and laser polarisation are more efficiently ionised/dissociated and detected. Either or both of these processes can account for the observed anisotropy of the fragment ions. In this report some an 'gular distributions are presented for the N2O and H2S molecules which exhibit unusual behaviour regarding the N- and S-fragment ions. The data were taken using the ultra-intense femtosecond Astra Ti:S laser facility at RAL.
Author

Angular Distribution; Anisotropy; Ions; Dissociation; Hydrogen Sulfide; Nitrogen Oxides; Molecular Structure

20000033507 Imperial Coll. of Science, Technology and Medicine, Blackett Lab., London, UK

High Harmonic Generation in Organic Molecules

Hay, N., Imperial Coll. of Science, Technology and Medicine, UK; Springate, E., Imperial Coll. of Science, Technology and Medicine, UK; Mendham, K., Imperial Coll. of Science, Technology and Medicine, UK; Marangos, J. P., Imperial Coll. of Science, Technology and Medicine, UK; Castillejo, M., Consejo Superior de Investigaciones Cientificas, Spain; deNalda, R., Consejo Superior de Investigaciones Cientificas, Spain; Taday, P. F., Rutherford Appleton Lab., UK; Divall, E. J., Rutherford Appleton Lab., UK; Langley, A. J., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 92-93; In English; See also 20000033474; Copyright; Avail: Issuing Activity

We present preliminary results of an investigation into high harmonic generation (HHG) in organic molecules. Benzene and cyclohexane vapours were compared with monatomic xenon in two complementary studies using near infrared pulses generated by titanium sapphire chirped pulse amplification laser systems. Pulse of duration 70 fs at 795 nm and 240 fs at 780 nm were provided by Astra and the Blackett Laboratory Laser Consortium titanium sapphire laser respectively. The two studies covered an intensity range from approx. 4 x l0(exp 13) to approx. 5 x 10(exp 15) W/sq cm. HHG in monatomic gases has been studied

for some time and is now reasonably well understood. Small molecules, diatomics in particular, have also received some attention. Their behaviour is generally similar to atoms - the familiar plateau and cut-off arc present in the harmonic spectra, with the position of the cut-off approximately predicted by the I(sub p) + 3U(sub p) rule. Very few studies have included larger molecules. We were motivated to study HHG in organic molecules for several reasons. Organic Molecules can be highly polarizable. The presence of pi-delocalised electrons in some organics such as benzene and butadiene can increase the polarizability. There is evidence from previous work comparing butane and butadiene that this can increase the harmonic conversion efficiency. Some species, such as cyclohexane, exhibit a giant resonance. The cyclohexane giant resonance at 10.4 eV is potentially much more accessible to multiphoton excitation by near-infrared photons (approx. 1.5eV) than the giant resonances present in atoms that have excitation energies typically approx. 100 eV. Recent studies using ion time of flight spectroscopy to study ionisation and dissociation of organic molecules have shown that they can be remarkably stable when exposed to high intensity ultra-short laser pulses. Benzene, for example, can remain essentially intact at intensities approaching 5 x 10(exp 14) W/sq cm.
Author
Harmonic Generations; Organic Chemistry; Benzene; Cyclohexane; Vapors; Diatomic Molecules

20000033509 Glasgow Univ., Dept. of Physics and Astronomy, UK
An Investigation of the Angular Distributions of Fragment Ions from Coulomb Explosion of the Linear CS2 Molecule
Graham, P., Glasgow Univ., UK; Ledingham, K. W. D., Glasgow Univ., UK; Singhal, R. P., Glasgow Univ., UK; McCanny, T., Glasgow Univ., UK; Hankin, S. M., Glasgow Univ., UK; Fang, X., Glasgow Univ., UK; Smith, D. J., Glasgow Univ., UK; Langley, A. J., Rutherford Appleton Lab., UK; Taday, P. F., Rutherford Appleton Lab., UK; Kosmidis, C., Ioannina Univ., Greece; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 95-98; In English; See also 20000033474; Copyright; Avail: Issuing Activity

As theoretical and experimental study of triatomic molecules Subjected to intense laser beams gains momentum, useful insights are obtained into the dynamical processes involved. The experiments are becoming increasingly sophisticated and include alignment and trapping of molecules. Indeed, the ability to control the alignment of the overall Molecular dipole moment with the laser field can have significant implications in the control of chemical reactions (steric effects) and hence is receiving intensive contemporary interest from several groups. A dramatic upsurge in short pulse laser technology, with its concomitant high achievable peak powers, has been observed in the last few years. This has largely been due to the development of chirped-pulse amplification (CPA) techniques. Using the ultra-intense (I approx. = 1 x 10(exp 16) W/sq cm) Astra femtosecond (tau = 50 fs) laser facility at RAL, we have studied the effect of this ultra-intense laser/matter interaction. Specifically we have observed the angular distribution of fragment ions from the parent molecules subsequent to Coulomb explosion, and the mechanism responsible for the observed anisotropy - alignment or preferential ionization.
Author
Angular Distribution; Fragments; Coulomb Collisions; Linearity; Carbon Disulfide; Numerical Analysis; Experimentation; Laser Beams; Triatomic Molecules

20000033512 Nottingham Univ., School of Chemistry, UK
Picosecond Time-Resolved Photoelectron Angular Distributions from S1 Paradifluorobenzene
Reid, K. L., Nottingham Univ., UK; Field, T. A., Nottingham Univ., UK; Towrie, M., Rutherford Appleton Lab., UK; Matousek, P., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 105-106; In English; See also 20000033474; Copyright; Avail: Issuing Activity

It has been known for some time that photoelectron angular distributions (PADs) can provide a probe of the alignment of the state that is ionized. The use of time-resolved PADs to monitor the evolution of excited state alignment following (1+1) resonance-enhanced multiphoton ionization (REMPI) was proposed and demonstrated on a nanosecond time-scale for atoms by the groups of Lambropoulos and Berry and for molecules by our group. The use of picosecond time-resolved PADs following laser excitation as a means of probing the effects of rotation-vibration coupling in an excited electronic state was originally suggested in a theoretical paper by Noguchi. Although time-resolved photoelectron spectroscopy has been used as a method of examining intra-molecular dynamics by the groups of Reilly, Knee and Stolow among others, to date these groups have not measured photoelectron angular distributions. In recent years the idea of measuring picosecond or even femtosecond time-resolved PADs has been given impetus by the development of the ”velocity mapping ” technique by Eppink and Parker in which emitted photoelectrons are imaged, and also by some very recent theoretical work. In this report we present picosecond time-resolved PADs measured following excitation of the 3(sup 1)5(sup 1) level in S(sub 1) paradifluorobenzene in a (1+1) REMPI scheme. We employed field-free time-of-flight photoelectron spectroscopy, which enabled us to monitor all the ion states formed simultaneously and also to define

a photoelectron ejection direction. Angular distributions were mapped out by rotating the polarization vectors of the exciting and ionizing laser beams together in essentially the same technique as that described by Leahy.
Author
Time Dependence; Photoelectrons; Angular Distribution; Alignment; Emittance; Excitation; Photoionization

20000033513 Glasgow Univ., Chemistry Dept., UK
Ps-TR(sup 3) Studies into Photoelectron Transfer Processes in Metallo-Based Cyclophanes, Catenanes and Rithenium Intercalates
Benniston, A. C., Glasgow Univ., UK; Matousek, P., Rutherford Appleton Lab., UK; Parker, A. W., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 107-108; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Over the past years the advances in laser spectroscopy have resulted in the development of improved time-resolved tools for probing ultra-fast photochemical processes. Picosecond time-resolved resonance Raman spectroscopy (TR(sup 3)) is one such method which permits the probing of structural alterations in molecular assemblies over ultra-fast timescales. It was illustrates a selection of molecular systems which we have been studying using picosecond TR(sup 3) spectroscopy, and more recently the new Kerr-gated (K-TR(sup 3)) method. In all the cases the ruthenium(II) polypyridyl moiety is the photoactive centre able to relay an electron to the electron acceptor site(s) in the molecular assemblies. The systems 1-4 were studied primarily as models of the photosynthetic reaction centre, and our interest is in using this series of compounds to prove whether directional electron transfer is possible.
Derived from text
Chemical Analysis; Research; Photochemical Reactions; Laser Spectroscopy

20000033520 Nottingham Univ., School of Chemistry, UK
Competition Between the Br and Br(sup *) Channels in the A-Band Photodissociation of CH3Br
Underwood, J., Nottingham Univ., UK; Powis, I., Nottingham Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 124-125; In English; See also 20000033474; Copyright; Avail: Issuing Activity

The A-band dissociation of the methyl halides provides a prototype for the theoretical and experimental investigation of polyatomic molecular photodissociation. Absorption of a single photon in this continuum results in a broad, unstructured absorption band leading to two reaction channels: CH3 + X(sup *)(2)P(sub 1/2) and CH3 + X(2)P(sub 3/2). The excitation gives rise to two electronic states in the limit of weak spin-orbit coupling, but splits into five components under strong spin-orbit interaction. In C(sub 3(nu)) symmetry curve crossing between these components results, but Jahn-Teller-like distortion creates a conical intersection. The Surface crossing can thus play a key role in determining the branching between the two asymptotic decay channels.
Derived from text
Bromine; Methyl Compounds; Numerical Analysis; Experimentation; Electron States; Photodissociation; Prototypes

20000033522 Birmingham Univ., School of Chemistry, UK
Rate Coefficients for the Reaction and Relaxation of H2O in Specific Vibrational States with H Atoms and H2O
Barnes, P., Birmingham Univ., UK; Sharkey, P., Birmingham Univ., UK; Sims, I. R., Birmingham Univ., UK; Smith, I. W. M., Birmingham Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 129-130; In English; See also 20000033474; Copyright; Avail: Issuing Activity

The notion of selectively promoting chemical reactions by the excitation of particular vibrational modes in the reagents has been proposed for some years. In order to explore this possibility it is necessary to proceed beyond the generic three-atom reaction A + BC yields AB + C, where there is only one reagent vibration. In recent years, the exothermic reaction between OH radicals and H2, and the reverse endothermic reaction between H atoms and H2O OH + H2 yields H2O + H (1), Delta(sub r)H(sup theta) = -63.3 kJ/ mol (2)has become the prototype of four-atom reactions for both experiment and theory. The groups of Crim and Zare have demonstrated dramatic bond selectivity in reaction (2) by exciting H2O to specific vibrational levels by overtone hand absorption. Among other things, Crim et al. showed that, whereas OH is formed in v = 0 when H atoms react with H2O (104 greater than), it is formed mainly in v = I when H atoms react with H2O (113 greater than), demonstrating that the two OH stretching modes in H2O act essentially as 'local modes', so that sufficient excitation deposited in one of them can lead to selective breaking of that bond in reaction with H atoms. This conclusion was beautifully confirmed by experiments on the reaction between H atoms and

HOD in which it was demonstrated that the reaction products were either OD + H2 or OH + HD, depending on whether the OH or OD stretching mode in HOD was excited.
Derived from text
Chemical Reactions; Molecular Relaxation; Water; Vibrational States; Hydrogen; Atoms

20000033523 Birmingham Univ., School of Chemistry, UK
Vibrational Energy Transfer in Polyatomic Molecules: Energy Transfer in Collisions of Highly Excited NCNO with He, Ar and N2
Wright, S. M. A., Birmingham Univ., UK; Sims, I. R., Birmingham Univ., UK; Smith, I. W. M., Birmingham Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 131-132; In English; See also 20000033474; Copyright; Avail: Issuing Activity

The transfer of energy in collisions involving polyatomic molecules with large amounts of internal energy is a Subject of intense interest at the present time and is Much less well understood than the vibrational relaxation of small molecules in low states of excitation. The ultimate aim is to measure the distribution function P(E'(vertical line)E) which defines the distribution of Final state energies E' following single collisions between the polyatomic molecule with internal energy E and the collision partner M. In practice, one currently has to be satisfied with measures of is less than <(Delta)E>, the mean energy transferred from the polyatomic molecule, with <E, the average internal energy of the ensemble of molecules. to compare with data we have obtained with large molecules such as toluene and pyrazine, we have chosen to study energy transfer in nitrosyl cyanide, NCNO.
Derived from text
Energy Transfer; Vibration Effects; Polyatomic Molecules; Collisions; Nitrosyls; Excitation; Cyanides

20000033524 Oxford Univ., Physical and Theoretical Chemistry Lab., Oxford, UK
Conformational Landscapes in Molecular and Biomolecular Systems
Simons, J. P., Oxford Univ., UK; Robertson, E. G., Oxford Univ., UK; Hockridge, M. R., Oxford Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 133-135; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Infer- and intra-molecular hydrogen-bonded interactions are a universal feature of biomolecular architectures, influencing their electronic charge distributions, conformational landscapes and supra-molecular Structures. There is a subtle balance between intra-molecular and inter-molecular bonding, for example between an amide group and neighbouring groups on a peptide chain, or an amide group and neighbouring solvent Molecules, such as water. The free jet expansion coupled with LIF or R2PI detection and rotational band contour analysis, provides a powerful strategy for probing both conformational and supra-molecular structure. It becomes even more powerful when it is reinforced by ion-dip spectra] 'hole-burning' experiments. Mass selected detection permits the identification of size-selected hydrated clusters (as well as their molecular hosts) while the 'hole-burning' experiments enable their spectral features to be separately isolated. Structural assignments can be achieved through analysis of the rotational and/or vibrational band contours of the isolated features, aided crucially, by the predictions of ab initio Computation.
Author
Conformal Mapping; Molecular Structure; Hydrogen; Gas Expansion; Computation; Chemical Bonds

20000033526 Medical Research Council, Radiation and Genome Stability Unit, Harwell, UK
Ionisation of DNA by 193 nm Light Yields Damage Mainly at Guanine by Intra-Molecular Charge Migration
ONeill, P., Medical Research Council, UK; Plumb, M., Medical Research Council, UK; Parker, A. W., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 138-139; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Exposure of DNA to ionising radiation results in chemical modifications caused by two different processes: (1) direct ionisation of the DNA molecule, the direct effect, and (2) damage from radical species produced in the vicinity of the DNA, the scavengeable (indirect) effect. The advent of short wavelength ultraviolet lasers has enabled the Study of the direct ionisation processes without the interaction of the ionisation products of water. Photoionisation of aqueous solutions of DNA with 193 nm laser light results in the formation of a photoejected electron via a monophotonic process. The DNA radicals formed by photoionisation are proposed precursors of low yields of single strand breaks (ssb), which we have confirmed using Rayleigh light scattering experiments. Further, migration of the electron loss centres to guanine has been demonstrated thereby enriching the yield of guanine radicals. Radical product(s) formed at guanine are indeed the precursor(s) of strand breakage which occurs in yields of less than 1% of the photoionisation events. The yield of base modifications formed within plasmid DNA determined using enzymes which are selective for different damage sites and create a single strand breakage at the site of the damage are approx. 5x and 20x higher for damages excised by Escherichia coli endonuclease III (Nth) and Escherichia coli formamidopyrimidine-DNA glycosylase (Fpg) respectively. (Fpg) excises oxidised purine modifications, including

8-oxo-7,8-dihydroguamne and 2,6-diamino-4-hydroxy-5formamidopyrimidine (FapyGua), and it additionally has a beta, delta-lyase activity that nicks DNA at apurinic/apyrimidic (AP sites). Nth is known to excise oxidized pyrimidine damages and has a beta-lyase activity that nicks DNA at apurinic/apyrimidic (AP sites).
Derived from text
Ionizing Radiation; Deoxyribonucleic Acid; Light Beams; Damage; Guanines; Intramolecular Structures; Beta Particles

20000033529 Oxford Univ., Clarendon Lab., Oxford, UK
Femtosecond Dynamics of Resonantly Excited Excitons in GaN
Hess, S., Oxford Univ., UK; Walraet, F., Oxford Univ., UK; Taylor, R. A., Oxford Univ., UK; Ryan, J. F., Oxford Univ., UK; Beaumont, B., Centre National de la Recherche Scientifique, France; Gibart, P., Centre National de la Recherche Scientifique, France; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 143-145; In English; See also 20000033474; Copyright; Avail: Issuing Activity

GaN and its alloys are of considerable interest for optoelectronic device applications in the blue and ultraviolet spectral regions, and a detailed understanding or their optical properties is important for designing and optimizing devices such as light emitting diodes and lasers. As in all direct, wide band-gap semiconductors, the band-edge optical response of GaN is dominated by excitonic effects: the exciton binding energy is approx. 20 meV, and it has already been shown that excitons play an important role in the optical reflection and absorption spectra at low carrier density and low temperature. However, the situation at high carrier density and temperature is not so clear. The Coulomb interaction between electrons and holes is expected to become screened with increasing density, and together with phase-space filling, this should lead to a bleaching of the exciton resonance. However, excitonic gain has been reported for GaN at high excitation density. This behaviour is complicated by the fact that the emission spectrum of wide band-gap materials tends to be dominated by bound exciton recombination, and is therefore highly, dependent on sample quality. Consequently, exciton dynamics are determined to a great extent by localization at impurities and defects, and only in high quality material can intrinsic relaxation and radiative recombination processes be studied.
Derived from text
Time Dependence; Absorption Spectra; Gallium Nitrides; Semiconductors (Materials); Optical Reflection; Optoelectronic Devices; Emission Spectra

20000033550 Essex Univ., Dept. of Physics, Colchester, UK
A Cheap CCD for Measuring Hot Electron Temperatures
Pestehe, S. J., Essex Univ., UK; Tallents, G. J., Essex Univ., UK; Smith, R., Essex Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 197-198; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

Superthermal electrons are produced in large irradiance X-ray laser experiments (less than 10(exp 14) W/sq cm, harmonic generation from solid target and laser fusion experiments. These hot electrons can accelerate fast ions and cause target preheating, production of X-ray continuum and K line emission. The hard X-ray (5-50 keV) continuum slope has been used to measure the hot electron temperature. In this paper we demonstrate the diagnosis of moderate-energy electron temperatures generated by irradiating multi-layered disc targets with 248nm, 350 fs, 10(exp 17) W/sq cm Titania KrF laser pulses. The moderate-energy electron temperatures up to 10 keV have been measured by a photon counting technique using an inexpensive CCD. The relation of the hot electron temperature to the time interval between the start of a pre-pulse and the 300 fs pulse and irradiance has been investigated. The self-calibration of the CCD with this technique and its comparison with the calibration of the same CCD with a standard X-ray tube will be illustrated.
Author
Charge Coupled Devices; Temperature Effects; Hot Electrons; X Ray Lasers; Titania; Pulsed Lasers; K Lines; Harmonic Generations; Electron Energy

20000033554 Queen Mary and Westfield Coll., Dept. of Chemistry, London, UK
Interligand Electron Transfer in MLCT-Excited State of [Re(MQ(+))(CO)3(dmb])(2+): Kinetics and Medium Effects
Liard, D. J., Queen Mary and Westfield Coll., UK; Vlcek, A., Jr., Queen Mary and Westfield Coll., UK; Matousek, P., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 104; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

The ultrafast excited state dynamics of [Re(MQ(+))(CO)3(dmb)] (PF6)2 and [Re(4-Etpy)(CO)3(dmb)](PF6)2, where dmb = 4,4'-dimethyl-2,2'-bipyridine, MQ(+) = N-methyl-4,4'-bipyridinium, 4-Etpy = 4-ethylpyridine, were studied in acetonitrile

and ethylene glycol. The rate of electron transfer was determined for the excited state, interligand, electron transfer: **[Re-2(Mq(+)(CO)3(dmb(-)}(2+) yields *[Re-2[(MQ*)(CO)3(dmb)](2+).
Derived from text
Ligands; Electron Transfer; Ethylene Compounds; Absorption Spectra; Methyl Compounds; Excitation

20000033691 NASA Lewis Research Center, Cleveland, OH USA
Simple Device for Monitoring Secondary Electron Emission of Materials in the Pulse Mode
Krainsky, Isay L., NASA Lewis Research Center, USA; Lesny, Gary G., NASA Lewis Research Center, USA; Review of Scientific Instruments; Apr. 1998; Volume 69, No. 4, pp. 1916-1917; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A simple device for simultaneously measuring the secondary electron emission coefficient sigma and the primary current in the pulse mode has been built. It allows convenient monitoring of these parameters for either conductive or insulating materials.
Author
Secondary Emission; Electron Beams; Pulse Duration; Electron Emission; Measuring Instruments; Electric Current

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.

20000032168 National Inst. of Standards and Technology, (MSEL), Gaithersburg, MD USA
NIST Center for Neutron Research: 1999 Programs and Accomplishments
Cappelletti, R. L.; Clutter, L. K.; Jan. 2000; 90p; In English
Report No.(s): PB2000-103342; NISTIR-6437; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Contents include the following: Introduction to the NIST Center for Neutron Research (NCNR); Research Highlights (Local Spin Resonance and Spin-Peirels-Like Phase Transition in ZnCr2O4, Polymer Brush Response to Solvent Flow, Probing the Location of the Terminal Groups of a Dendrimer, Multi-Technique Studies of Ultrathin SiO2 Films, Charge Disproportionation and Magnetic Ordering in CaFeO3); Serving the Scientific and Technological Communities; Reactor Operations and Engineering; Instrumentation Developments; Research Titles (Polymers, Biomolecular Science, Neutron Physics), Publications; Organizational Charts; NCNR/NIST Resident Staff and Visiting Scientists; Contacts.
NTIS
Research and Development; Neutrons

20000032968 NASA Marshall Space Flight Center, Huntsville, AL USA
Fixed-Order Mixed Norm Designs for Building Vibration Control
Whorton, Mark S., NASA Marshall Space Flight Center, USA; Calise, Anthony J., Georgia Inst. of Tech., USA; [2000]; 15p; In English; 41st; 41st SDM Conference, 3-6 Apr. 2000, Atlanta, GA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study investigates the use of H2, mu-synthesis, and mixed H2/mu methods to construct full order controllers and optimized controllers of fixed dimensions. The benchmark problem definition is first extended to include uncertainty within the controller bandwidth in the form of parametric uncertainty representative of uncertainty in the natural frequencies of the design model. The sensitivity of H2 design to unmodeled dynamics and parametric uncertainty is evaluated for a range of controller levels of authority. Next, mu-synthesis methods are applied to design full order compensators that are robust to both unmodeled dynamics and to parametric uncertainty. Finally, a set of mixed H2/mu compensators are designed which are optimized for a fixed compensator dimension. These mixed norm designs recover the H2 design performance levels while providing the same levels of robust stability as the mu designs. It is shown that designing with the mixed norm approach permits higher levels of controller authority for which the H2 designs are destabilizing. The benchmark problem is that of an active tendon system. The controller designs are all based on the use of acceleration feedback.
Author
Vibration Damping; Structural Stability; Structural Vibration; Vibration Tests; Buildings

20000032974 NASA Marshall Space Flight Center, Huntsville, AL USA

Development and Results of a First Generation Least Expensive Approach to Fission: Module Tests and Results

Houts, Mike, NASA Marshall Space Flight Center, USA; Godfroy, Tom, NASA Marshall Space Flight Center, USA; Pederson, Kevin, NASA Marshall Space Flight Center, USA; Sena, J. Tom, NASA Marshall Space Flight Center, USA; VanDyke, Melissa, NASA Marshall Space Flight Center, USA; Dickens, Ricky, NASA Marshall Space Flight Center, USA; Reid, Bob J., NASA Marshall Space Flight Center, USA; Martin, Jim, NASA Marshall Space Flight Center, USA; Feb. 11, 2000; 7p; In English; 8th; Proceedings of ICONE 8: 8th International Conference on Nuclear Engineering, 2-6 Apr. 2000, Baltimore, MD, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The use of resistance heaters to simulate heat from fission allows extensive development of fission systems to be performed in non-nuclear test facilities, saving time and money. Resistance heated tests on the Module Unfueled Thermal-hydraulic Test (MUTT) article has been performed at the Marshall Space Flight Center. This paper discusses the results of these experiments and identifies future tests to be performed.

Author

Heating Equipment; Fission

20000033372 NASA Marshall Space Flight Center, Huntsville, AL USA

Simulated Atomic Fission Engine (S.A.F.E)

VanDyke, Melissa, NASA Marshall Space Flight Center, USA; Oct. 13, 1999; 10p; In English; Space Technologies Applications International Forum Conference, 31 Jan. - 4 Feb. 2000, Albuquerque, NM, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents viewgraphs of S.A.F.E. (Simulated Atomic Fission Engine). The topics include: 1) Why Space Fission Propulsion? 2) History of Fission System Development; 3) New Approach to Space Fission Propulsion System Development; 4) Propulsion Flight Demonstrator Schematic Flight Configuration; 5) Ongoing Propellant Energy Source Tests; 6) First Generation Propulsion System Status; 7) Tungsten Fuel Pin Simulator Tests; 8) Full Module Test (High Efficiency Mode); and 9) First Generation Propulsion Flight Demonstrator Status.

CASI

Fission; Propulsion System Performance; Nuclear Fuels; Simulators

74
OPTICS

Includes light phenomena and the theory of optical devices. For lasers see 36 Lasers and Masers.

20000032217 NASA Marshall Space Flight Center, Huntsville, AL USA

Investigation of Third Order Optical Nonlinearity and Reverse Saturable Absorption of Octa-alkoxy Metallophthalocyanines

Sanghadasa, Mohan, Alabama Univ., USA; Shin, In–Seek, Alabama Univ., USA; Barr, Thomas A., Alabama Univ., USA; Clark, Ronald D., New Mexico Highlands Univ., USA; Guo, Huai–Song, New Mexico Highlands Univ., USA; Martinez, Angela, New Mexico Highlands Univ., USA; Penn, Benjamin G., NASA Marshall Space Flight Center, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 545-550; In English; See also 20000032189

Contract(s)/Grant(s): NAGW-4078; NAG8-1057; NAG8-1288; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

In recent years, there has been a growing interest in the development of passive optical power limiters for the protection of the human eye and solid-state sensors from damage caused by energetic light pulses and also for other switching applications. One of the key issues involved is the search for appropriate materials that show effective reverse saturable absorption. Phthalocyanines seem to be good candidates for such applications because of their higher third order nonlinearity and the unique electronic absorption characteristics. A series of 1,4,8,11,15, 18,22,25-octa-alkoxy metallophthalocyanines containing various central metal atoms such as zinc, copper, palladium, cobalt and nickel were characterized for their third order nonlinearity and for their nonlinear absorptive properties to evaluate their suitability to function as reverse saturable absorbers.

Author

Phthalocyanin; Power Limiters; Optical Materials; Organic Materials; Organometallic Compounds; Pulsed Lasers; Optical Equipment; Alkyl Compounds

20000032246 NASA Marshall Space Flight Center, Huntsville, AL USA

Effect of halogenation on the nonlinear optical properties of porthyrin and substituted porphyrins

Cardelino, Beatriz H., Spelman Coll., USA; Moore, Craig E., NASA Marshall Space Flight Center, USA; Benloss, Angela, Spelman Coll., USA; Thompson, Albert N., Jr., Spelman Coll., USA; Richards, Rosalie A., Spelman Coll., USA; Roney, Celeste A., Spelman Coll., USA; Sanghadasa, Mohan, Alabama Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 663-670; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The effect that fluorine and chlorine substitution has on the nonlinear optical properties of porphyrin, tetramethylporphyrin and tetraphenylporphyrin has been theoretically studied. The calculations of nonlinear optical properties have been obtained by performing finite-field calculations on structures determined by semiempirical methods. In addition, tetra(p-chlorophenyl)porphyrin and tetra(p-bromophenyl)porphyrin were synthesized by the condensation of pyrrol and the appropriate aldehyde. Thin films of polymethylmethacrylate were obtained containing these materials, by spin coating onto glass substrates. The films were characterized by third-harmonic generation. It was determined that the experimental conditions enhance the third-order polarizability of the tetraphenylporphyrins by a factor of about 1.6.

Author

Halogenation; Nonlinearity; Optical Properties; Porphyrins

20000032279 NASA Marshall Space Flight Center, Huntsville, AL USA

Syntheses of Octasubstituted Metal Phthalocyanines for Nonlinear Optics

Guo, Huaisong, New Mexico Highlands Univ., USA; Townsend, Cheryl, New Mexico Highlands Univ., USA; Sanghadasa, Mohan, Alabama Univ., USA; Amai, Robert L. S., New Mexico Highlands Univ., USA; Clark, Ronald D., New Mexico Highlands Univ., USA; Penn, Benjamin, NASA Marshall Space Flight Center, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 757-762; In English; See also 20000032189

Contract(s)/Grant(s): NAGW-4078; NAG8-1288; NAG8-1057

Report No.(s): 98URC135; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Many organic materials can be used as nonlinear optical media. Phthalocyanines are of special interest because they show an unusually large third order nonlinear response, they are thermally and photochemically stable and they can be formed into oriented thin films (Langmuir-Blodgett films). They also can be easily complexed by a large variety of metals, which place them at the interface between organics and organometallics, and allows for fine tuning of the macro cycle electronic properties by the coordinated metal and substituent groups. A series of 1,4,8,11,15,18,22,25-octaalkoxy metal-free and metal phthalocyanines and 2,3,9,10,16,17,23,24-octaalkoxy metal phthalocyanines has been synthesized. Their nonlinear optical properties have been measured. The physical properties of all the phthalocyanines synthesized in this work are subject to both acid and solvent effects.

Author

Nonlinear Optics; Phthalocyanin; Synthesis (Chemistry); Organic Materials; Optical Properties; Photochemical Reactions

20000032282 Fisk Univ., Dept. of Physics, Nashville,TN USA

Optical Properties of Phosphorus Implanted into Fused Silica

Denmark, D., Fisk Univ., USA; Taylor, T., Fisk Univ., USA; Mu, R., Fisk Univ., USA; Ueda, A., Fisk Univ., USA; Tung, Y. S., Fisk Univ., USA; Wu, M. H., Fisk Univ., USA; Henderson, D. O., Fisk Univ., USA; White, C. W., Oak Ridge National Lab., USA; Zuhr, R., Oak Ridge National Lab., USA; Meldrum, A., Oak Ridge National Lab., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 769-774; In English; See also 20000032189

Report No.(s): 98URC137; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

A series optical characterization of phosphorus ion implanted fused silica annealed at various temperatures with three different ion doses has been conducted. It is clearly demonstrated the thermal annealing effect on silica defects due to P ion implantation, formation of the P2 molecules and the final assembly of the P semiconductor quantum dots in each ion dose. The study of the P implanted silica has not only provide a unique opportunity to understand ion - material interaction, thermal diffusion and other fundamental physics and chemistry, it also serve as a guidance for semiconductor quantum dot fabrication.

Author

Optical Properties; Phosphorus; Silica Glass; Silicon Dioxide; Semiconductors (Materials); Annealing

20000032283 Clark-Atlanta Univ., GA USA

Constitutive Modeling of the Mechanical Properties of Optical Fibers

Moeti, L., Clark-Atlanta Univ., USA; Moghazy, S., Clark-Atlanta Univ., USA; Veazie, D., Clark-Atlanta Univ., USA; Cuddihy, E., Jet Propulsion Lab., California Inst. of Tech., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 217-222; In English; See also 20000032189

Report No.(s): 98URC040; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Micromechanical modeling of the composite mechanical properties of optical fibers was conducted. Good agreement was obtained between the values of Young's modulus obtained by micromechanics modeling and those determined experimentally for a single mode optical fiber where the wave guide and the jacket are physically coupled. The modeling was also attempted on a polarization-maintaining optical fiber (PANDA) where the wave guide and the jacket are physically decoupled, and found not to applicable since the modeling required perfect bonding at the interface. The modeling utilized constituent physical properties such as the Young's modulus, Poisson's ratio, and shear modulus to establish bounds on the macroscopic behavior of the fiber. Author

Mathematical Models; Mechanical Properties; Micromechanics; Optical Fibers; Polarization

20000032310 Puerto Rico Univ., Dept. of Physics, Mayaguez, Puerto Rico

Anisotropic Optical-Response of Eu-doped Yttrium Orthosilicate

Liu, Huimin, Puerto Rico Univ., Puerto Rico; Santiago, Miguel, Puerto Rico Univ., Puerto Rico; Jia, Weiyi, Puerto Rico Univ., Puerto Rico; Zhang, Shoudu, Academia Sinica, China; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 848-853; In English; See also 20000032189

Contract(s)/Grant(s): NCCW-88; DAAH04-96-1-0416; DE-FRO2-94ER-757640; NSF EHR-91-08775

Report No.(s): 98URC151; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Eu-doped yttrium orthosilicate (Eu(3+) : Y2SiO5) had been a subject being investigated for coherent time-domain optical memory and information processing applications since its ultraslow optical dephasing was discovered several years ago. In this crystal the weakly allowed (7)F0 - (5)D0 transition of europium ions exhibits a sufficient long dephasing time and no spectral difli.usion on a time scale of several hours at low temperature, thus an information pattern or data can be stored as a population grating in the ground state hyperfine levels. On the other hand, the study on photon-echo relaxation shows that the dephasing time T2 of Eu (3+) and other rare-earth ions doped YAG, YAlO3 strongly depends on the intensity of the excitation pulses. In Eu (3+) :YAlO3, an exponential decay of photon-echo with T2 = 53 microseconds if the excitation pulses are weak (5 vJ/pulse) was observed. However, when the excitation pulses are strong (80 pJ/pulse) they observed a much shortened T2 with a highly nonexponential decay pattern. The conclusion they derived is that the intensity-dependent dephasing rate effects are quite general, and it depends on how much the excitation intensity varies. In this paper we use transient grating formation technique showing that a temporal lattice distortion may only occur along crystal c axis, caused by EU (3+) excitation. At high excitation level the produced exciton in conduction band may also couple to the dynamical lattice relaxation process, giving rise to an apparently much shortened dephasing time.

Derived from text

Anisotropy; Optical Memory (Data Storage); Europium; Yttrium; Doped Crystals; Silicates

20000032311 New Mexico Univ., NASA Center for Autonomous Control Engineering, Albuquerque, NM USA

Use of MCNP Monte Carlo Code as a Tool for Collimator Design

Gutierrez, Daniel, New Mexico Univ., USA; Grazioso, Ron, New Mexico Univ., USA; Partridge, Michael, New Mexico Univ., USA; Heger, A. Sharif, New Mexico Univ., USA; Wolfe, David, New Mexico Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 296-300; In English; See also 20000032189

Report No.(s): 98URC054; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

The use of MCNP Monte Carlo Code as a tool for collimator design was test by comparing actual collimator tests by experimental mean to the simulations generated by of MCNP. Multiple runs of simulated method and the experimental method were performed using a point source. The count detected by each method were plotted individually and then after corrections for total activity were made, they were plotted against each other. The only difference in the two methods was seen at the edges of

the hole. This difference could come about because of the inability to make a true point source in the experimental method. Beside the difference at the edges the MCNP Monte Carlo Code result were very highly correlated to the experimental results.
Author
Monte Carlo Method; Applications Programs (Computers); Collimators; Design Analysis; Imaging Techniques

20000032623 Saitama Inst. of Tech., Saitama, Japan
Observation of Rocking Curves in Lane Case with Only Imaginary Part of X-Ray Polarizability
Fukamachi, Tomoe, Saitama Inst. of Tech., Japan; Negishi, Riichirou, Saitama Inst. of Tech., Japan; Kawamura, Takaaki, Saitama Inst. of Tech., Japan; Yoshizawa, Masami, Saitama Inst. of Tech., Japan; Nakajima, Tetsuo, Saitama Inst. of Tech., Japan; Ehara, Kenji, Saitama Inst. of Tech., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 52-55; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

By using monochromated X-rays from synchrotron radiation (KEK PF) in the range between the K-absorption edges for Ga and As in a GaAs perfect crystal, we have observed the transmitted rocking curve of 200 reflection which is induced by only the imaginary part of X-ray polarizability. The rocking curve is good agreement with the calculated one based on the formulae by Fukamachi and Kawamura.
Author
Gallium Arsenides; X Ray Analysis; Crystal Optics; Synchrotron Radiation

20000032917 NASA Marshall Space Flight Center, Huntsville, AL USA
Reduced Gravity Zblan Optical Fiber
Tucker, Dennis S., NASA Marshall Space Flight Center, USA; Workman, Gary L., Alabama Univ., USA; Smith, Guy A., Alabama Univ., USA; [2000]; 2p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-0945; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

Two optical fiber pullers have been designed for pulling ZBLAN optical fiber in reduced gravity. One fiber puller was designed, built and flown on board NASA's KC135 reduced gravity aircraft. A second fiber puller has been designed for use on board the International Space Station.
Author
Microgravity; Optical Fibers; Pulling; Fiber Optics

20000032936 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Control of Molecular Orientation of LC Alignment Film Surfaces by UV Light Irradiation
Usami, Kiyoaki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 313-314; In Japanese; Copyright; Avail: Issuing Activity

We have investigated the relation between the surface anisotropy of a poly [4,4'-oxydiphenylene-pyromellitimide] (PMDA-ODA) film irradiated with linearly polarized UV (LPUV) light (A = 266 nm) and the irradiation energy. The surface anisotropy induced by irradiation of LPUV light is much smaller than that induced by rubbing. The reason for this is that the decomposition rate of the polyimide chain oriented parallel to the polarization direction of the LPUV light is only by about 23% greater than that oriented perpendicular to it. Using the decomposition rate ratio determined experimentally, polyimide chain orientation of the film surface was simulated for various conditions of LPUV light irradiation. The controllability of polyimide chain orientation by LPUV light irradiation was discussed.
Author
Anisotropy; Controllability; Irradiation; Polymeric Films; Molecular Chains

20000032937 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Cube Optical Filter using Silver Island Multilayers
Hasegawa, Takashi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 273-274; In Japanese; Copyright; Avail: Issuing Activity

For cube optical filters, we have investigated the optical characteristics of periodic multilayers of silver island layers and glass layers. The optical characteristics of the filters are controlled by the structural parameters of silver island layers. It has been confirmed that the proposed cube filters have low polarization sensitivity.
Author
Optical Filters; Optical Properties; Silver; Optical Polarization; Glass Coatings

20000032945 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on Waveguide In-line Optical Devices using Liquid Crystal

Yoda, Hidehiko, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 40-42; In Japanese; Copyright; Avail: Issuing Activity

Waveguide in-line optical devices using liquid crystal (LC) are useful for high integration and various functions in optical components. In this paper, such two kinds of devices are reported. One is a tunable wavelength filter using twisted nematic LC, which can he applied as a basic component of wavelength division multiplexed transmission systems. The tuning characteristics of the filter are analyzed using Jones matrix method and coupled mode theory. The other is an LC waveplate integrated into a polymer waveguide, which has a novel structure and potential for an optical circuit element used to transform the state of polarization of guided waves. The LC waveplate is designed to work as a half-waveplate, which behavior is confirmed.
Author

Optical Waveguides; Liquid Crystals; Optical Equipment

20000032975 NASA Marshall Space Flight Center, Huntsville, AL USA

Data Retrieval Algorithms for Validating the Optical Transient Detector and the Lightning Imaging Sensor

Koshak, W. J., NASA Marshall Space Flight Center, USA; Blakeslee, R. J., NASA Marshall Space Flight Center, USA; Bailey, J. C., Raytheon STX Corp., USA; Journal of Atmospheric and Oceanic Technology; March 2000; Volume 17, pp. 279-297; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A linear algebraic solution is provided for the problem of retrieving the location and time of occurrence of lightning ground strikes from an Advanced Lightning Direction Finder (ALDF) network. The ALDF network measures field strength, magnetic bearing, and arrival time of lightning radio emissions. Solutions for the plane (i.e., no earth curvature) are provided that implement all of these measurements. The accuracy of the retrieval method is tested using computer-simulated datasets, and the relative influence of bearing and arrival time data an the outcome of the final solution is formally demonstrated. The algorithm is sufficiently accurate to validate NASA:s Optical Transient Detector and Lightning Imaging Sensor. A quadratic planar solution that is useful when only three arrival time measurements are available is also introduced. The algebra of the quadratic root results are examined in detail to clarify what portions of the analysis region lead to fundamental ambiguities in sc)iirce location, Complex root results are shown to be associated with the presence of measurement errors when the lightning source lies near an outer sensor baseline of the ALDF network. For arbitrary noncollinear network geometries and in the absence of measurement errors, it is shown that the two quadratic roots are equivalent (no source location ambiguity) on the outer sensor baselines. The accuracy of the quadratic planar method is tested with computer-generated datasets, and the results are generally better than those obtained from the three-station linear planar method when bearing errors are about 2 deg.
Author

Data Retrieval; Algorithms; Computerized Simulation; Lightning; Imaging Techniques; Magnetic Bearings

20000032982 NASA Goddard Space Flight Center, Greenbelt, MD USA

NGST OTA Optical Metrology Instrumentation and Conceptual Approaches

Keski–Kuha, R., NASA Goddard Space Flight Center, USA; Bely, P., Space Telescope Science Inst., USA; Burg, R., NASA Goddard Space Flight Center, USA; Burge, J., Arizona Univ., USA; Davila, P., NASA Goddard Space Flight Center, USA; Geary, J., Alabama Univ., USA; Hapopian, J., NASA Goddard Space Flight Center, USA; Jacobson, D., NASA Marshall Space Flight Center, USA; Lowman, A., Jet Propulsion Lab., California Inst. of Tech., USA; Macenka, S., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 6p; In English, 27-31 Mar. 2000, Munich, Germany; Sponsored by International Society for Optical Engineering; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An Integrated Product Team (IPT) was formed to develop a detailed concept for optical test methodology for testing of the NGST individual primary, secondary and tertiary mirrors and the full telescope system on the ground. Optical testing is a significant cost driver therefore the testing has to understood in detailed fashion early. A brief summary of the preliminary metrology test plan at the mirror component and telescope system level is presented.
Author

Metrology; Mirrors; Telescopes

20000033086 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of Reflectometry using Optical Spectral Domain Interference and its Application

Funaba, Tadayuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 130-133; In Japanese; Copyright; Avail: Issuing Activity

Reflectometry using optical spectrum domain interference is the unique technique of measuring reflection without a mechanical shift. In this paper, reflectometry using optical spectrum domain interference was proposed and an analysis was performed with a device function of a spectrometer. The verification experiment and the measurement application were demonstrated. The power spectrum of the multi-mode laser and the super luminescent diode was approximated by the well-known function and analyzed a measurement characteristic. The validity of the analysis was confirmed by the experiment. A measurement system was constructed and analyzed the basic characteristic. Application to profile measurement and tomographic measurement was tried. If a distance from the reference plane was within 500 microns, a good result was obtained in profile measurement. Inside structure around the surface could be recognized in tomographic measurement. The fundamental theory of reflectometry using optical spectrum domain interference was established and its potential for the measurement application was shown.
Author
Refractometers; Optical Measurement; Electromagnetic Interference

20000033181 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Polarization Control Device Using Liquid Crystal and the Control Method
Chiba, Takafumi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 16-19; In Japanese; Copyright; Avail: Issuing Activity

In this study, a novel polarization stabilizer which employs liquid crystal rotatable waveplates is proposed and demonstrated for the first time. The stabilizer has a simple configuration, no moving parts and endless-control capability. High polarization stability was confirmed under various SOP (State of Polarization) fluctuations. Response speed limit of the polarization stabilizer is about 2.5 Hz (900 deg/s) at present, but improvement of the controller should make it faster. We applied the polarization stabilizer to a semiconductor optical amplifier having polarization dependence. It was effective in the gain stabilizing. and the total optical gain was 4.8 dB.
Author
Control Equipment; Liquid Crystals; Stabilization; Polarization (Waves)

20000033287 National Defence Research Establishment, Div. of Sensor Technology, Linkoeping, Sweden
Methods for Evaluating Image Degradation ***Metoder foer Bildstoerningsanalys***
Oestman, P.; Ericson, N.; Apr. 1999; 132p; In Swedish; Original contains color illustrations
Report No.(s): PB2000-103075; FOA-R-99-01115-612-SE; No Copyright; Avail: National Technical Information Service (NTIS)

As a consequence of stray light an optical sensor can be jammed when exposed to optical radiation, even if the source of radiation is located outside the field of view of the sensor. This constitutes a threat against optical seekers, image intensifiers, cameras, optical sights etc, because these sensors can be jammed by laser illumination. This report describes methods for evaluating degradations in images created by sensors that have been exposed to such jamming. The report is the result of a master thesis and contains an inventory of published methods, modified such methods and some invented methods. The methods have been tested and compared to each other. The test results have also been compared to the extent of image degradation estimated by test subjects.
NTIS
Images; Degradation; Jamming; Optical Measuring Instruments; Radiation Spectra

20000033551 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK
A Closed-Loop Adaptive Optical System for Laser Wavefront Control
Hooker, C. J., Rutherford Appleton Lab., UK; Divall, E. J., Rutherford Appleton Lab., UK; Lester, W. J., Rutherford Appleton Lab., UK; Moutzouris, K., Rutherford Appleton Lab., UK; Reason, C. J., Rutherford Appleton Lab., UK; Ross, I. N., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 199-200; In English; See also 20000033474; Copyright; Avail: Issuing Activity

The R&D programme to develop an adaptive optical system for the control of laser beam quality has continued throughout the year. Since the publication of the previous report we have changed the experimental configuration of the testbed, to allow monitoring of the focus after the adaptive mirror. After changing the way in which the control matrix is generated, we have successfully operated the system in closed-loop mode, and achieved substantial improvements in the far field of an aberrated

beam. We have also begun construction of a larger-aperture mirror for off-line trials on Vulcan, which we intend to conduct in TA2 later in the year.
Author
Closed Cycles; Research and Development; Fabrication; Optical Equipment; Feedback Control; Laser Beams; Optical Control

75
PLASMA PHYSICS

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

20000032087 National Inst. for Fusion Science, Toki, Japan
Complete Suppression of Pfirsch-Schluter Current in a Toroidal l=3 Stellarator
Sato, Yasuhiko, Kyoto Univ., Japan; Yokoyama, Masayuki, National Inst. for Fusion Science, Japan; Wakatani, Masahiro, Kyoto Univ., Japan; Pustovitov, Vladimir D., Kurchatov (I. V.) Inst. of Atomic Energy, USSR; October 1999; ISSN 0915-633X; 18p; In English
Report No.(s): NIFS-612; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Pfirsch-Schluter (PS) current is an inherent property of a finite pressure toroidal equilibrium of tokamak and stellarator. However it was pointed out recently (V. D. Pustovitov, Nuclear Fusion 36 (1996) 583) that the P-S current would be suppressed completely if the external vertical field could be adjusted to satisfy the condition Omega = (Omega) in an l = 3 stellarator. Here Omega = (bar-B(sup 2))/B(sup 2, sub 0) - 2epsilon cos theta, l is a pole number, absolute value of bar-B the vacuum helical magnetic field, B(sub 0) the toroidal field, epsilon the inverse aspect ratio, theta the poloidal angle and (...) denotes the average over the toroidal angle. An example of such a stellarator equilibrium is presented in this paper. For this stellarator equilibrium, behavior of rotational transform and Boozer magnetic spectrum is clarified when the pressure is increased. Both formation of helical magnetic axis and reduction of toroidal curvature are important ingredients to reduce the P-S current. However, the collisionless particle confinement is not improved in this example.
Author
Stellarators; Tokamak Devices; Plasma Control; Toroidal Plasmas; Nuclear Fusion; Collisionless Plasmas

20000032088 National Inst. for Fusion Science, Toki, Japan
H(-) Ion Source using a Localized Virtual Magnetic Filter in the Plasma Electrode: Type I LV Magnetic Filter
Oka, Y., National Inst. for Fusion Science, Japan; Kaneko, O., National Inst. for Fusion Science, Japan; Tsumori, K., National Inst. for Fusion Science, Japan; Takeiri, Y., National Inst. for Fusion Science, Japan; Osakabe, M., National Inst. for Fusion Science, Japan; Kawamoto, T., National Inst. for Fusion Science, Japan; Asano, E., National Inst. for Fusion Science, Japan; Akiyama, R., National Inst. for Fusion Science, Japan; December 1999; ISSN 0915-633X; 14p; In English
Report No.(s): NIFS-622; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new multicusp H(-) ion source using a Localized Virtual magnetic filter of type I in the plasma electrode is investigated. A multipole (MP) arrangement with a spacing of 10 mm of the magnet bars holds an extraction hole, optimizing the efficient production of high H(-) current, and at the same time only a small electron component was co-extracted with the H(-) ions. The local filter arrangement separates the beam electrons at a low energy. It is shown that the co-extracted total electron current is determined principally by the integrated magnetic field flux (Gcm) of the local filter with an extraction system at a constant extraction voltage. When the value of the Gcm is increased, the total electron component is reduced, while the H(-) electrical efficiency had a broad maximum around the optimized value of the Gcm. A thicker plasma electrode should be necessary for sufficient reduction of electron current. In pure hydrogen operation, the achieved current density of H(-) is 10 mA/sq cm . When Cs was seeded in a filter optimized for pure volume mode H(-) production, the maximum H(-) current density obtained is 51 mA/sq cm and the ratio I(sub ele) / H(-) is approximately 0.4 without applying a bias potential.
Author
Hydrogen; Ion Sources; Negative Ions; Magnetic Fields; Magnetic Flux; Plasma Electrodes

20000032089 National Inst. for Fusion Science, Toki, Japan
Analysis of Current Diffusive Ballooning Mode in Tokamaks
Uchida, M., Kyoto Univ., Japan; Fukuyama, A., Kyoto Univ., Japan; Itoh, K., National Inst. for Fusion Science, Japan; Itoh, S.–I., Kyushu Univ., Japan; December 1999; ISSN 0915-633X; 12p; In English
Report No.(s): NIFS-615; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effect of finite gyroradius on the current diffusive ballooning mode is examined. Starting from the reduced MHD equations including turbulent transports, coupling with drift motion and finite gyroradius effect of ions, we derive a ballooning mode equation with complex transport coefficients. The eigenfrequency, saturation level and thermal diffusivity are evaluated numerically from the marginal stability condition. Preliminary results of their parameter dependence is presented.
Author
Thermal Diffusivity; Ballooning Modes; Magnetohydrodynamic Stability; Magnetohydrodynamics; Plasma Control

20000032090 National Inst. for Fusion Science, Toki, Japan
Core Localized Toroidal Alfven Eigenmodes Destabilized by Energetic Ions in the CHS Heliotron/Torsatron
Takechi, M., Nagoya Univ., Japan; Matsunaga, G., Nagoya Univ., Japan; Takagi, S., Nagoya Univ., Japan; Ohkuni, K., Nagoya Univ., Japan; Toi, K., National Inst. for Fusion Science, Japan; Osakabe, M., National Inst. for Fusion Science, Japan; Isobe, M., National Inst. for Fusion Science, Japan; Okamura, S., National Inst. for Fusion Science, Japan; Matsuoka, K., National Inst. for Fusion Science, Japan; September 1999; ISSN 0915-633X; 10p; In English
Report No.(s): NIFS-610; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
In a fusion reactor, it is predicted that the toroidal Alfven eigenmodes (TAE) destabilized by the pressure gradient of energetic alpha particles with super-Alfvenic velocity, could expel the alpha particles before thermalization. In large tokamaks, the excitation of TAEs has been extensively studied by the use of energetic ions generated by neutral beam injection (NBI) and ion cyclotron heating and also by the use of alpha particles in a deuterium-tritium plasma. TAE research is also important for helical systems, with moderate or high magnetic shear, that is, a heliotron/torsatron device. In the CHS heliotron/torsatron, we investigate TAE excitation by energetic ions in NBI-heated plasma.
Derived from text
Magnetohydrodynamic Waves; Magnetohydrodynamics; Energetic Particles; Alpha Particles; Heliotrons; Tokamak Devices; Plasma Control; Plasmas (Physics); Ion Cyclotron Radiation

20000032091 National Inst. for Fusion Science, Toki, Japan
MHD Equilibrium and Stability in Heliotron Plasmas
Ichiguchi, Katsuji, National Inst. for Fusion Science, Japan; September 1999; ISSN 0915-633X; 46p; In English
Report No.(s): NIFS-611; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Recent topics in the theoretical magnetohydrodynamic (MHD) analysis in the heliotron configuration are over-viewed. Particularly, properties of three-dimensional equilibria, stability boundary of the interchange mode, effects of the net toroidal current including the bootstrap current and the ballooning mode stability are focused.
Author
Magnetohydrodynamics; Magnetohydrodynamic Stability; Heliotrons; Plasma Control; Plasmas (Physics); Equilibrium Flow; Three Dimensional Motion

20000032095 National Inst. for Fusion Science, Toki, Japan
Design of Spheromak Injector using Conical Accelerator for Large Helical Device
Miyazawa, J., National Inst. for Fusion Science, Japan; Yamada, H., National Inst. for Fusion Science, Japan; Yasui, K., National Inst. for Fusion Science, Japan; Kato, S., National Inst. for Fusion Science, Japan; Fukumoto, N., Himeji Inst. of Tech., Japan; Nagata, M., Himeji Inst. of Tech., Japan; Uyama, T., Himeji Inst. of Tech., Japan; November 1999; ISSN 0915-633X; 20p; In English
Report No.(s): NIFS-614; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Optimization of CT injector for LHD has been carried out and conical electrode for adiabatic CT compression is adopted in the design. Point-model of CT acceleration in a co-axial electrode is solved to optimize the electrode geometry and the power supplies. Large acceleration efficiency of 34% is to be obtained with 3.2 m long conical accelerator and 40 kV - 42 kJ power supply. The operation scenario of a CT injector named SPICA mk. I (SPheromak Injector using Conical Accelerator) consisting of 0.8 m conical accelerator is discussed based on this design.
Author
Spheromaks; Plasma Control; Tokamak Devices; Injectors; Stellarators; Heliotrons

20000032096 National Inst. for Fusion Science, Toki, Japan
Non-Dissipative Kinetic Simulation and Analytical Solution of Three-Mode Equations of Ion Temperature Gradient Instability
Watanabe, T.–H., National Inst. for Fusion Science, Japan; Sugama, H., National Inst. for Fusion Science, Japan; Sato, T., National

Inst. for Fusion Science, Japan; December 1999; ISSN 0915-633X; 14p; In English
Report No.(s): NIFS-619; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A non-dissipative drift kinetic simulation scheme, which rigorously satisfies the time-reversibility, is applied to the three-mode coupling problem of the ion temperature gradient (ITG) instability. It is found from the simulation that the three-mode ITG system repeats growth and decay with a period which shows a logarithmic divergence for infinitesimal initial perturbations. Accordingly, time average of the mode amplitude vanishes, as the initial amplitude approaches to zero. An exact solution is analytically given for a class of initial conditions. An excellent agreement is confirmed between the analytical solution and numerical results. The results obtained here provide a useful reference for basic benchmarking of theories and simulations of the ITG modes.

Author

Dissipation; Drift Rate; Euler Equations of Motion; Kinetic Equations; Simulation; Ion Temperature; Temperature Gradients

20000032184 National Inst. for Fusion Science, Toki, Japan

Reduced Drift Kinetic Equation for Neoclassical Transport of Helical Plasmas in Ultra-Low Collisionality Regime

Wang, Shaojie, Academy of Sciences, China; Sanuki, Heiji, National Inst. for Fusion Science, Japan; Sugama, Hideo, National Inst. for Fusion Science, Japan; October 1999; ISSN 0915-633X; 14p; In English
Report No.(s): NIFS-613; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Based on the original five-dimensional drift kinetic equation, a three-dimensional reduced drift kinetic equation has been obtained to describe the neoclassical transport of helical plasmas in ultra-low collisionality regime where the collision frequency is much lower than the poloidal bounce frequency of the super banana particles. The reduced drift kinetic equation describes the evolution of the distribution function in terms of three independent constants of motion. In contrast to the conventional neoclassical theory, this reduced drift kinetic equation includes the effects of finite super banana width and the effects of finite aspect ratio. Therefore, this reduced drift kinetic equation is suitable for studying the collisional transport of fast ions in helical magnetic confinement systems.

Author

Drift Rate; Kinetic Equations; Transport Theory; Three Dimensional Motion

20000032218 Florida Agricultural and Mechanical Univ., Lab. for Modern Fluid Physics, Tallahassee, FL USA

Reverse Energy Cascade in Turbulent Weakly Ionized Plasmas

Williams, Kyron, Florida Agricultural and Mechanical Univ., USA; Appartaim, R., Florida Agricultural and Mechanical Univ., USA; Belay, K., Florida Agricultural and Mechanical Univ., USA; Johnson, J. A., III, Florida Agricultural and Mechanical Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 61-66; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

For systems far from equilibrium, the neglect of a role for viscous effects in turbulence may be generally inappropriate when the relaxation time for the molecular process approaches the local flow time (Orou et al. (1996)). Furthermore, for stationary collisional plasmas, the conventional Reynolds number is irrelevant under circumstances where the standard features of turbulence in ordinary gases are observed in the plasma (Johnson et al. (1987)). The current theoretical understanding of these turbulent phenomenon is particularly inadequate for turbulence associated with ionizing shock waves; generally speaking, thermodynamic, acoustic and pressure fluctuations are all seen as amplified across the shock wave followed by a dramatic decay (relaminarization) usually attributed to a lack of importance of viscosity in the turbulent regions. This decay would be accelerated when the flow speed is also reduced due to the importance usually given to the conventional Reynolds number (which is directly proportional to velocity) as a quality of turbulence index. However, evidence supporting this consensus is lacking. by contrast, recent evidence of vanishing triple correlations form De Silva et al. (1996) provides strong support for early theoretical speculation of inherently molecular effects in macroscopic turbulence in Tsuge (1974). This specifically suggests that the role of compressive effects ordinarily associated with the shock wave could be significantly muted by the existence of a strongly turbulent local environment. There is also more recent theoretical speculation (Frisch et al. (1984)) of an inherently and previously unsuspected non-dissipative nature to turbulence, with energy conservation being nurtured by reverse energy cascades in the turbulent fluctuation spectra. Furthermore, the role which might be played by fluctuations on quantum mechanical phenomena and variations in molecular parameters is completely unknown, especially of the sort which might be found in optical spectra. A

determination of the role which changing turbulent parameters might play on optical signatures behind a reflected shock wave should therefore provide a useful tool for the evolution of theoretical models for turbulence.
Derived from text
Collisional Plasmas; Ionized Gases; Shock Waves; Turbulent Flow; Viscous Flow; Reflected Waves; Energy Conservation; Hypersonic Shock; Shock Wave Interaction

20000032236 Fisk Univ., Dept. of Physics, Nashville, TN USA
Measurements of the Plasma Parameters and Low Frequency Oscillations in the Fisk Plasma Source
Thomas, Edward, Jr., Fisk Univ., USA; Wallace, Kent, Fisk Univ., USA; Lampkin, Gregory, Fisk Univ., USA; Watson, Michael, Fisk Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 612-617; In English; See also 20000032189
Contract(s)/Grant(s): NCC8-133; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
A new plasma device, the Fisk Plasma Source (FPS), has been developed at Fisk University. This plasma device is used to study the physics of low temperature plasmas and plasma-material interactions. The FPS device is a stainless steel vacuum 6-way cross vacuum vessel with at 10-inch inner diameter. Low temperature argon plasmas are generated using DC glow discharge and thermionic filament techniques. Spatial profiles of the plasma density, plasma potential, and electron temperature are measured using Langmuir probes. We present initial experimental measurements of density and temperature profiles in the FPS device. Experimental and theoretical studies of low frequency oscillations observed in the FPS device are also presented.
Author
Cold Plasmas; Plasma Frequencies; Plasma Interactions; Plasma Potentials; Plasmas (Physics); Plasma Density

20000032274 Fisk Univ., Dept. of Physics, Nashville,TN USA
Plasma Processing of Metallic and Semiconductor Thin Films in the Fisk Plasma Source
Lampkin, Gregory, Fisk Univ., USA; Thomas, Edward, Jr., Fisk Univ., USA; Watson, Michael, Fisk Univ., USA; Wallace, Kent, Fisk Univ., USA; Chen, Henry, Fisk Univ., USA; Burger, Arnold, Fisk Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 751-756; In English; See also 20000032189
Contract(s)/Grant(s): NCC8-133
Report No.(s): 98URC134; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
The use of plasmas to process materials has become widespread throughout the semiconductor industry. Plasmas are used to modify the morphology and chemistry of surfaces. We report on initial plasma processing experiments using the Fisk Plasma Source. Metallic and semiconductor thin films deposited on a silicon substrate have been exposed to argon plasmas. Results of microscopy and chemical analyses of processed materials are presented.
Author
Metal Films; Plasmas (Physics); Semiconductors (Materials); Thin Films; Mathematical Models; Argon Plasma

20000032497 Japan Atomic Energy Research Inst., Tokyo, Japan
Stationary periodic and solitary waves induced in an isotropic plasma by a strong short laser pulse
Tsintsadze, L. N.; Nishikawa, K.; Tajima, T.; Mendonca, J. T.; Mar. 31, 1999; 23p; In English
Report No.(s): DE99-758374; JAERI-RESEARCH-99-030; No Copyright; Avail: Department of Energy Information Bridge
A description of propagation of a relativistically intense short laser pulse into an isotropic plasma is presented. A kinetic equation for the spectral function of the electromagnetic (EM) waves is derived for an arbitrary amplitude pump wave, where the fully relativistic case is considered. The resulting kinetic equation of the spectral function is used along with the self of equations of the plasma to derive a general dispersion relation, and the importance of relativistic effects is pointed out. In the case of a superstrong short laser pulse novel Langmuir waves, with phase velocities larger than the speed of light, and waves of ion-sound type, which are damped only on ions, are found. In addition, for the case when the plasma density along with the mass of the electrons satisfies the 'frozen-in' condition, stationary nonlinear new type of ion-sound waves are investigated. The mechanism of the emission of these waves is also discussed.
NTIS
Solitary Waves; Isotropic Media; Plasma Waves; Lasers

20000032627 Saitama Inst. of Tech., Saitama, Japan

Oxidation of Cycloalkanes in a Radio Frequency Plasma

Tezuka, Meguru, Saitama Inst. of Tech., Japan; Iwasaki, Masakazu, Saitama Inst. of Tech., Japan; Yajima, Tatsuhiko, Saitama Inst. of Tech., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 30-33; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Cyclopentane, cyclohexane, cycloheptane, and cyclooctane were reacted in a radio frequency plasma containing oxygen to give mixtures of the corresponding cycloalkanones and cycloalkanols. Tetralin was also oxidized to 1-tetralone and 1-tetralol. Based on the effects of reaction variables on the oxidation rate, the reaction scheme involving the autoxidation of cycloalkyl radicals was proposed.

Author

Plasmas (Physics); Radio Frequencies; Cyclic Hydrocarbons; Gas Mixtures; Oxidation; Oxygen Atoms

20000032965 NASA Marshall Space Flight Center, Huntsville, AL USA

Charged Particle Environment Definition for NGST: L2 Plasma Environment Statistics

Minow, Joseph I., Sverdrup Technology, Inc., USA; Blackwell, William C., Sverdrup Technology, Inc., USA; Neergaard, Linda F., Sverdrup Technology, Inc., USA; Evans, Steven W., NASA Marshall Space Flight Center, USA; Hardage, Donna M., NASA Marshall Space Flight Center, USA; Owens, Jerry K., NASA Marshall Space Flight Center, USA; [2000]; 12p; In English; Astronomical Telescopes and Instrumentation 2000, 27-31 Mar. 2000, Munich, Germany

Contract(s)/Grant(s): NAS8-40836; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The plasma environment encountered by the Next Generation Space Telescope satellite in a halo orbit about L2 can include the Earth's magnetotail and magnetosheath in addition to the solar wind depending on the orbital radius chosen for the mission. Analysis of plasma environment impacts on the satellite requires knowledge of the average and extreme plasma characteristics to assess the magnitude of spacecraft charging and materials degradation expected for the mission lifetime. This report describes the analysis of plasma data from instruments onboard the IMP 8 and Geotail spacecraft used to produce the plasma database for the LRAD engineering-level phenomenology code developed to provide the NGST L2 environment definition.

Author

Plasmas (Physics); Geomagnetic Tail; Magnetosheath; Solar Wind

20000032991 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Measurements of Particle Energy and Line Spectra in a High Density Plasma Flow

Sugimura, Taku, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 213-214; In Japanese; Copyright; Avail: Issuing Activity

A plasma flow velocity U, an ion temperature T(sub i), and a Mach number M(sub i) are measured simultaneously by a Mach probe, a time-of-flight type neutral-particle analyzer(TOF) and a spectrometer, in the HITOP device. We compared results of Mach probe measurement with those of the TOF and spectrometer. It is shown that M(sub i) estimated from the three methods are consistent with each other. It is observed that U increases in the region where the magnetic field is divergent, while T(sub i) decreases in the same region. It is considered that the thermal energy was transferred into the plasma flow energy.

Author

Particle Energy; Line Spectra; Magnetohydrodynamic Flow; Velocity Measurement; Temperature Measurement

20000032992 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Alfven-Wave Excitation and Propagation by a Newly-Developed Antenna

Ochiai, Tsutomu, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 211-212; In Japanese; Copyright; Avail: Issuing Activity

Excitation of shear Alfven waves has been so far investigated by use of several types of antennas. A new type of antenna, Rogowski-type coil, was developed and experimentally investigated for exciting azimuthally-symmetric shear Alfven waves. Radial profile of B(sub theta) and phase velocity showed that m=O shear Alfven wave was successfully excited by the Rogowski-type coil and propagated along magnetic field lines. A propagation characteristics measured by magnetic probes agreed with a theoretical dispersion relation which takes account of the flow velocity.

Author

Magnetohydrodynamic Waves; S Waves; Wave Excitation; Plasma Antennas

20000032993 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Supersonic Plasma Flow in Various Magnetic Nozzles

Hori, Fumio, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 209-210; In Japanese; Copyright; Avail: Issuing Activity

Supersonic plasma flow in various magnetic nozzle configurations are investigated in the HITOP(HIgh density TOhoku Plasma) device. Mach number of the plasma flow is measured by Mach probe along the flow direction. In case of expanding magnetic field configuration, so called magnetic nozzle, Mach number is observed to increase from 1.3 to 2.5 and then to decrease. Mechanism of the acceleration and deceleration is discussed.

Author

Magnetic Field Configurations; Magnetohydrodynamic Flow; Supersonic Flow; Magnetic Nozzles

20000032994 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Plasma Diagnostics using Microwave Reflectometry Method

Fukushi, Kenji, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 207-208; In Japanese; Copyright; Avail: Issuing Activity

Reflectometry method is investigated in order to measure radial density profiles and fluctuations in plasmas. A microwave reflectometer is applied to the HITOP plasma to measure the density profile and density fluctuation. Experimental results of the reflectometer are compared with those of electrostatic probes. In addition, the possibility of magnetic-fluctuation measurement by use of the reflectometry in the HITOP plasmas is discussed.

Author

Magnetic Measurement; Microwave Reflectometers; Plasma Diagnostics

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Control of Fine-Particle Cloud Structures in a Plasma

Ozaki, Ryoichi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 203-204; In Japanese; Copyright; Avail: Issuing Activity

Fine particles in plasmas, which are negatively charged up, have been demonstrated to form a Coulomb crystal under strong Coulomb interaction. After first observation of the Coulomb crystal in rf discharge devices, a dusty plasma consisting of many fine particles has been actively investigated. Here, we control a structure of fine particle clouds in a dc discharge plasma by applying dc potential or magnetic fields. A long fine-particle plasma-column, which is extended vertically along the magnetic field, is successfully formed by using a double plasma method. String structures of fine particles are also observed on a small levitation electrode. The particles constitute a chain-like structure ordered in vertical direction with a fundamental crystal structure. We first find that the vertical strings rotate as a whole in electron gyration direction perpendicular to the vertical magnetic field.

Author

Plasma Clouds; Coulomb Potential; Magnetic Fields

20000033091 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of High Performance Semiconductor Plasma Etching Process

Komeda, Hiroyuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 81-83; In Japanese; Copyright; Avail: Issuing Activity

The purpose of this study is fabrication of high performance semiconductor plasma etching process for sub-quarter micron technology and beyond. Especially, contact hole etching process demands low physical damage in addition to high selectivity and minimal charging with a large scale uniform plasma. In this study, mechanism of surface reactions such as fluorocarbon film deposition, plasma-induced damage and micro-loading effect were investigated. And then, key parameters for high performance plasma etching were determined. Furthermore, high performance and low cost contact hole etching technology using a new plasma source called Balanced Electron Drift(BED) magnetron plasma that demonstrates plasma-induce-damage free contact hole etching was developed.

Author

Semiconductor Plasmas; Plasma Etching

20000033110 Association Euratom-CEA, Dept. de Recherches sur la Fusion Controlee, Saint Paul-les-Durance, France

Hot plasma effects on the polarization of electron cyclotron waves

Dumont, R.; Giruzzi, G.; Dec. 31, 1998; 24p; In English

Report No.(s): DE99-632235; EUR-CEA-FC-1653; No Copyright; Avail: Department of Energy Information Bridge

The evolution of the wave polarization during the propagation of electron cyclotron waves in hot plasmas is investigateD. The coupled mode equations are solved in slab geometry, including the relativistic corrections to the dielectric tensor. This formalism is applied to purely ordinary or extraordinary modes, propagating obliquely with respect to the magnetic field in tokamak plasmas, in order to determine the rate of change of the mode purity due to finite temperature effects. It is found that such an alteration of the mode purity can be one to three orders of magnitude larger than in a cold plasma. However, the overall effect remains tolerable for most applications and typical parameters of magnetically confined plasmas.

NTIS

Plasmas (Physics); Tokamak Devices; Polarization (Waves); High Temperature Plasmas; Temperature Effects

20000033111 Association Euratom-CEA, Dept. de Recherches sur la Fusion Controlee, Saint Paul-les-Durance, France

Bifurcated equilibria in two-dimensional MHD with diamagnetic effects

Ottaviani, M.; Tebaldi, C.; Dec. 31, 1998; 29p; In English

Report No.(s): DE99-632234; EUR-CEA-FC-1652; No Copyright; Avail: Department of Energy Information Bridge

In this work we analyzed the sequence of bifurcated equilibria in two-dimensional reduced magnetohydrodynamics. Diamagnetic effects are studied under the assumption of a constant equilibrium pressure gradient, not altered by the formation of the magnetic island. The formation of an island when the symmetric equilibrium becomes unstable is studied as a function of the tearing mode stability parameter (Delta)' and of the diamagnetic frequency, by employing fixed-points numerical techniques and an initial value code. At larger values of (Delta)' a tangent bifurcation takes place, above which no small island solutions exist. This bifurcation persists up to fairly large values of the diamagnetic frequency (of the order of one tenth of the Alfven frequency). The implications of this phenomenology for the intermittent MHD dynamics observed in tokamaks is discussed.

NTIS

Tokamak Devices; Magnetohydrodynamics; Diamagnetism; Equilibrium Equations; Two Dimensional Models

20000033112 Association Euratom-CEA, Dept. de Recherches sur la Fusion Controlee, Saint Paul-les-Durance, France

Gyro-radius scaling of ion thermal transport from global numerical simulations of ITG turbulence

Ottaviani, M.; Manfredi, G.; Dec. 31, 1998; 33p; In English

Report No.(s): DE99-632233; EUR-CEA-FC-1651; No Copyright; Avail: Department of Energy Information Bridge

A three-dimensional, fluid code is used to study the scaling of ion thermal transport caused by Ion-Temperature-Gradient-Driven (ITG) turbulence. The code includes toroidal effects and is capable of simulating the whole torus. It is found that both close to the ITG threshold and well above threshold, the thermal transport and the turbulence structures exhibit a gyro-Bohm scaling, at least for plasmas with moderate poloidal flow.

NTIS

Tokamak Devices; Turbulence; Plasmas (Physics); Fluid Dynamics; Three Dimensional Models

20000033180 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Dynamic Evolution of Plasma Structures Due to Local Production of Huge Negative Ions

OOhara, Wataru, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 20-23; In Japanese; Copyright; Avail: Issuing Activity

Dynamic structures formed due to local production of huge negative ions in a plasma are investigated by means of a Q-machine experiment and a one-dimensional electrostatic particle simulation. The plasma becomes unstable for a large rate of negative ion production, being accompanied by a double-layer formation generating solitary pulses with negative potential. The solitary pulses play a role, in making negative ions ejected rapidly from the system. Produced negative ions are found to strongly diffuse across magnetic field lines and a drift wave instability driven by the negative ions is simultaneously observed.

Author

Magnetohydrodynamic Stability; Negative Ions; Plasmas (Physics)

20000033477 Imperial Coll. of Science, Technology and Medicine, Dept. of Physics, London, UK

Measurements of the Inverse Faraday Effect in High Intensity Laser Produced Plasmas

Tatarakis, M., Imperial Coll. of Science, Technology and Medicine, UK; Krushelnick, K., Imperial Coll. of Science, Technology and Medicine, UK; Najmudin, Z., Imperial Coll. of Science, Technology and Medicine, UK; Clark, E. L., Imperial Coll. of Science, Technology and Medicine, UK; Salvati, M., Imperial Coll. of Science, Technology and Medicine, UK; Santala, M. I. K., Imperial Coll. of Science, Technology and Medicine, UK; Dangor, A. E., Imperial Coll. of Science, Technology and Medicine, UK; Malka, V., Ecole Polytechnique, France; Neely, D., Rutherford Appleton Lab., UK; Alloott, R., Rutherford Appleton Lab.,

UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 16-17; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

The generation of magnetic fields in laser-produced plasmas has recently been the subject of increasing attention both theoretically and experimentally. One particular phenomenon the inverse Faraday effect (IFE), has been a source of some controversy as theoretical predictions are in disagreement IFE is a magneto-optical phenomenon in which the propagation of circularly polarized radiation through a non-linear medium induces an axial magnetic field along the direction of propagation. Relatively small fields generated in this way were measured in solid state materials using lasers at low powers in early experiments and in the early 1970s magnetic fields were induced in plasmas through the use of circularly polarized microwaves. It has been postulated that using circularly polarized light at much higher intensities, time averaged azimuthal currents in near critical density plasmas could be generated which might produce an extremely large axial magnetic field. For 1 micron laser radiation at I = 10(exp 19) Watts/sq cm and a plasma density of 8 x 10(exp 20)/cc recent calculations predict a magnetic field of greater than 10 MG which should be localised in space to the focal region of the intense laser pulse. There have been recent measurements of Fields due to this effect at lower intensity (approx. 10(exp 14) W/sq cm) which disagree significantly with theoretical predictions. In this paper, we report the first time-resolved measurements of multi-MegaGauss magnetic fields generated by the IFE in an underdense plasma by a laser focused at relativistic intensities of approx. 10(exp 19) W/sq cm. The experiments were performed using the CPA beam of the Vulcan laser at the Rutherford Appleton Laboratory.

Derived from text

Faraday Effect; High Power Lasers; Laser Plasmas; Magnetic Field Configurations; Plasma Density; Polarized Radiation; Time Measurement

20000033479 Imperial Coll. of Science, Technology and Medicine, Dept. of Physics, London, UK

Evidence of Seeding Mechanisms for the Convective Raman Side-Scattering Instability

Najmudin, Z.a, Imperial Coll. of Science, Technology and Medicine, UK; Krushelnick, K., Imperial Coll. of Science, Technology and Medicine, UK; Clark, E. L., Imperial Coll. of Science, Technology and Medicine, UK; Salvati, M., Imperial Coll. of Science, Technology and Medicine, UK; Santala, M. I. K., Imperial Coll. of Science, Technology and Medicine, UK; Tatarakis, M., Imperial Coll. of Science, Technology and Medicine, UK; Dangor, A. E., Imperial Coll. of Science, Technology and Medicine, UK; Malka, V., Ecole Polytechnique, France; Neely, D., Rutherford Appleton Lab., UK; Allott, R., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 20-21; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

Recent experiments have demonstrated the potential of using under-dense plasmas as a source of high (multi - MeV) energy electrons. These electrons are accelerated by the electric fields associated with large amplitude electron plasma waves (EPW) generated in the plasma by an intense laser pulse. If the plasma wave is relativistic (i.e., has a phase velocity close to the speed of light) electrons trapped within the wave can also be accelerated to relativistic energies. Several schemes exist for the production of large amplitude relativistic EPW. The most straightforward of these is the self-modulated wake-field accelerator. In this scheme, an intense laser pulse is focused into an under-dense plasma. Noise level plasma waves cause modulation of the laser pulse wavepacket due to variations of the plasmas refractive index (which is dependent on the plasma density). Since low density plasma has a higher refractive index, the laser intensity is larger in the troughs of the EPW. Such variations in laser intensity further enhance the plasma density modulations through the action of the ponderomotive force. Hence, a feedback mechanism is created - which results in growth of the plasma wave and modulation of the laser envelope in the plasma. The spectrum of the laser beam therefore exhibits satellites separated from the fundamental frequency by the plasma frequency, so that - in analogy to atomic physics - this process is referred to as Stimulated (Forward) Raman Scattering (FRS). In this paper, we report on the study of self-scattering and propagation of a high intensity laser beam in an underdense plasma. In particular, we emphasise the importance of ionisation and Raman side-scatter and their importance in the evolution of the self-modulated wake-field accelerator.

Derived from text

Experimentation; Atomic Physics; Dense Plasmas; Electron Plasma; Forward Scattering; Raman Spectra; Stability; Self Propagation

20000033480 Imperial Coll. of Science, Technology and Medicine, Blackett Lab., London, UK

Multi Megagauss Magnetic Field Generation and Proton Transport Through Solids from Ultra-Intense Laser-Plasma Interactions

Clark, E. L., AWE PLC, UK; Krushelnick, K., Imperial Coll. of Science, Technology and Medicine, UK; Zepf, M., Imperial Coll. of Science, Technology and Medicine, UK; Tatarakis, M., Imperial Coll. of Science, Technology and Medicine, UK; Beg, F. N., Imperial Coll. of Science, Technology and Medicine, UK; Santala, M. I. K., Imperial Coll. of Science, Technology and Medicine, UK; Watts, I., Imperial Coll. of Science, Technology and Medicine, UK; Dangor, A. E., Imperial Coll. of Science, Technology

and Medicine, UK; Davies, J. R., Instituto Superior Tecnico, Portugal; Norreys, P. A., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 22-23; In English; See also 20000033474; Copyright; Avail: Issuing Activity

In this paper, we report the use of an innovative diagnostic technique to measure magnetic fields in solid density plasmas produced by ultra-high intensity lasers (5 x 10(exp 19) W/sq cm). These measurements are obtained by recording the deflection of energetic protons produced simultaneous]), in the interaction which indicate that fields inside the target must be in excess of 30 MG. This paper reports the highest recorded magnetic fields generated in the laboratory, the first measurements of magnetic fields produced in overdense regions of plasma, as well as the first measurements of high energy proton generation (up to 18 MeV) and propagation into the target during intense laser plasma interactions.

Author

Magnetic Fields; Protons; Transportation Energy; Laser Plasma Interactions; Solids

20000033481 Imperial Coll. of Science, Technology and Medicine, Blackett Lab., London, UK

Improvements in the Source Characteristics of Harmonics from Plasma Surfaces Using Higher Contrast Ratio Laser Pulses

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At high intensities the harmonics generated by the laser-solid interaction stiffer from a low source brightness due to spectral broadening and a large angular emission distribution. Previously it has been found that the conversion efficiencies depend on the scalelength L/lambda, of the plasma formed before the arrival of the main pulse, and at high values of I(lambda(sup 2)) the low source brightness has been associated with the prepulse and contrast ratio of the incident laser beam. A method that would effectively increase the contrast ratio of the incident laser would therefore reduce the deleterious effects of any pre-plasma formation and approach the conditions necessary for the theoretical predictions of specular emission and transform limited bandwidths. This is important since the harmonics emitted by the interaction of an intense laser pulse with a solid target represent a promising source of coherent short wavelength radiation, with high conversion efficiencies observed both experimentally and in simulations. One way of increasing the contrast ratio of the incident laser is to use a 'plasma mirror'. This consists of a transparent optical flat placed at a point after the final focusing optic where the intensity is approximately 10(exp 14) W/sq cm. Any prepulse below this plasma formation threshold is transmitted, while above this value a plasma is formed and the light is reflected from the critical surface close to the peak of the pulse. Since the plasma expansion length (c(sub s)tau = 0.1 micron, where tau is the main pulse duration and c(sub s) is the sound speed) is small compared to the laser wavelength the reflectivity is consistent with a sharp plasma-vacuum boundary and the plasma acts as a plane mirror. In this way the contrast ratio of the laser pulse can be increased by a factor of 100 - 1000.

Author

Harmonics; Plasmas (Physics); Pulsed Lasers; Emittance; Electromagnetic Interactions; Efficiency

20000033482 Imperial Coll. of Science, Technology and Medicine, Blackett Lab., London, UK

Measurement of the Direction of Fast Electrons Versus Plasma Scale-Length

Santala, M. I. K., Imperial Coll. of Science, Technology and Medicine, UK; Clark, E., Imperial Coll. of Science, Technology and Medicine, UK; Watts, I., Imperial Coll. of Science, Technology and Medicine, UK; Beg, F. N., Imperial Coll. of Science, Technology and Medicine, UK; Tatarakis, M., Imperial Coll. of Science, Technology and Medicine, UK; Zepf, M., Imperial Coll. of Science, Technology and Medicine, UK; Krushelnick, K., Imperial Coll. of Science, Technology and Medicine, UK; Dangor, A. E., Imperial Coll. of Science, Technology and Medicine, UK; McCanny, T., Glasgow Univ., UK; Spencer, I., Glasgow Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 27-28; In English; See also 20000033474; Copyright; Avail: Issuing Activity

The angular distribution of bremsstrahlung gamma-rays produced by fast electrons accelerated in relativistic laser-solid interaction has been studied by photo-neutron activation in copper. We show that the gamma-ray beam moves from the target normal to the direction of the laser k-vector as the scale-length is increased. Similar behaviour is found also in 2D-PIC simulations.

Author

Angular Distribution; Bremsstrahlung; Gamma Rays; Neutron Activation Analysis

20000033483 Imperial Coll. of Science, Technology and Medicine, Blackett Lab., London, UK

Multi MeV Heavy Ion Emission from Ultra-Intense Laser-Plasma Interactions

Clark, E. L., AWE PLC, UK; Krushelnick, K., Imperial Coll. of Science, Technology and Medicine, UK; Zepf, M., Imperial Coll. of Science, Technology and Medicine, UK; Tatarakis, M., Imperial Coll. of Science, Technology and Medicine, UK; Beg, F. N., Imperial Coll. of Science, Technology and Medicine, UK; Santala, M. I. K., Imperial Coll. of Science, Technology and Medicine, UK; Watts, I., Imperial Coll. of Science, Technology and Medicine, UK; Dangor, A. E., Imperial Coll. of Science, Technology and Medicine, UK; Norreys, P. A., Rutherford Appleton Lab., UK; Machacek, A., Oxford Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 29-30; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

This paper reports measurements of the high energy ions and protons emitted from the front of solid targets, of various materials, produced from ultra-intense laser-plasma interaction, Heavy ions with energies up to 420 MeV have been observed from the ablating plume of the plasma, the maximum energies observed being for the ions with the highest mass number and charge state. The proton spectra show a peaked structure and the angular distribution of the protons indicates the presence of a low energy ”ion ring”. Targets including aluminium, glass and lead were irradiated with the CPA beam of the VULCAN laser, Vulcan delivers about 50 J in a pulse of approximately I ps duration at a wavelength of 1.053 microns. The beam was p-polarised and was focused on to the target at 45 degrees using a f/1.6 on-axis parabola. The intensity on target was determined from the laser beam diagnostics and by using a penumbral camera to measure the spot size resulting in a maximum intensity on target up to 5 x 10(exp 19) W/sq cm.

Derived from text

Heavy Ions; Emittance; Laser Plasma Interactions; Plasmas (Physics); Irradiation; Angular Distribution

20000033488 Imperial Coll. of Science, Technology and Medicine, London, UK

Reverse Shocks Caused by Expanding Plasmas Impacting Upon Foams

Vickers, C., Imperial Coll. of Science, Technology and Medicine, UK; Iwase, A., Imperial Coll. of Science, Technology and Medicine, UK; Pasley, J., Imperial Coll. of Science, Technology and Medicine, UK; Hoarty, D., Atomic Weapons Research Establishment, UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 41-42; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

Recent theoretical studies of exploding Type I supernovae have suggested that as the supernova ejecta interacts with the circumstellar medium, e.g. that left over from the stellar wind of the progenitor, a blast wave is formed. When this blast wave interacts with the bow shock caused by the interaction of the stellar wind with the interstellar medium, a forward shock results. Ejecta material tends to stagnate at the impact site and the pressure from this can cause a reverse shock to form in the expanding ejecta. Little physical evidence to back this up is available and most of our knowledge comes from computer-based simulations. The ejecta of the supernova remnant, SN 1987A, is expected to impact upon its circumstellar ring sometime in the next six years (in fact the Hubble Space Telescope has already seen the beginnings of the impact). The impact is expected to give new details on both the nature of the interstellar medium and the history of the supernova progenitor. Experimental studies into the phenomenon will help improve the computational models and give a better over-view of the radiation profile expected from the collision and allow an optimum observation strategy to be developed, Fortunately some simple situations can be scaled down to laboratory levels and experiments can be performed that will provide a basis for enhancement of the simulation codes. We outline details of such an experiment carried out that applies to the case where the expanding material follows a power-law density profile that interacts with a stationary medium of constant density. We used an exploding chlorinated foil to impact upon a low-density chlorinated foam. Spatially resolved point projection X-ray spectroscopy methods were used to record the optical density of the system around the Chlorine K-band. Analysis of this data gives detailed information about the density and temperature of the system at given times.

Author

Shock Waves; Bow Waves; Collisions; Computerized Simulation; Detonation Waves; Foams; Impact Loads; Supernova Remnants

20000033496 Lebedev Physical Inst., Tamm Theoretical Physics Dept., Moscow, Russia

Suppression of Raman Gain by Finite Level Ion Acoustic Waves in Inhomogeneous Plasma

Lukyanov, A. V., Lebedev Physical Inst., Russia; Barr, H. C., Essex Univ., UK; Boyd, T. J. M., Essex Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 62-63; In English; See also 20000033474; Copyright; Avail: Issuing Activity

The influence on stimulated Raman scattering (SRS) of secondary decays and stimulated Brillouin scattering (SBS) has received much experimental and theoretical attention in recent years on account of its relevance to ICF experiments. Mostly,

analytic studies were restricted to homogeneous plasma. Here we report the outcome of a study of the influence of secondary decays on Raman gain levels in inhomogeneous plasma when a finite level of ion acoustic waves is present,
Author
Raman Spectra; Stimulation; Research; Inhomogeneity; Plasmas (Physics)

20000033501 Rutherford Appleton Lab., Central Laser facility, Chilton, UK
Designing Cylindrical Targets to Measure the Radiative Properties of High Density and Temperature Plasmas
Xu, Y., Rutherford Appleton Lab., UK; Rose, S. J., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 72; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Cylindrical implosion is of great interest because of its excellent diagnostic access . In this paper we investigate whether it is possible to achieve a high density and temperature plasma with a relatively low temperature and density gradient using a cylindrical implosion directly-driven by a high-power laser . We present 1-D numerical simulations to explore the plasma conditions that may be achieved. Our long-term aim is to design an experiment that will allow a measurement of the radiative opacity of the compressed plasma, with a view to assessing the accuracy of current opacity calculations.
Author
High Temperature Plasmas; Cylindrical Bodies; Design Analysis; Low Temperature

20000033540 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK
Frequency Doubling for Ultra-High Intensity, High Contrast Ratio Plasma Interactions
Allott, R. M., Rutherford Appleton Lab., UK; Clarke, R. J., Rutherford Appleton Lab., UK; Neely, D., Rutherford Appleton Lab., UK; Collier, J. L., Rutherford Appleton Lab., UK; Danson, C. N., Rutherford Appleton Lab., UK; Edwards, C. B., Rutherford Appleton Lab., UK; Hernandez–Gomez, C., Rutherford Appleton Lab., UK; Hutchinson, M. H. R., Rutherford Appleton Lab., UK; Notley, M., Rutherford Appleton Lab., UK; Pepler, D. A., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 179-180; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

Recently, there has been increased interest in using the second harmonic of the chirped pulse amplified (CPA) Vulcan Nd:glass laser system. With shorter duration Pulses and ultra-high intensities, pulse contrast plays a crucial role in many interactions. Due to the non-linear nature of the process, frequency doubling offers one route of reducing an), pedestal or laser pre-pulse. In addition, a shorter drive wavelength can be advantageous in some laser-plasma interaction experiments. This paper describes the frequency doubling of a 140 x 110 mm, 40 J, sub-picosecond, 1054 nm beam for laser matter interaction studies at the Central Laser Facility. The conversion characteristics including efficiency, beam quality, focusability and pulse length for two large aperture (157 mm diameter) high quality KDP crystals of thickness 2 mm and 4 mm were studied.
Author
Pulsed Lasers; Laser Plasma Interactions; Frequencies

76
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.

20000032092 Kentucky Univ., Center for Computational Sciences, Lexington, KY USA
Quantum Molecular Dynamics Simulations of Nanotube Tip Assisted Reactions
Menon, Madhu, Kentucky Univ., USA; [1998]; 10p; In English
Contract(s)/Grant(s): NAG2-1208; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this report we detail the development and application of an efficient quantum molecular dynamics computational algorithm and its application to the nanotube-tip assisted reactions on silicon and diamond surfaces. The calculations shed interesting insights into the microscopic picture of tip surface interactions.
Author
Molecular Dynamics; Surface Reactions; Computerized Simulation

20000032204 Hampton Univ., Dept. of Physics, VA USA
Stimulated Raman amplification, oscillation, and linewidth in barium nitrate
McCray, Christopher J., Hampton Univ., USA; Chyba, Thomas H., Hampton Univ., USA; NASA University Research Centers

Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 23-27; In English; See also 20000032189; Sponsored in part by the Virginia Space Grant Consortium

Contract(s)/Grant(s): NCC1-215; NAGW-2929; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Measurements of Raman gain in a Ba(NO3)2 crystal are reported at 532 nm using a Raman oscillator/amplifier arrangement for differential absorption lidar measurements of ozone. The experimentally determined gain coefficient will be compared with theoretical results. The effect of single and multi-longitudinal mode pumping upon the amplification process will be discussed. Measurement of the Raman linewidth for 1st 2nd and 3d stokes shifts arc presented.
Author

Amplification; Oscillations; Barium Compounds; Raman Spectra

20000032221 NASA Lewis Research Center, Cleveland, OH USA

Oxygen Impurities and Defects in Epitaxial Layer SiC and SiC Wafer Characterized by Room and Low Temperatures FTIR

Lu, W. J., Fisk Univ., USA; Collins, W. E., Fisk Univ., USA; Shi, D. T., Fisk Univ., USA; Tung, Y. S., Fisk Univ., USA; Larkin, D. J., NASA Lewis Research Center, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 557-562; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

SiC as a highly promising semiconducting material has received increasing attention in the last decade. The impurities such as oxygen and hydrogen have a great effect in electronic properties of semiconducting materials. In this study, the FTIR spectra were measured at room temperature (25 C) and low temperature (-70 C) for an n-type SiC substrate, a p-type epitaxial layer SiC, and patterned Ta on a p-type epitaxial layer SiC sample. The oxygen related IR peaks were measured for all three samples at room and low temperatures. The peak at 1105 cm(exp -1) is the result of a substitutional carbon and a interstitial oxygen in SiC. The concentration of the impurity oxygen increases in the SiC epitaxial layer during the CVD and electron beam processes. For the n-type SiC substrate, this peak does not appear. The peak at 905 cm(exp -1) exists in the IR spectra only for two epitaxial layer on p-type SiC substrate samples. This peak is related to oxygen vacancy centers in SiC, which are introduced in the CVD epitaxial growth process. At low temperature, the peak at 1105 cm(exp -1) shifts down and the peak at 905 cm(exp -1) shifts up for the epitaxial layer SiC samples. It can be explained that, at low temperatures, the stress increases due to the distorted bonds. The study shows that FTIR is a very effective method to evaluate low concentration impurities in SiC.
Author

Epitaxy; Impurities; Low Temperature; Room Temperature; Substrates; Defects; Fabrication; Thin Films; Infrared Spectra; Fourier Transformation; Silicon Carbides

20000032224 Prairie View Agricultural and Mechanical Coll., Center for Applied Radiation Research, TX USA

Analysis of Phase Separation in Czochralski Grown Single Crystal Ilmenite

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Ilmenite (FeTiOs) is a wide bandgap semiconductor with an energy gap of 2.58 eV. Ilmenite has properties suited for radiation tolerant applications, as well as a variety of other electronic applications. Single crystal ilmenite has been grown from the melt using the Czochralski method. Growth conditions have a profound effect on the microstructure of the samples. Here we present data from a variety of analytical techniques which indicate that some grown crystals exhibit distinct phase separation during growth. This phase separation is apparent for both post-growth annealed and unannealed samples. Under optical microscopy, there appear two distinct areas forming a matrix with an array of dots on order of 5 pm diameter. While appearing bright in the optical micrograph, atomic force microscope (AFM) shows the dots to be shallow pits on the surface. Magnetic force microscope (MFM) shows the dots to be magnetic. Phase identification via electron microprobe analysis (EMPA) indicates two major phases in the unannealed samples and four in the annealed samples, where the dots appear to be almost pure iron. This is consistent with

micrographs taken with a scanning probe microscope used in the magnetic force mode. Samples that do not exhibit the phase separation have little or no discernible magnetic structure detectable by the MFM.
Derived from text
Ilmenite; Czochralski Method; Microstructure; Single Crystals; Crystal Growth; Melts (Crystal Growth); Semiconductor Devices

20000032226 NASA Marshall Space Flight Center, Huntsville, AL USA
Bulk Crystal Growth of Nonlinear Optical Organic Materials Using Inverted Vertical Gradient Freeze Method
Choi, J., Alabama A & M Univ., USA; Cruz, Magda, Alabama A & M Univ., USA; Metzl, R., Alabama A & M Univ., USA; Wang, W. S., Alabama A & M Univ., USA; Aggarwal, M. D., Alabama A & M Univ., USA; Penn, Benjamin G., NASA Marshall Space Flight Center, USA; Frazier, Donald O., NASA Marshall Space Flight Center, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 577-582; In English; See also 20000032189
Contract(s)/Grant(s): NAG5-5121; NAG8-1390; NSF HRD-93-53548; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

A new process for producing large bulk single crystals of benzil (C6H5COCOC6H5) is reported in this paper. Good quality crystals have been successfully grown using this approach to crystal growth. This method seems to be very promising for other thermally stable NLO organic materials also. The entire contents vycor crucible 1.5 inch in diameter and 2 inch deep was converted to single crystal. Purity of the starting growth material is also an important factor in the final quality of the grown crystals. The entire crystal can be very easily taken out of the crucible by simple maneuvering. Initial characterization of the grown crystals indicated that the crystals are as good as other crystals grown by conventional Bridgman Stockbarger technique.
Author
Crystal Growth; Freezing; Optical Materials; Organic Materials; Single Crystals; Bridgman Method

20000032227 NASA Marshall Space Flight Center, Huntsville, AL USA
Growth of Bulk Single Crystals of Dicyanovinyl-Ansiole and its Derivatives for Nonlinear Optical Applications
Gebre, T., Alabama A & M Univ., USA; Choi, J., Alabama A & M Univ., USA; Wang, W. S., Alabama A & M Univ., USA; Metzl, R., Alabama A & M Univ., USA; Aggarwal, M. D., Alabama A & M Univ., USA; Romero, Melvin, New Mexico Highlands Univ., USA; Clark, Ronald D., New Mexico Highlands Univ., USA; Penn, Benjamin G., NASA Marshall Space Flight Center, USA; Frazier, Donald O., NASA Marshall Space Flight Center, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volume 2 and 3, pp. 583-588; In English; See also 20000032189
Contract(s)/Grant(s): NAG5-5121; NAG8-1390; NSF HRD-93-53548; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Bulk single crystals of a series of thermally stable nonlinear optical organic materials, Dicyanovinyl-anisole (DIVA) and their methoxy derivatives, have been successfully grown using the Bridgman-Stockbarger technique. The growth conditions are chosen to be temperature gradient of 5 to 10 C/cm and lowering rate of 0.1 to 0.3 mm/h. Single crystals of DIVA and its derivatives, of 8 x 8 x 50 cu mm in size, have been grown while maintaining a flat solid-liquid growth interface.
Author
Optical Materials; Bridgman Method; Organic Materials; Temperature Gradients; Single Crystals; Nonlinearity; Methoxy Systems; Anisole; Crystal Growth

20000032235 Fisk Univ., Dept. of Physics, Nashville, TN USA
Surface Morphology of Undoped and Doped ZnSe Films
George, T., Fisk Univ., USA; Hayes, M., Fisk Univ., USA; Chen, H., Fisk Univ., USA; Chattopadhyay, K., Fisk Univ., USA; Thomas E., Fisk Univ., USA; Morgan, S., Fisk Univ., USA; Burger, A., Fisk Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 101-106; In English; See also 20000032189
Contract(s)/Grant(s): NCC8-133; B336497; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Rare-earth doped ions in polar II-VI semiconductors have recently played an important role in the optical properties of materials and devices. In this study, undoped ZnSe and erbium doped ZnSe films were grown by radio frequency (RF) magnetron sputtering method. Atomic Force Microscopy (AFM) was used together with optical microscopy and UV-Vis spectroscopy to characterize the films. Doped samples were found to have higher surface roughness and quite different surface morphology

compared to that of undoped samples. The grown films generally show a relatively smooth and uniform surface indicating that they are of overall good quality. The impact of plasma etching on ZnSe:Er film examined under AFM is also discussed.
Author
Morphology; Erbium; Zinc Selenides; Semiconductors (Materials); Doped Crystals

20000032240 Hampton Inst., Dept. of Physics, VA USA
1.54 micron Emission from Erbium implanted GaN for Photonic Applications
Thaik, Myo, Hampton Inst., USA; Hommerich, U., Hampton Inst., USA; Schwartz, R. N., Hughes Research Labs., USA; Wilson, R. G., Hughes Research Labs., USA; Zavada, J. M., Army Research Office, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 107-112; In English; See also 20000032189
Contract(s)/Grant(s): NCC1-251; DAAH04-96-I-0089; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The development of efficient and compact light sources operating at 1.54 micron is of enormous importance for the advancement of new optical communication systems. Erbium (1%) doped fiber amplifiers (EDFA's) or semiconductor lasers are currently being employed as near infrared light sources. Both devices, however, have inherent limitations due to their mode of operation. EDFA's employ an elaborate optical pumping scheme, whereas diode lasers have a strongly temperature dependent lasing wavelength. Novel light emitters based on erbium doped III-V semiconductors could overcome these limitations. Er doped semiconductors combine the convenience of electrical excitation with the excellent luminescence properties of Er(3+) ions. Electrically pumped, compact, and temperature stable optoelectronic devices are envisioned from this new class of luminescent materials. In this paper we discuss the potential of Er doped GaN for optoelectronic applications based on temperature dependent photoluminescence excitation studies.
Author
Microbeams; Light Emission; Light Sources; Erbium; Gallium Nitrides; Semiconductors (Materials); Semiconductor Devices; Photonics

20000032243 Fisk Univ., Dept. of Physics, Nashville, TN USA
Photorefractive effect in CdMnTe:V Crystal
Pour, K. M., Fisk Univ., USA; Chattopadahyay, K., Fisk Univ., USA; Chen, H., Fisk Univ., USA; Chen, K. T., Fisk Univ., USA; Morgan, S., Fisk Univ., USA; Burger, A., Fisk Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 644-649; In English; See also 20000032189
Contract(s)/Grant(s): NASW-2925; GYF1457096-03120; NSF HRD-95-50605; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

We present two-wave mixing result obtained with a CdMnTe:V crystal. A photorefractive gain coefficient of 0.20 /cm was observed at 633 nm with the signal-to-pump ratio being of the order of 10(exp -3). This crystal was grown by vertical Bridgman Technique and doped with Vanadium during the growth. The crystal were of good optical quality and showed high resistivity. Room temperature absorption and low temperature photoluminescence studies comparing the band edge and defect center at the doped and undoped CdMnTe crystal will also be discussed.
Author
Photorefractivity; Photoluminescence; Cadmium Tellurides; Manganese Alloys; Crystals

20000032247 Fisk Univ., Fisk Center for Photonic Materials and Devices, Nashville, TN USA
Purification and Crystal Growth of Lead Iodide by Physical Vapor Transport Method
Wright, G. W., Fisk Univ., USA; Cole, M., Fisk Univ., USA; Chen, Y.–F., Fisk Univ., USA; Chen, K.–T., Fisk Univ., USA; Chen, H., Fisk Univ., USA; Chattopadhyay, K., Fisk Univ., USA; Burger, A., Fisk Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 113-118; In English; See also 20000032189
Contract(s)/Grant(s): NAGW-2925; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Lead iodide (PbI2) is a layered compound semiconductor being developed as room temperature x- and gamma-ray detector. Compared to the more studied material, mercuric iodide, PbI2 has a higher melting temperature and no phase transition until liquid phase which are indications of better mechanical properties. In this study, the source material was purified by the zone-refining process, and the purest section was extracted from center of the the zone-refined ingot to be grown by physical vapor transport (PVT) method. The zone-refined material and as-grown crystals were characterized by optical microscopy and differential

scanning calorimetry (DSC) to reveal the surface morphology, purity and stoichiometry. The results shows that both materials are near-stoichiometric composition, with the purity of the as-grown crystals higher than zone-refined materials. The resistivity of the as-grown crystal (10" Omega-cm) was derived from current-voltage (I-V) measurement, and is 10 times higher than the zone-refined materials. Detail results will be presented and discussed.
Author
Purification; Purity; Crystal Growth; Lead (Metal); Iodides; Mercury Compounds

20000032280 New Mexico Highlands Univ., Dept. of Physical Sciences, Las Vegas,NM USA
X-Ray Diffraction Analysis of NLO Crystals: Traditional Applications and More New Opportunities
Antipin, Mikhail Yu., New Mexico Highlands Univ., USA; Clark, Ronald D., New Mexico Highlands Univ., USA; Nesterov, Vladimir N., Academy of Sciences (USSR), USSR; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 209-216; In English; See also 20000032189
Contract(s)/Grant(s): NAG5-5121
Report No.(s): 98URC039; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Single crystal X-ray diffraction analysis is one of the more important methods for the molecular and crystal structure determination of matter and therefore it has a great importance in material science including design and engineering of different compounds with non-linear optical (NLO) properties. It was shown in our previous publications that this method provides unique information about molecular structure of NLO compounds, their crystal symmetry and crystal packing arrays, molecular conformation and geometries and many other structural and electronic characteristics that are important for understanding the nature of NLO properties of solids. A very new application of the X-ray diffraction method is related to analysis of the electron density distribution p(r) in crystals and some of its characteristics (atomic and group charges, dipole and higher multipole moments, etc.), that may be obtained directly form the diffraction measurements. In the present work, we will discuss our preliminary low temperature high-resolution X-ray data for the m-nitroaniline (mNA) single crystal (VI). This is one of the "classical" organic NLO materials and electron density distribution analysis in this simple compound has a great scientific interest. Derived from text
Nonlinear Optics; Optical Properties; X Ray Diffraction; Organic Compounds; Crystal Structure

20000032281 Puerto Rico Univ., Dept. of Physics, San Juan, Puerto Rico
Raman and Photoluminescence Spectroscopy of Nano-crystalline PbTiO3 Sensor Materials with Different Doping Ions
Katiyar, R. S., Puerto Rico Univ., Puerto Rico; Jinfang, Meng, Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 763-768; In English; See also 20000032189
Contract(s)/Grant(s): NCCW-88; NSF OSR-94-52893
Report No.(s): 98URC136; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Raman spectra & photoluminescence studies in PbTiO3, have been carried out, as a function of particle size, temperature, pressure and dopants. There appears respectively a distinct temperature-induced soft mode phase transition in each sample whose Curie temperature can be determined from the mean-field theory. The detailed Curie temperature shift in the modified PbTiO3 ceramics by Ba, SR, La and Zr, has been investigated as a function of particle size. Pressure-induced phase transitions display an obvious diffuse behavior. Room temperature photoluminescence for nanocrystalline Ba(1-x)Pb(x)TiO3 have been observed. These studies favor preparations of high efficiency PbTiO3 sensors.
Author
Photoluminescence; Raman Spectroscopy; Lead Titanates; Pyroelectricity; Barium Titanates; Nanocrystals; Additives

20000032314 NASA Marshall Space Flight Center, Huntsville, AL USA
Fabrication and Characterization of Thin Film Ion Implanted Composite Materials for Integrated Nonlinear Optical Devices
Sarkisov, S., Alabama A & M Univ., USA; Curley, M., Alabama A & M Univ., USA; Williams, E. K., Alabama A & M Univ., USA; Wilkosz, A., Alabama A & M Univ., USA; Ila, D., Alabama A & M Univ., USA; Poker, D. B., Oak Ridge National Lab., USA; Hensley, D. K., Oak Ridge National Lab., USA; Smith, C., NASA Marshall Space Flight Center, USA; Banks, C., NASA Marshall Space Flight Center, USA; Penn, B., NASA Marshall Space Flight Center, USA; Clark, R., New Mexico Highlands Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 860-865; In English; See also 20000032189

Contract(s)/Grant(s): DE-AC05-96OR-22464; NAG5-5121
Report No.(s): 98URC153; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Ion implantation has been shown to produce a high density of metal colloids within the layer regions of glasses and crystalline materials. The high-precipitate volume fraction and small size of metal nanoclusters formed leads to values for the third-order susceptibility much greater than those for metal doped solids. This has stimulated interest in use of ion implantation to make nonlinear optical materials. On the other side, LiNbO3 has proved to be a good material for optical waveguides produced by MeV ion implantation. Light confinement in these waveguides is produced by refractive index step difference between the implanted region and the bulk material. Implantation of LiNbO3 with MeV metal ions can therefore result into nonlinear optical waveguide structures with great potential in a variety of device applications. We describe linear and nonlinear optical properties of a waveguide structure in LiNbO3-based composite material produced by silver ion implantation in connection with mechanisms of its formation.

Author

Composite Materials; Ion Implantation; Optical Equipment; Thin Films; Metal Ions; Fabrication; Doped Crystals; Optical Waveguides; Silver

20000032343 Prairie View Agricultural and Mechanical Coll., CARR, TX USA

Evaluation of Ba65SR35TiO3 MIS Structure for Semiconductor Memory Applications

Washington, K., Prairie View Agricultural and Mechanical Coll., USA; Brown, F., Prairie View Agricultural and Mechanical Coll., USA; Fogarty, T. N., Prairie View Agricultural and Mechanical Coll., USA; McWhinney, H., Prairie View Agricultural and Mechanical Coll., USA; Wang, F. C., Prairie View Agricultural and Mechanical Coll., USA; Wilkins, R., Prairie View Agricultural and Mechanical Coll., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 348-353; In English; See also 20000032189; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

As device sizes shrink new demands are made on device materials. A major factor in the reliability and radiation tolerance of MOS devices is the performance of the insulating ”oxide” layer. High dielectric constant materials such as ferroelectrics are being investigated as a replacement for SiO2 in these devices. The advantages are expected to be increased charge storage capacity, low operating voltages, long term endurance and greater radiation tolerance. Some possible applications are as capacitive storage elements in DRAM cells or as voltage tunable capacitors in filters, oscillators and other circuits. This paper examines and explores the potential for such materials with emphasis on their applications as storage elements in DRAM cells and by examining the effects of ionizing radiation on these materials. The samples used in this study were composed of Ba65SR35TiO3 and laid on bare silicon using a metal organic decomposition technique. Capacitance-Voltage measurements were made to characterize the MIS defects as a function of ionizing radiation. These measurements indicated the presence of deep insulator traps, change in the interface structure, possible diffusion between the silicon and barium strontium titanate layers and the presence of mobile ions. A surface depth profile was performed to aid in the verification of these results.

Author

Barium Titanates; Silicon; MIS (Semiconductors); Computer Storage Devices; Memory (Computers); Chips (Memory Devices)

20000032618 Saitama Inst. of Tech., Saitama, Japan

Dynamical Diffraction with Borrmann Absorption for Thin Crystal in Bragg Case

Negishi, Riichiro, Saitama Inst. of Tech., Japan; Fukamachi, Tomoe, Saitama Inst. of Tech., Japan; Kawamura, Takaaki, Saitama Inst. of Tech., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 82-86; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Borrmann effect in the Bragg case for a thin crystal is studied by changing the ratio between the real and the imaginary parts of X-ray polarizability. The effect becomes conspicuous by increasing the imaginary part with respect to the real part. Also for an asymmetric reflection, the Borrmann effect becomes conspicuous by increasing the asymmetric factor.

Author

Bragg Angle; Crystals; X Ray Diffraction; Thin Films; Absorption Spectra

20000032852 Ohio State Univ., Columbus, OH USA

Effects of Plasma Hydrogenation on Trapping Properties of Dislocations in Heteroepitaxial InP/GaAs

Ringel, S. A., Ohio State Univ., USA; Chatterjee, B., Ohio State Univ., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 401-408; In English; See also 20000032812
Contract(s)/Grant(s): NAG1-1461; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In previous work, we have demonstrated the effectiveness of a post-growth hydrogen plasma treatment for passivating the electrical activity of dislocations in metalorganic chemical vapor deposition (MOCVD) grown InP on GaAs substrates by a more than two order of magnitude reduction in deep level concentration and an improvement in reverse bias leakage current by a factor of approx. 20. These results make plasma hydrogenation an extremely promising technique for achieving high efficiency large area and light weight heteroepitaxial InP solar cells for space applications. In this work we investigate the carrier trapping process by dislocations in heteroepitaxial InP/GaAs and the role of hydrogen passivation on this process. It is shown that the charge trapping kinetics of dislocations after hydrogen passivation are significantly altered, approaching point defect-like behavior consistent with a transformation from a high concentration of dislocation-related defect bands within the InP bandgap to a low concentration of individual deep levels after hydrogen passivation. It is further shown that the ”apparent” activation energies of dislocation related deep levels, before and after passivation, reduce by approx. 70 meV as DLTS fill pulse times are increased from 1 usec. to 1 msec. A model is proposed which explains these effects based on a reduction of Coulombic interaction between individual core sites along the dislocation cores by hydrogen incorporation. Knowledge of the trapping properties in these specific structures is important to develop optimum, low loss heteroepitaxial InP cells.
Author
Hydrogen Plasma; Trapping; Dislocations (Materials); Epitaxy; Indium Phosphides; Gallium Arsenides; Technology Utilization; Solar Cells

20000032853 Yale Univ., New Haven, CT USA
Nucleation, Growth, and Strain Relaxation of Lattice-Mismatched III-V Semiconductor Epitaxial Layers
Welser, R. E., Yale Univ., USA; Guido, L. J., Yale Univ., USA; Proceedings of the 13th Space Photovoltaic Research and Technology Conference (SPRAT 13); September 1994, pp. 409-418; In English; See also 20000032812
Contract(s)/Grant(s): NGT-50832; NSF ECS-92-53760; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche
We have investigated the early stages of evolution of highly strained 2-D InAs layers and 3-D InAs islands grown by metal-organic chemical vapor deposition (MOCVD) on (100) and (111) B GaAs substrates. The InAs epilayer / GaAs substrate combination has been chosen because the lattice-mismatch is severe (approx. 7.20%), yet these materials are otherwise very similar. By examining InAs-on-GaAs composites Instead of the more common In(x)Ga(1-x)As alloy, we remove an additional degree of freedom (x) and thereby simplify data interpretation. A matrix of experiments is described in which the MOCVD growth parameters -- susceptor temperature, TMIn flux, and AsH3 flux -- have been varied over a wide range. Scanning electron microscopy, atomic force microscopy, transmission electron microscopy, and electron microprobe analysis have been employed to observe the thin film surface morphology. In the case of 3-D growth, we have extracted activation energies and power-dependent exponents that characterize the nucleation process. As a consequence, optimized growth conditions have been identified for depositing approx. 250 A thick (100) and (111)B oriented InAs layers with relatively smooth surfaces. Together with preliminary data on the strain relaxation of these layers, the above results on the evolution of thin InAs films indicate that the (111)B orientation is particularly promising for yielding lattice-mismatched films that are fully relaxed with only misfit dislocations at the epilayer / substrate interface.
Author
Nucleation; Epitaxy; Crystal Growth; Relaxation (Mechanics); Lattice Parameters; Semiconductors (Materials); Surface Layers; Indium Arsenides; Metalorganic Chemical Vapor Deposition

20000032941 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
Memory Effect of Liquid Crystal Surface Alignment
Xuan, Li, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 55-58; In Japanese; Copyright; Avail: Issuing Activity
This paper describes memory effect of liquid crystal surface alignment. This effect is considered to be caused by the surface adsorption and desorption of liquid crystal on polymer surface. In the experiment, a sandwich cell with a nematic liquid crystal doped with a cholesteric liquid crystal was used. After removal of an electric field parallel to the surface, liquid crystal molecule rotates by the effect of twisting power competing with the effect of the surface adsorption of liquid crystal molecules. In order to explain this dynamical process we have proposed an adsorption-desorption model. In terms of this point of view, the rotational speed of the director of the adsorpted molecule is determined by the adsorption energy and angle delta-phi between director of adsorbed molecule and that of the closest molecular layer. Then we measured the alignment rotation speed by experiment and delta-phi by analysis of the distribution of the order parameters according to Mean Field Theory. Finally 0.9 eV of the adsorption energy was obtained.
Author
Liquid Crystals; Adsorption; Desorption; Alignment

20000033007 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on Control of Compound Semiconductor Surfaces and Interfaces

Shoji, Daisei, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 154-157; In Japanese; Copyright; Avail: Issuing Activity

The properties of chemically-treated GaAs surfaces and interfaces formed by deposition of metals (Ag, Au, In) and insulator (CaF2) onto the GaAs surfaces have been investigated using synchrotron-radiation photoemission spectroscopy, multiple internal reflection infrared absorption spectroscopy (MIR-IRAS), and x-ray diffraction. It is shown that GaAs surfaces treated with (NH4)2S(x) solution are dominantly covered by Ga and As sulfides without native oxides. MIR-IRAS measurement of H2S adsorption onto GaAs show that formation of Ga-S-Ga bridge-bond is more favorable than As-S bond, which would be the origin of chemical passivity of the sulfur (S)-terminated GaAs surface. When Ag, Au are deposited onto the S-terminated surface, As segregation and alloy formation are suppressed. It is demonstrated that CaF, epitaxially grows on the S-terminated GaAs surface at a substrate temperature of as low as 300 C, and that there is a lowering of the interface state density brought by epitaxial growth of CaF, on the GaAs surface.

Author

Gallium Arsenides; MIS (Semiconductors); Epitaxy; Vapor Deposition

20000033009 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of Fabrication of As/GaSb/AlSb Heterostructures and Its Applications to Opto-Electronic Device

Ohtani, Keita, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 146-149; In Japanese; Copyright; Avail: Issuing Activity

Since InAs/GaSb/AlSb type-II heterostructure has a unique band lineup such as a type-II broken gap structure (InAs/GaSb) and a large conduction band offset (InAs/AlSb), various opto-electronic device applications have been proposed and realized. Intersubband optical transitions in a quantum well structure have drawn much attention because of the large oscillator strength and the wide tunability range of optical transition from near- to far-infrared. The light source based on intersubband transition in type-II InAs/GaSb/AlSb heterostructure offers a number of advantages over type-I GaAs/AlGaAs and GaInAs/AlInAs material systems in terms of the tunability of wavelength and the control of carrier transport in the heterostructure. In this paper, we present the first observation of intersubband light emission by electrical pumping. To realize the type-II InAs/GaSb/AlSb intersubband light emitting diode, (I) theoretical consideration of type-II intersubband light emitter, (II) fabrication of high quality heterostructure by a molecular beam epitaxy, and (III) its evaluation by transport and optical measurements are performed.

Author

Molecular Beam Epitaxy; Semiconductors (Materials); Indium Arsenides; Gallium Antimonides; Aluminum Antimonides; Optical Pumping

20000033037 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on Fabrication and Shape Control for 3D Periodic Nanostructures

Yasuda, Noriaki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 299-300; In Japanese; Copyright; Avail: Issuing Activity

Photonic Crystals show potential to open a new field in optoelectronics. We fabricated 3D Photonic Crystals consisting of a-Si/SiO2 multilayered by rf sputtering. In order to attain desired optical properties for device applications, we need to manufacture optimum structures. So we experimented on controlling the dispersion of incident particles to obtain more flexibility on multilayer's shape. As a result, it became possible to fabricate structures not achieved before.

Author

Optoelectronic Devices; Photonics; Nanostructures (Devices); Nanocrystals

20000033038 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

In-Line Liquid Crystal Rotatable Waveplate and its Applications

Nunes, Luis Romeu, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 297-298; In English; Copyright; Avail: Issuing Activity

A controllable waveplate device using ferroelectric type liquid crystal (LC) as die controllable birefringent medium is proposed. The device consists of forming a gap along a fiber axis, and in this insert LC. The configuration has an in-line form where die fibers and die LC are sandwiched by two Si substrates. The device measures 10 x 20 x 2 mm in size and has 0.22 db of insertion loss.

Author

Liquid Crystals; Birefringence; Ferroelectricity

20000033040 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of Intrinsic Josephson Effect in a-axis-oriented LSCO Thin Films

Yamauchi, Masaaki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 293-294; In Japanese; Copyright; Avail: Issuing Activity

In this work, we prepared in-plane-aligned La(2-x)SR(x)CuO4(LSCO)(l00) thin films (a-axis-oriented LSCO thin films) on LaSRAlO4(LSAO)(100) substrates and investigated current-voltage(I-V) characteristics of intrinsic Josephson junctions in the films. On the smooth surface of films with large-sized crystal grains, a bridge structure was fabricated along the c-axis of LSCO. For a 1 micron x 10 micron (width x length) bridge structure, I-V characteristics show many ”branches” around the critical Current(I(sub c) which originate with intrinsic Josephson Junctions.

Author

Josephson Effect; Josephson Junctions; Thin Films; Superconducting Films; Lanthanum Oxides

20000033041 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of Intrinsic Josephson Junctions in Bi2SR2CaCu2O(y) Single Crystals

Yamada, Nozomi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 291-292; In Japanese; Copyright; Avail: Issuing Activity

We fabricated the intrinsic Josephson junctions (IJJ) by Si ion implantation into Bi2SR2CaCu2O(y) (BSCCO) single crystals which was grown by the travelling solvent floating zone (TSFZ) method. Si ion was implanted into BSCCO with the acceleration energy of 80keV. The superconductivity of implanted portion of BSCCO was inhibited, and then we defined junctions precisely. The project range of Si controls the thickness of IJJ. The junctions we fabricated exhibited the typical I-V characteristics of IJJ in BSCCO.

Author

BSCCO Superconductors; Josephson Junctions; Single Crystals

20000033075 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on Epitaxial Film Growth of Si-Ge-C Systems

Takatsuka, Toshinori, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 373-374; In Japanese; Copyright; Avail: Issuing Activity

Low-temperature Si(1-x-y)Ge(x)C(y) epitaxial growth on Si(100) at 500-550 C in a SiH4-GeH4-CH3SiH3-H2 gas mixture by an ultraclean low-pressure chemical vapor deposition (CVD) was investigated. The reduction of the deposition rate shifts to the higher CH3SiH3 partial pressures with increasing GeH4 partial pressure. The C concentration is nearly proportional to the CH3SiH3 partial pressures. Next, single-atomic layer growth process of Si and C on Ge(100) and Si(100) using CH3SiH3 was investigated. The Si and C single-atomic layer growth was achieved at 400-450 C with self-limited reaction of CH3SiH3. It is also found that the surface segregation of Ge is suppressed compared with the SiH4 exposure on Ge(100).

Author

Vapor Deposition; Atomic Layer Epitaxy; Partial Pressure; Semiconducting Films

20000033076 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on Atomic-Layer Doping to Group IV Semiconductors

Shimamune, Yosuke, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 371-372; In Japanese; Copyright; Avail: Issuing Activity

Atomic-layer adsorption of P on Si(100) and Ge(100) at 300-750 C by PH3 was investigated using an ultraclean low-pressure chemical vapor deposition(CVD). In the case of PH3 exposure at Si(100), the P atom concentration was influenced by the PH3 exposure temperature as well as the atmosphere before and after PH3 exposure. At 300 C, PH3 adsorbed dissociatively on the H-free Si surface, but the PH3 adsorption was suppressed on the H-terminated Si surface. At 450-550 C, the P atom concentration on the Si surface increased up to about three atomic-layers by exposing PH3 and it was not influenced much by the atmosphere after PH3 exposure. At 650 C and above, the P atom concentration increased up to about two atomic-layers or less. The P desorption is caused not only by the thermal desorption but also by the reduction due to hydrogen, especially at 650 C and above. In the case of PH3 exposure at Ge(100), P adsorbed on the Ge surface at 300-450 C but not at 550 C or above. At 300 C, the P atom concentration on the Ge surface saturated to about one atomic-layer.

Author

Semiconductors (Materials); Phosphines; Vapor Deposition; Atomic Layer Epitaxy

20000033077 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on the Surface Modification of Group IV Semiconductors

Seino, Takuya, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 369-370; In Japanese; Copyright; Avail: Issuing Activity

As the surface modification of group IV semiconductors, the atomic-order nitridation of Si(100) by a nitrogen plasma has been investigated using an ultraclean ECR plasma apparatus. The N atom concentration increased with the nitrogen plasma exposure time and tended to saturate to a value corresponding to a few atomic-layers. When the shutter was placed in front of the wafer (shutter closed), the direct ion incidence was suppressed and the N atom concentration was smaller than that with the shutter opened. In the initial stage of nitridation, the N atom concentration was normalized by the product of the relative optical emission intensity with the nitrogen plasma exposure time both in the case the shutter opened and closed. Assuming Langmuir-type kinetics neglecting desorption, excellent agreement was observed by fitting the experimental data. When the N atom concentration became higher than that corresponding to double atomic-layers, it was almost the same in both cases with the shutter opened and closed when the amount of the incident ions was the same. Therefore, it is suggested that nitridation of the deeper atoms below the surface is induced by the ion incidence.

Author

Nitrogen Plasma; Semiconductors (Materials); Surface Properties

20000033100 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of Organic Nonlinear Optical Crystal DAST Growth and its Electric Field Effect Devices

Sohma, Shunichi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 351-352; In Japanese; Copyright; Avail: Issuing Activity

Organic nonlinear optical crystal DAST (4-dimethylamino-N-methyl-4-stilbazolium tosylate) excels over other nonlinear optical materials in its abilities. The large hyperpolarizabilities Beta and good alignment of the charge transfer axis in the crystal make the huge nonlinearity such as electro optical (E-O) coefficients and nonlinear optical coefficients. Furthermore, low dielectric constants are very effective for high speed devices. In this paper, we developed the crystal growth stability and reproducibility for large and high quality DAST by the seed crystals fixed method. We also report the characteristics of DAST optical rectification and the estimation of nonlinear optical coefficient, and our preliminary results on experiments of electric field monitoring via the DAST E-O effect.

Author

Nonlinear Optics; Electro-Optical Effect; Electro-Optics

20000033103 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study of Reflective Color Display with Interference Method

Watanabe, Hisashi, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 337-338; In Japanese; Copyright; Avail: Issuing Activity

Usual color liquid crystal displays (LCDs) are using micro color filter and back light. However, this micro color filter type has drawback in decreasing of brightness and resolution. In addition, the back light has the problem of large power consumption. In order to solve these problems, I proposed a new reflective color LCD without the micro color filter and back light. This LCD is employing the field sequential color system. Satisfactory brightness and color was obtained.

Author

Display Devices; Liquid Crystals

20000033530 Oxford Univ., Clarendon Lab., Oxford, UK

Time-Resolved Band-Gap Renormalization and Gain in GaN Epilayers

Hess, S., Oxford Univ., UK; Taylor, R. A., Oxford Univ., UK; Ryan, J. F., Oxford Univ., UK; Beaumont, B., Centre National de la Recherche Scientifique, France; Gibart, P., Centre National de la Recherche Scientifique, France; Cain, N. J., Sheffield Univ., UK; Roberts, V., Sheffield Univ., UK; Roberts, J. S., Sheffield Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 146-148; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Recent reports of stimulated emission from GaN epilayers and InGaN quantum Wells have shown that there is an appreciable redshift of the stimulated emission relative to the low-density photoluminescence (PL) spectrum. Further work by Schmidt et al. has indicated the presence of large optical nonlinearities in GaN under nanosecond excitation in the region of the band-edge, including induced absorption below the bandgap at high excitation densities. These results have a direct bearing on the nature of the stimulated emission process in GaN particularly with respect to the role of excitons versus electron-hole plasma emission. In

this paper we present the results of experiments on thin films of GaN intended to investigate the optically pumped gain and the time-resolved transient absorption at high excitation densities.
Author
Time Functions; Gallium Nitrides; Emission Spectra; Photoluminescence; Semiconductor Plasmas; Stimulated Emission; Thin Films; Energy Gaps (Solid State)

20000033548 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK
A Single Shot 3rd Order Cross-Correlator for Pulse Contrast and Pulse Shape Measurements
Collier, J., Rutherford Appleton Lab., UK; Hernandez–Gomez, C., Rutherford Appleton Lab., UK; Ross, I., Rutherford Appleton Lab., UK; Allott, R., Rutherford Appleton Lab., UK; Danson, C., Rutherford Appleton Lab., UK; Hall, A., Rutherford Appleton Lab., UK; Spencer, T. J., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 194-195; In English; See also 20000033474; Original contains color illustrations; Copyright; Avail: Issuing Activity

Traditionally, in CPA and short pulse systems temporal pulse characteristics are generally measured using a 2nd order cross correlation, or autocorrelation, However, whilst the use o autocorrelations is widespread, they suffer from a number of drawbacks. If a pulse has an intensity distribution in time I(t) then the 2nd order intensity autocorrelation A(sub 2)(tau) can be defined as A(sub 2)(tau) = integral of I(t).I(t +tau)dt with limit between -infinity to +infinity. The function A(sub 2)(tau) is symmetric about tau = 0 and as such it is unable to differentiate temporal activity ahead of the real optical pulse from temporal activity behind. This means that pre or post pulses cannot be determined. Furthermore, because of this symmetry, complex or rapidly changing temporal shapes tend to become smoothed and cannot be easily resolved. Finally, optical auto-correlation usually relies on sum frequency mixing of two replicated pulses at a fundamental wavelength producing signals at the second harmonic wavelength. High dynamic ranges are thus not possible because of the additional presence of second harmonic wavelengths from direct second harmonic generation from either or both of the replicated pulses.
Derived from text
Cross Correlation; Dynamic Range; Harmonic Generations

20000033692 NASA Lewis Research Center, Cleveland, OH USA
Perimeter Governed Minority Carrier Lifetimes in 4H-SiC p(+)-n Diodes Measured by Reverse Recovery Switching Transient Analysis
Neudeck, Philip G., NASA Lewis Research Center, USA; Journal of Electronic Engineers; 1998; Volume 27, No. 4, pp. 317-323; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Minority carrier lifetimes in epitaxial 4H-SiC p(+)-n junction diodes were measured via an analysis of reverse recovery switching characteristics. Behavior of reverse recovery storage time (t(s)) as a function of initial ON-state forward current (I(F)) and OFF-state reverse current (I(R)) followed well-documented trends which have been observed for decades in silicon p-n rectifiers. Average minority carrier (hole) lifetimes (tau(p)) calculated from plots of t(s) vs I(R)/I(F) strongly decreased with decreasing device area. Bulk and perimeter components of average hole lifetimes were separated by plotting 1/tau(p) as a function of device perimeter-to- area ratio (P/A). This plot reveals that perimeter recombination is dominant in these devices, whose areas are all less than 1 sq mm. The bulk minority carrier (hole) lifetime extracted from the 1/tau(p) vs P/A plot is approximately 0.7 micro-s, well above the 60 ns to 300 ns average iit'eptimes obtained when perimeter recombination effects are ignored in the analysis. Given the fact that there has been little previous investigation of bipolar diode and transistor performance as a function of perimeter-to-area ratio, this work raises the possibility that perimeter recombination may be partly responsible for poor effective minority carrier lifetimes and limited performance obtained in many previous SiC bipolar junction devices.
Author
Carrier Lifetime; Minority Carriers; P-N Junctions; Recombination Reactions; Hydrogen; Silicon Carbides; Junction Diodes; Epitaxy

20000033694 NASA Lewis Research Center, Cleveland, OH USA
Process-Induced Morphological Defects in Epitaxial CVD Silicon Carbide
Powell, J. A., NASA Lewis Research Center, USA; Larkin, D. J., NASA Lewis Research Center, USA; Phys. Stat. Sol. (b); 1997; Volume 202, pp. 529-548; In English
Contract(s)/Grant(s): NAG3-1702; DARPA Order D-149; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Silicon carbide (SiC) semiconductor technology has been advancing rapidly, but there are numerous crystal growth problems that need to be solved before SiC can reach its full potential. Among these problems is a need for an improvement in the surface morphology of epitaxial films that are grown to produce device structures. Various processes before and during epilayer growth lead to the formation of morphological defects observed in SiC epilayers grown on SiC substrates. In studies of both 6H and

4H-SiC epilayers, atomic force microscopy (AFM) and other techniques have been used to characterize SiC epilayer surface morphology. In addition to the well-known micropipe defect, SiC epilayers contain growth pits, triangular features (primarily) in 4H-SiC, and macro step due to step bunching. In work at NASA Lewis, it has been found that factors contributing to the formation of some morphological defects include: defects in the substrate bulk, defects in the substrate surface caused by cutting and polishing the wafer, the tilt angle of the wafer surface relative to the basal plane, and growth conditions. Some of these findings confirm results of other research groups. This paper presents a review of published and unpublished investigations into processes that are relevant to epitaxial film morphology.
Author
Silicon Carbides; Vapor Deposition; Epitaxy; Morphology; Microstructure; Crystal Defects; Thin Films

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.

20000032492 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Lessons from Quantum Field Theory: Hopf Algebras and Spacetime Geometries
Connes, A.; Kreimer, D.; Apr. 1999; 18p; In English
Report No.(s): PB2000-102534; IHES/M/99/22; No Copyright; Avail: National Technical Information Service (NTIS)
We discuss the prominence of Hopf algebras in recent progress in Quantum Field Theory. In particular, we will consider the Hopf algebra of renormalization, whose antipode turned out to be the key to a conceptual understanding of the subtraction procedure. We shall then describe several occurrences of this, or closely related Hopf algebras in other mathematical domains, such as foliations, Runge-Kutta methods, iterated integrals and multiple zeta values. We emphasize the Unifying role which the Butcher group, discovered in the study of numerical integration of ordinary differential equations, plays in QFT.
NTIS
Quantum Theory; Algebra; Space-Time Functions; Field Theory (Algebra)

20000032617 Saitama Inst. of Tech., Saitama, Japan
A Generalized Supersymmetry and Supergravity
Shima, Kazunari, Saitama Inst. of Tech., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 60-63; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
The local gauge symmetry is the most fundamental notion in particle physics. In superstring theory (SST), local supersymmetry (SUSY) realized as the world-sheet supersymmetry (WS-SUSY) plays an important role for the advocated success of the theory as a promising model for the unification of matters and forces including gravity. In WSSUSY, the world spacetime is 10 dimensional flat space specified by fermionic vector-spinor coordinates Psi(mu)(tau, alpha) in addition to the ordinary bosonic vector coordinates Chi(tau, alpha). However, due to complicated mathematical structures of SST, it is not clear whether SST is really the theory of everything. While, within the framework of 4 dimensional local field theory, apart from the brilliant success of U(1) x SU(2) x SU(3) local gauge theory for electroweak and strong interactions, we have not yet succeeded in constructing a promising model of the unification. It is a challenge to unify all forces and matters in Nature within the framework of 4 dimensional local field theory. We may still miss some fundamental geometrical local gauge symmetry to accommodate the gravitational force in 4 dimensional local field theory. Previously, we have extended the ordinary superspace (x(mu), epsilon(s)) of SUSY to the WSSUSY of SST analogue the generalized superspace (x(mu),epsilon(x)) and surveyed a new local gauge symmetry in 4 dimensional curved space. This paper considers the generalization of superspace, superalgebra and supergravity in 4 dimensional sapcetime.
Author
Supersymmetry; Unified Field Theory; Particle Theory; String Theory; Gauge Theory; Group Theory; Theoretical Physics; Supergravity; Space-Time Functions

20000032619 Saitama Inst. of Tech., Saitama, Japan
Composition Chaos-Designs by BASIC Language
Koyama, Hitoshi, Saitama Inst. of Tech., Japan; Journal of Saitama Institute of Technology; 1992; ISSN 0918-8177, pp. 76-81; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Chaos theory promotes new ways of looking our world and fosters the use of interdisciplinary approaches. Processes that formerly separated out scientific figures for analytic purposes and artistic designs for sensuous purposes can now bring them together by computing visualisation. We have obtained some curious/beautiful Chaos-designs by BASIC language. This paper also reviews progress in this area, the range of possible applications, and future potential.
Author
Chaos; Computer Techniques; Basic (Programming Language); Computer Programming

20000032981 Lockheed Martin Corp., Solar and Astrophysics Lab., Palo Alto, CA USA
Inertia and Gravitation in the Zero-Point Field Model ***Final Report, 24 May 1996 - Mar. 31 2000***
Haisch, Bernhard, Lockheed Martin Corp., USA; Rueda, Alfonso, California State Univ., USA; [2000]; 42p; In English
Contract(s)/Grant(s): NASW-5050; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This is a study in the area of theoretical physics exploring the possible connection and its implications between the electromagnetic zero-point field of the quantum vacuum and the inertia of matter.
Author
Electromagnetic Fields; Gravitation; Inertia; Theoretical Physics; Zero Point Energy

20000033099 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Ultrafast Spin Relaxation in GaAs/AlGaAs Quantum Well
Terauchi, Ryota, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 353-354; In Japanese; Copyright; Avail: Issuing Activity
We have investigated electron spin relaxation time tau(sub e) at 5 K-300 K in GaAs/AlGaAs multiple quantum wells with different electron mobility mu using a circularly polarized pomp-probe measurement. The relationship among tau(sub e), mu and temperature T is found to be close to tau(sub e) proportional to 1/(mu Tau)(exp -1) at T is greater than 40 K, showing that the main spin relaxation mechanism at 40 K-300 K is the D'yakonov-Perel' mechanism.
Author
Aluminum Gallium Arsenides; Electron Spin; Quantum Wells; Semiconductors (Materials)

80
SOCIAL AND INFORMATION SCIENCES (GENERAL)

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

20000032159 New Horizons Regional Education Center, Hampton, VA USA
New Horizons Regional Education Center 1999 FIRST Robotics Competition
Purman, Richard I., New Horizons Regional Education Center, USA; Mar. 29, 1999; 3p; In English
Contract(s)/Grant(s): NAG1-2139; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The New Horizons Regional Education Center (NHREC) in Hampton, VA sought and received NASA funding to support its participation in the 1999 FIRST Robotics competition. FIRST, Inc. (For Inspiration and Recognition of Science and Technology) is an organization which encourages the application of creative science, math, and computer science principles to solve real-world engineering problems. The FIRST competition is an international engineering contest featuring high school, government, and business partnerships.
Author
Robotics; Competition; Research and Development; Education

20000032189 Alabama A & M Univ., Center for Hydrology, Soil Climatology and Remote Sensing, Normal, AL USA
NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education, Volumes 2 and 3
Coleman, Tommy L., Editor, Alabama A & M Univ., USA; White, Bettie, Editor, NASA, USA; Goodman, Steven, Editor, NASA Marshall Space Flight Center, USA; Sakimoto, P., Editor, NASA, USA; Randolph, Lynwood, Editor, NASA, USA; Rickman, Doug, Editor, NASA Marshall Space Flight Center, USA; Feb. 22, 1998; 975p; In English, 22-25 Feb. 1998, Huntsville, AL, USA; See also 20000032190 through 20000032360; CD-ROM contains PDF files of the conference proceedings.
Contract(s)/Grant(s): NCC8-140
Report No.(s): NONP-NASA-CD-1999011585; ISBN 1-889335-06-1; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche; C01, CD-ROM

This volume chronicles the proceedings of the 1998 NASA University Research Centers Technical Conference (URC-TC '98), held on February 22-25, 1998, in Huntsville, Alabama. The University Research Centers (URCS) are multidisciplinary research units established by NASA at 11 Historically Black Colleges or Universities (HBCU's) and 3 Other Minority Universities (OMU's) to conduct research work in areas of interest to NASA. The URC Technical Conferences bring together the faculty members and students from the URC's with representatives from other universities, NASA, and the aerospace industry to discuss recent advances in their fields.
Author
Multidisciplinary Research; Education; Aerospace Engineering; Conferences; Earth Sciences; Hydrology; Aeronautics

20000032194 Tennessee State Univ., Center of Excellence in Information Systems, Nashville, TN USA
Explorers of the Universe
Alvarez, Marino C., Tennessee State Univ., USA; Busby, Michael R., Tennessee State Univ., USA; Sotoohi, Goli, Tennessee State Univ., USA; Rodriguez, William J., University School of Nashville, USA; Hennig, Lee Ann, Thomas Jefferson High School for Science and Technology, USA; Berenty, Jerry, Thomas Jefferson High School for Science and Technology, USA; King, Terry, Hunters Lane High School, USA; Grener, Doreen, Wellington School, USA; Kruzan, John, Wellington School, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 468-473; In English; See also 20000032189
Contract(s)/Grant(s): NCC5-228; NCC5-96; NGT-40021; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
The Explorers of the Universe is a multifaceted scientific/literacy project that involves teachers and their students with problem oriented situations using authentic materials. This paper presents examples of self-directed cases researched by high school students and the met acognitive tools they use in the planning, carrying out, and finalizing their reports.
Author
Education; Universe; Observation

20000032289 Puerto Rico Univ., Mayaguez, Puerto Rico
GLOBE: An International-Interdiscidinary Program
Lopez–Garriga, J., Puerto Rico Univ., Puerto Rico; Camacho, R., Puerto Rico Univ., Puerto Rico; Nazario, W., Puerto Rico Univ., Puerto Rico; DeJesus, W., Puerto Rico Univ., Puerto Rico; Mora, D., Puerto Rico Univ., Puerto Rico; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 784-788; In English; See also 20000032189
Report No.(s): 98URC140; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM
In a world where science and engineering have become two of the most challenging fields of studies, interdisciplinary education, experimental knowledge, and hands-on experience are components of a successful general education. Students should be given opportunities to develop adequate communication and reasoning skills through hands-on scientific experiences. They must learn how to think critically and logically in order to create and analyze scientific data and arguments. The integration helps students to understand, consolidate, and mature the knowledge and the relevance of their science activities. This in turn will prepare them to choose wisely their carrier and it will enhance their educational opportunities. to achieve these goals various educational initiatives have been created. One of them, the Global Learning and Observations to Benefit the Environment (GLOBE) program (www.globe.gov) involves students and teachers born over 5,500 schools in more than 60 countries around the world. Pre-college students and teachers work with professors and research scientists to learn more about our planet. The program uses environmental experiments to help develop skills in chemistry, earth sciences, mathematics, data analysis and communication. The general topics discussed in support of the GLOBE protocols measurements involve Atmosphere, Hydrology, Land Cover, and Soils.
Derived from text
Learning; Education; Earth Sciences; Instructors; Environmental Tests

20000032319 NASA Stennis Space Center, Bay Saint Louis, MS USA
Improving Student Achievement in Math and Science
Sullivan, Nancy G., NASA Stennis Space Center, USA; Hamsa, Irene Schulz, Xavier Univ. of Louisiana, USA; Heath, Panagiota, Southern Univ., USA; Perry, Robert, Southern Univ., USA; White, Stacy J., Mississippi Valley State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 878-882; In English; See also 20000032189
Report No.(s): 98URC156; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

As the new millennium approaches, a long anticipated reckoning for the education system of the USA is forthcoming, Years of school reform initiatives have not yielded the anticipated results. A particularly perplexing problem involves the lack of significant improvement of student achievement in math and science. Three ”Partnership” projects represent collaborative efforts between Xavier University (XU) of Louisiana, Southern University of New Orleans (SUNO), Mississippi Valley State University (MVSU), and the National Aeronautics and Space Administration (NASA), Stennis Space Center (SSC), to enhance student achievement in math and science. These ”Partnerships” are focused on students and teachers in federally designated rural and urban empowerment zones and enterprise communities. The major goals of the ”Partnerships” include: (1) The identification and dissemination of key indices of success that account for high performance in math and science; (2) The education of pre-service and in-service secondary teachers in knowledge, skills, and competencies that enhance the instruction of high school math and science; (3) The development of faculty to enhance the quality of math and science courses in institutions of higher education; and (4) The incorporation of technology-based instruction in institutions of higher education. These goals will be achieved by the accomplishment of the following objectives: (1) Delineate significant ?best practices? that are responsible for enhancing student outcomes in math and science; (2) Recruit and retain pre-service teachers with undergraduate degrees in Biology, Math, Chemistry, or Physics in a graduate program, culminating with a Master of Arts in Curriculum and Instruction; (3) Provide faculty workshops and opportunities for travel to professional meetings for dissemination of NASA resources information; (4) Implement methodologies and assessment procedures utilizing performance-based applications of higher order thinking via the incorporation of Global Learning Observations to Benefit the Environment (GLOBE), Mission to Planet Earth and the use of Geographic Imaging Systems into the K-12th grade curriculum.
Derived from text
Education; Engineering; Science; Students

20000032333 North Carolina Agricultural and Technical State Univ., NASA Center for Autonomous and Control Engineering, Greensboro, NC USA

Preliminary Work for Examining the Scalability of Reinforcement Learning

Clouse, Jeff, North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 937-941; In English; See also 20000032189
Contract(s)/Grant(s): ACE-48146; NAG4-132
Report No.(s): 98URC167; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Researchers began studying automated agents that learn to perform multiple-step tasks early in the history of artificial intelligence (Samuel, 1963; Samuel, 1967; Waterman, 1970; Fikes, Hart & Nilsonn, 1972). Multiple-step tasks are tasks that can only be solved via a sequence of decisions, such as control problems, robotics problems, classic problem-solving, and game-playing. The objective of agents attempting to learn such tasks is to use the resources they have available in order to become more proficient at the tasks. In particular, each agent attempts to develop a good policy, a mapping from states to actions, that allows it to select actions that optimize a measure of its performance on the task; for example, reducing the number of steps necessary to complete the task successfully. Our study focuses on reinforcement learning, a set of learning techniques where the learner performs trial-and-error experiments in the task and adapts its policy based on the outcome of those experiments. Much of the work in reinforcement learning has focused on a particular, simple representation, where every problem state is represented explicitly in a table, and associated with each state are the actions that can be chosen in that state. A major advantage of this table lookup representation is that one can prove that certain reinforcement learning techniques will develop an optimal policy for the current task. The drawback is that the representation limits the application of reinforcement learning to multiple-step tasks with relatively small state-spaces. There has been a little theoretical work that proves that convergence to optimal solutions can be obtained when using generalization structures, but the structures are quite simple. The theory says little about complex structures, such as multi-layer, feedforward artificial neural networks (Rumelhart & McClelland, 1986), but empirical results indicate that the use of reinforcement learning with such structures is promising. These empirical results make no theoretical claims, nor compare the policies produced to optimal policies. A goal of our work is to be able to make the comparison between an optimal policy and one stored in an artificial neural network. A difficulty of performing such a study is finding a multiple-step task that is small enough that one can find an optimal policy using table lookup, yet large enough that, for practical purposes, an artificial neural network is really required. We have identified a limited form of the game OTHELLO as satisfying these requirements. The work we report here is in the very preliminary stages of research, but this paper provides background for the problem being studied and a description of our initial approach to examining the problem. In the remainder of this paper, we first describe reinforcement

learning in more detail. Next, we present the game OTHELLO. Finally we argue that a restricted form of the game meets the requirements of our study, and describe our preliminary approach to finding an optimal solution to the problem.
Derived from text
Artificial Intelligence; Neural Nets; Machine Learning; Adaptive Control; Feedforward Control; Robotics; Task Planning (Robotics)

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20000032157 National Inst. of Standards and Technology, Gaithersburg, MD USA
NVCASE Program Handbook: Procedures for Obtaining NIST Recognition as an Accreditor
Gladhill, R. L.; Dec. 1999; 28p
Report No.(s): PB2000-101377; NISTIR-6440; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This handbook provides guidance to bodies desiring to obtain recognition as an Accreditation Body (accreditor) under the National Voluntary Conformity Assessment Systems evaluation Program (NVCASE). It explains the generic procedures, conditions, and requirements for NIST recognition. The NVCASE program supports NIST obligations as a Designating Authority for Conformity Assessment Bodies (CABs) as specified in inter-governmental Mutual Recognition Agreements Pacific Economic Cooperation (APEC) MRA, Inter-American Telecommunications Commission (CITEL) MRA. It also supports requests from other Government regulatory agencies when CAB evaluation is required, (e.g., the Federal Communications Commission (FCC) Telecommunications Certification Body (TCB) Program, FCC Docket 98-68.) The generic requirements described in this handbook are based upon ISO-IEC documents Guides 58 and 61.
NTIS
Handbooks; Certification; Assessments

20000032266 North Carolina Agricultural and Technical State Univ., NASA Autonomous Control Engineering Center, Greensboro,NC USA
A Novel Approach to Decision Making
Baghdadchi, Jalal, North Carolina Agricultural and Technical State Univ., USA; Homaifar, Abdollah, North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 728-733; In English; See also 20000032189
Contract(s)/Grant(s): ACE-48146; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM
Decision-making is the core of any control system. The driving metaphor for a traditional decision-maker is the existence of an explicit memory base and its ability to analyze and express any situation that the controlled plant experiences, by a set of mutually disjoint rules. The disjoint nature of the rules reflects the fact that in engineering world we tend to partition the problems to smaller tasks, deal with each individual task separately, and then reassemble the overall solution. Given that the majority of problems and situations in real-time do not lend themselves easily to this type of partitioning, we are proposing a decision making scheme which confronts the problems in their entirety, thus, functioning to a great extent like the human brain.
Author
Decision Making; Brain; Bionics; Artificial Intelligence; Human Factors Engineering

20000032267 Auburn Univ., Dept. of Computer Science and Engineering, AL USA
Multiobjective Evolutionary Path Planning via Sugeno-Based Tournament Selection
Dozier, Gerry, Auburn Univ., USA; McCullough, Shaun, Auburn Univ., USA; Homaifar, Abdollah, North Carolina Agricultural and Technical State Univ., USA; Esterline, Albert, North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 734-738; In English; See also 20000032189
Contract(s)/Grant(s): ACE-48146; NAG4-131
Report No.(s): 98URC131; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM
This paper introduces a new tournament selection algorithm that can be used for evolutionary path planning systems. The fuzzy (Sugeno) tournament selection algorithm (STSA) described in this paper selects candidate paths (CPs) to be parents and undergo reproduction based on: (1) path feasibility, (2) the euclidean distance of a path from the origin to its destination, and (3)

the average change in the slope of a path. In this paper, we provide a detailed description of the fuzzy inference system used in the STSA as well as some examples of its usefulness. We then use 12 instances of our STSA to rank a population of CPs based on the above criteria. We also show how the STSA can obviate the need for the development of an explicit (lexicographic multiobjective) evaluation function and use it to develop multiobjective motion paths.
Author
Algorithms; Fuzzy Systems; Euclidean Geometry; Trajectory Planning

20000032306 North Carolina Agricultural and Technical State Univ., Dept. of Computer Science, Greensboro,NC USA
Motion Planning in a Society of Mobile Agents
Campbell, James, North Carolina Agricultural and Technical State Univ., USA; Esterline, Albert, North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 836-841; In English; See also 20000032189
Report No.(s): 98URC149; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Groups or societies of agents may collaborate on a common goal and thereby achieve more than by working individually. This paper discusses the use of societal theories to model the carrying out of a plan by a group of agents. We focus on plans that relate to agent motion since the low-level aspects of such plans are well understood and motion provides clear criteria for successful planning. We use statecharts to represent these plans, which are hierarchically structured and require concurrent behavior. We represent norms as statements in deontic logic, and we annotate statechart plans with such statements to indicate that certain norms apply to certain groups. In fact, the transitions in a statechart are often naturally interpreted in a normative way. Using deontic logic allows us to distinguish ideal behavior from actual behavior that violates norms and hence to represent fault tolerance.
Derived from text
Planning; Logic Programming; Sociology; Group Theory; Motion

20000033048 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study of Write-Once Optical Disk Memories That Have High Reflection using Ultra-Thin Silver Films
Deguchi, Tomoya, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 269-270; In Japanese; Copyright; Avail: Issuing Activity

For write-once optical memories, three types of write-once optical memories using the silver island films, that is, a single layer of thicker silver island film, a multilayer using silver quasi-island film, and a periodic multilayer of silver island films have been proposed and investigated for CD-compatible write-once optical memories with high reflection.
Author
Metal Films; Optical Disks; Thin Films; Optical Memory (Data Storage)

20000033375 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Dynamic User-Optimal Departure Time/Route Choice Problem with Time-Window
Chen, Huey–Kuo, National Central Univ., Taiwan, Province of China; Chang, Mei–Shiang, Chung-Hua Polytechnic Inst., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; 2000; ISSN 0253-3839; Volume 23, No. 1, pp. 71-81; In English
Contract(s)/Grant(s): NSC-88-2211-E-008-021; Copyright; Avail: Issuing Activity

A discrete-time predictive dynamic user-optimal departure time/route choice problem has been formulated and solved with the nested diagonalization method by Chen and Hsueh (1998a). That model did not impose constraints on either origin departure times or destination arrival times, which are typically required for regular work trips. For the purpose of better representing practical situations, the time-window constraints associated with both departure times and arrival times are incorporated into the previous dynamic user-optimal departure time/route choice model, resulting in a dynamic user-optimal departure time/route choice model with time-window, where the off-peak and peak phenomena can be properly differentiated within the analysis period, and the influence of earlier departures on later arrivals with respect to perceived route disutilities can be appropriately modeled.
Author
Time Domain Analysis; Mathematical Models; Arrivals

82
DOCUMENTATION AND INFORMATION SCIENCE

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

20000032208 Southern Univ., Baton Rouge, LA USA
Preserving Technical Knowledge by Using Web-Like Tools
Moreman, D., Southern Univ., USA; Dyer, J., Southern Univ., USA; Coffey, J., University of West Florida, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volume 2 and 3, pp. 523-526; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

A national treasure in technology is disappearing like melting snow. The senior engineers from the early days, who designed the systems still launching our missions into space, are leaving NASA: In many technical areas, no comparable people replace them. Areas exist in which documentation of creations and discoveries is sparse or has not been gathered into safe archive -- and certainly not into archive accessible by modern methods such as CD-ROMs and Web-like Intranets. We will now report on tools and methods we have developed to address this problem and this opportunity. We see our tools as part of a revolution transforming the great social net of sharable wisdom.
Derived from text
Expert Systems; Knowledge Representation; Aerospace Engineering; Applications Programs (Computers)

20000032231 Alabama A & M Univ., Dept. of Mathematics and Computer Science, Normal, AL USA
A Spatial Classifier for Multispectral Data Using Contextual Information
Hung, Chih–Cheng, Alabama A & M Univ., USA; Fahsi, Ahmed, Alabama A & M Univ., USA; Coleman, Tommy, Alabama A & M Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 89-94; In English; See also 20000032189
Contract(s)/Grant(s): NCCW-84; SUB90-206-A12; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; C01, CD-ROM

Connectivity describes the spatial relationship among pixels. A spatial classifier which employs the sigma probability concept of the Gaussian distribution and a type of contextual information connectivity of the pixels, is studied in this paper. This spatial classifier attempts to replicate the kind of spatial synthesis done by the human analyst during visual interpretation or to capture the spatial relationships inherent in an aerial photograph. Several classification results of the LANDSAT TM data using this classifier with different window sizes for capturing the contextual information are illustrated and compared.
Author
Spatial Distribution; Classifiers; Pixels; Multispectral Photography; Aerial Photography

20000032448 Yamagata Univ., Faculty of Engineering, Japan
Development of Syllabus Database from a Practical Standpoint
Tachibana, Kazuhiro, Yamagata Univ., Japan; Okuyama, Sumio, Yamagata Univ., Japan; Nishina, Tatsuo, Yamagata Univ., Japan; Tanaka, Atsushi, Yamagata Univ., Japan; Yahagi, Kiyoshi, Yamagata Univ., Japan; Saruta, Kazuki, Yamagata Univ., Japan; Hiranaka, Yukio, Yamagata Univ., Japan; Bulletin of Yamagata University (Engineering); 2000; ISSN 0085-834X; Volume 26, No. 1, pp. 47-52; In Japanese; Copyright; Avail: Issuing Activity

Nowadays, database system becomes an main central functionality unit in the computer systems as an indispensable source for efficient processing of office works and releasing information from companies, universities, government, and so on. Syllabus database system of Yamagata University was born in 1996, and is growing up by expanding, integrating and decentralizing it's functionalities with drastic structural changes. Current syllabus database holds many data not only for syllabus but also many kinds of education and research related data, and such data should be connected each other by defining rational data relation structure.
Author
Data Bases; Data Structures

20000032450 Yamagata Univ., Faculty of Engineering, Japan
Performance Analysis of Syllabus Database System of Yamagata University
Okuyama, Sumio, Yamagata Univ., Japan; Tachibana, Kazuhiro, Yamagata Univ., Japan; Tanaka, Atsushi, Yamagata Univ., Japan; Nishina, Tatsuo, Yamagata Univ., Japan; Yahagi, Kiyoshi, Yamagata Univ., Japan; Saruta, Kazuki, Yamagata Univ., Japan;

Hiranaka, Yukio, Yamagata Univ., Japan; Bulletin of Yamagata University (Engineering); 2000; ISSN 0085-834X; Volume 26, No. 1, pp. 53-57; In Japanese; Copyright; Avail: Issuing Activity

Performance analysis of the syllabus database system of Yamagata University has been carried out for the period from January 1999 to March 1999. During this period, 3304 syllabuses were processed and their manuscripts were updated 23409 times in total. The cost for facsimile calls used to verify the manuscripts was reduced to 116 by using web based input system than that of e-mail based system operated at 1998. The stability and throughput of the web based input system was improved by optimizing the access condition settings of web-subsystem.

Author

Data Bases; Data Structures; Data Systems

20000032611 NCI Information Systems, Inc., NASA Center for AeroSpace Information, Hanover, MD USA

NASA Thesaurus Hierarchical Listing (Data File for Site Usage)

January 2000; In English; Data file in tagged text format; approximately 5.5 MB

Report No.(s): NONP-NASA-DF-2000043664; No Copyright; Avail: CASI; EA2, Multimedia; Data file. Terms and conditions apply; letter of agreement required.

The NASA Thesaurus Hierarchical Listing is an electronic data file containing all valid terms and hierarchies, nonpostable USE references, and related terms contained in the NASA Thesaurus. The scope of this controlled vocabulary includes not only aerospace engineering and the natural space sciences, but all supporting areas of engineering, physics, Earth sciences, and the biological sciences. The Hierarchical Listing is provided as an electronic file in tagged text format. Each element of the listing is marked with an identifying tag for easy manipulation. File size is approximately 5.5 MB.

CASI

Thesauri; Terminology; Hierarchies; Aerospace Sciences; Aeronautics; Astronautics

20000032612 NCI Information Systems, Inc., NASA Center for AeroSpace Information, Hanover, MD USA

NASA Thesaurus Term List (Data File for Site Usage)

January 2000; In English; Text data file; approximately 308 KB.

Report No.(s): NONP-NASA-DF-2000043638; No Copyright; Avail: CASI; E09, Multimedia; Data file. Terms and conditions apply; letter of agreement required.

The NASA Thesaurus Term List is an electronic data file containing an alphabetical listing of over 17,900 authorized terms from the NASA Thesaurus (hierarchies, definitions, and cross references are not included.) The scope of this controlled vocabulary includes not only aerospace engineering and the natural space sciences, but all supporting areas of engineering, physics, Earth sciences, and the biological sciences. File size is approximately 308 KB.

CASI

Thesauri; Terminology; Aeronautics; Aerospace Sciences; Astronomy; Astronautics

20000032613 NCI Information Systems, Inc., NASA Center for AeroSpace Information, Hanover, MD USA

NASA Thesaurus Supplement: A Three-Part Cumulative Update of the 1998 Edition of the NASA Thesaurus, Supplement 4

January 2000; 25p; In English

Report No.(s): NASA/SP-2000-7501/SUPPL4; NAS 1.21:7501/SUPPL4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA Thesaurus Supplement is a cumulative update to the 1998 edition of the NASA Thesaurus (NASA/SP-1998-7501). The Supplement, published every six months, includes all new terms and associated hierarchies added since the cutoff for the 1998 edition (December 1997). Parts 1 and 2 (Hierarchical Listing and Rotated Term Display) correspond to Volumes 1 and 2 of the 1998 printed edition. Definitions are included in Part 1; uppercase/lowercase forms are provided in both Parts 1 and 2. Part 3 is a list of deletions or changes to valid terms.

CASI

Thesauri; Hierarchies; Terminology; Aerospace Sciences; Aeronautics; Astronomy; Astronautics

20000033054 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

An Algorithm of Character String Search in Document Images

Nakanishi, Taiga, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 257-258; In Japanese; Copyright; Avail: Issuing Activity

The keyword search in document images after preprocessing of recognition has problems such as missing keyword caused by recognition error and excessive time for preprocessing of recognition. to deal with these problems, we propose a high precision keyword search system that uses feature vectors of images in the comparing process, without any recognition in advance. According to our experiments, in both high and low quality document images, high recall rates (99.9% and 99.6% respectively) and high precision rates (99.5% and 98.2% respectively) are achievable by this new method.
Author
Character Recognition; Documents; Searching; Algorithms

20000033190 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Design of Network Information Management System
Nito, Hiroaki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 467-468; In Japanese; Copyright; Avail: Issuing Activity

When more and more people using Internet as their communication means in daily life, keeping networks from damage caused by network attacks becomes an urgent task of network management. For maintaining networks with high security level, monitoring and analyzing network traffic on a real-time basis is indispensable. However, on a backbone network filled with heavy traffic, this is a challenging problem. In this paper, we propose a real-time network traffic monitoring management system for detecting network attacks on backbone networks.
Author
Internets; Computer Information Security

20000033192 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Service Management in Large Scale Information Network
Kamiya, Hajime, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 463-464; In Japanese; Copyright; Avail: Issuing Activity

In today's Network, many dispersion techniques like mirroring or multi homing, has been researched and experimented for load-balancing or reducing users' information retrieval time. But to use these techniques effectively, users need to select the best server or route. In this paper, we examine the metric information for efficient server/route selection and propose new method for measuring that, using application logs. This method does not generate extra network traffic and can get metric information that reflects users' actual information retrieval time. Advantages of the proposed system are shown by experiment under practical network. A pilot of Search Engine and MIB as an application of our method is also obtained.
Author
Information Resources Management; Network Control

20000033194 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on the Safegaurd of Digital Contents by Watermarking
Nomiyama, Hiroyuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 437-438; In Japanese; Copyright; Avail: Issuing Activity

Digital contents are copyrighted in general. to protect them against illegal usage, digital watermarking has been extensively studied in the field of cryptology. However, we do not yet have a common agreement on what the digital watermark is. In this thesis we therefore propose a definition of watermarking from a theoretical viewpoint, and give its practical interpretation for a merchant buyer protocol. We then compare three watermarkings with the proposed definition, and give some comments on the security of these schemes. We also show that a dishonest merchant could deviate from the specified protocols. To prevent such a deviation, we give a general method to modify the protocol, and demonstrate a modified protocol in one of watermarkings based on the technique of zero-knowledge proofs.
Author
Cryptography; Computer Information Security; Protocol (Computers)

20000033200 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study about Image Database Retrieval System that use User's Individual Information
Ke, Rong, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 425-426; In Japanese; Copyright; Avail: Issuing Activity

The human's sensory information is different for everybody. In the past sensory information retrieval system of CG database, every user had to always use the same compare level to retrieve the graphics. In other ways, the system can not provide different

correspondence to different user. We are thinking of a solution and the system that we think of is use user's individual information and common retrieval level at the same time, so it can provide a more flexible search to every user than the past system.
Author
Data Retrieval; Information Retrieval; User Requirements

20000033261 Civil Aeromedical Inst., Oklahoma City, OK USA
Index to FAA Office of Aviation Medicine Reports: 1961 Through 1999 ***Final Report***
Collins, William E.; Wayda, Michael E.; Jan. 2000; 84p; In English
Report No.(s): AD-A373794; DOT/FAA/AM-00/1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

An index to Federal Aviation Administration Office of Aviation Medicine Reports (1964-1999) and Civil Aeromedical Institute Reports (1961-1963) is presented for those engaged in aviation medicine and related activities. The index lists all FAA aviation medicine reports published from 1961 through 1999: chronologically, alphabetically by author, and alphabetically by subject. A foreword describes aspects of the Civil Aeromedical Institute's 38 years of service, describes the index's sections, and explains how to obtain copies of published Office of Aviation Medicine technical reports.
DTIC
Aerospace Medicine; Indexes (Documentation)

20000033463 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
An Analysis of Training Adequacy and Additional Training Requirements as Perceived by Communications and Information Officers
Little, Rex W.; Dec. 1999; 125p; In English
Report No.(s): AD-A374160; AFIT/GIR/LAS/99D-7; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This study explores requirements for additional training Communications and Information officers. This research also looks at the best time to provide training/education in the identified training deficient areas. Training areas and categories were established by two previous theses and were modified by a group of field experts for this research. The following questions were posed in an effort to obtain the perception of officers in the field: (1) What training areas do Communications and information officers feel are deficient? (2) At what point during a Communications and Information officer's career would it be most appropriate to receive training in necessary areas? (3) What is the best way to incorporate additionally needed training into the existing training system? The results suggest that Air Force officers in this career field find the training to be satisfactory at best, with several training deficiencies in the multiple areas. The findings also show that officers would prefer to receive additional training either at the beginning of their career, or on a Just-in-Time/recurring basis. The results of this thesis show that improvements in training are necessary, and should emphasize both the beginning of an officer's career as well as Just-in-Time training that can be used "anytime/anywhere."
DTIC
Information Systems; Education; Communication

20000033468 Environmental Research Inst. of Michigan, Ann Arbor, MI USA
Communications Assessment Pilot ***Final Report, Mar 1998-May 1999***
Przybylinski, Stanley M.; Kohler, Ronald E.; Gluesing, Julia; Jun. 1999; 136p; In English
Contract(s)/Grant(s): F41624-97-D-5002; AF Proj. 2940
Report No.(s): AD-A374232; AFRL-HE-WP-TR-1999-0198; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Communications Assessment Pilot defined, developed, and tested a paper-based mechanism to provide near real-time feedback on communications within an organization. The manual mechanism developed is for change agents within an organization to monitor the effectiveness of communications across all levels and functions at the participating organization on an ongoing basis. The pilot determined the feasibility of developing an automated system that will allow managers to determine the effectiveness of selecting communication efforts. This monitoring allows for near real-time corrections in communication choices when effectiveness is being compromised. The intent is that this mechanism will become a permanent management tool for change agents and managers at the participating organizations. Developing and deploying a more automated version of this tool could be a follow-on project. The research for this project was conducted at WR-ALC and the Defense Reutilization and Marketing Service.
DTIC
Computer Networks; Communication; Management Planning; Real Time Operation

89
ASTRONOMY

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

20000032187 NASA Goddard Space Flight Center, Greenbelt, MD USA
Looking at NGST Through the Eyes of DCATT
Davila, Pam, NASA Goddard Space Flight Center, USA; Lowman, Andrew, NASA Goddard Space Flight Center, USA; Wilson, Mark, NASA Goddard Space Flight Center, USA; Redding, David, NASA Goddard Space Flight Center, USA; Bowers, Chuck, NASA Goddard Space Flight Center, USA; Hagopian, John, NASA Goddard Space Flight Center, USA; Dean, Bruce, NASA Goddard Space Flight Center, USA; Boucarut, Ray, NASA Goddard Space Flight Center, USA; Norton, Todd, NASA Goddard Space Flight Center, USA; Petrone, Peter, NASA Goddard Space Flight Center, USA; Robinson, Dave, NASA Goddard Space Flight Center, USA; Fitzmaurice, Mark, NASA Goddard Space Flight Center, USA; [1999]; 1p; In English, 27-31 Mar. 2000, Munich, Germany; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The first phase of the Developmental Characterized Active Telescope Testbed (DCATT) hardware system was integrated at Goddard Space Flight Center in early March of 1999 and has been operational for almost a year. Experiments are currently being conducted on the testbed to quantify and refine various methods and techniques in the baseline wavefront sensing and control process. This paper addresses the actual optical design of the Phase 0 hardware configuration and discusses the open loop system level performance of the system. Lessons learned for NGST during the buildup and characterization of the system are presented. Author

Design Analysis; Optical Equipment; Next Generation Space Telescope Project

20000032253 Tennessee State Univ., Center of Excellence in Information Systems, Nashville, TN USA
Optimal Scheduling of a Multi-User, Multi-Tasking Automatic Robotic Telescope
Tantaris, R. N., Tennessee State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 137-142; In English; See also 20000032189
Contract(s)/Grant(s): NCC5-228; NCC2-977; NGT-40021; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

An algorithm is introduced to generate the optimal schedule of observations for a multi-user, multi-tasking automatic robotic telescope. The schedule is optimal m that it will take the highest possible quality data, perform the largest number of tasks, and fairly serve multiple users in terms of data quality, allocated telescope time, and observation priorities. In addition, the algorithm addresses problems due to overloading and underloading the telescope. The algorithm, which employs dynamic-programming-based decision theory, is analytically proven to produce the optimal schedule using set theory. Simulations conducted using actual astronomical data are presented which show significant improvement over existing scheduling techniques. Once completed the new scheduling algorithm will be tested on the Tennessee State University/Harvard-Smithsonian Center for Astrophysics 32-inch automatic Photoelectric Telescope at Fairborn Observatory, Arizona.
Author

Algorithms; Computer Programs; Dynamic Programming; Scheduling

20000032255 Tennessee State Univ., Center of Excellence in Information Systems, Nashville, TN USA
Automatic Telescope Search for Extrasolar Planets
Henry, Gregory W., Tennessee State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 679-684; In English; See also 20000032189; Sponsored in part by the Richard Lounsbery Foundation
Contract(s)/Grant(s): NCC2-883; NCC5-228; NAG8-1014; NSF HRD-95-50561; NSF HRD-97-06268; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

We are using automatic photoelectric telescopes at the Tennessee State University Center for Automated Space Science to search for planets around nearby stars in our galaxy. Over the past several years, wc have developed the capability to make extremely precise measurements of brightness changes in Sun-like stars with automatic telescopes. Extensive quality control and calibration measurements result in a precision of 0.l% for a single nightly observation and 0.0270 for yearly means, far better than previously thought possible with ground-based observations. We are able, for the first time, to trace brightness changes in Sun-like

stars that are of similar amplitude to brightness changes in the Sun, whose changes can be observed only with space-based radiometers. Recently exciting discoveries of the first extrasolar planets have been announced, based on the detection of very small radial-velocity variations that imply the existence of planets in orbit around several Sun-like stars. Our precise brightness measurements have been crucial for the confirmation of these discoveries by helping to eliminate alternative explanations for the radial-velocity variations. With our automatic telescopes, we are also searching for transits of these planets across the disks of their stars in order to conclusively verify their existence. The detection of transits would provide the first direct measurements of the sizes, masses, and densities of these planets and, hence, information on their compositions and origins.
Author
Automatic Control; Telescopes; Solar Instruments; Extrasolar Planets; Sun

20000032259 Tennessee State Univ., Center for Automated Space Science (CASS), Nashville,TN USA
Random Spot on Chromospherically Active Stars
Williams, Tamara S., Tennessee State Univ., USA; Eaton, Joel A., Tennessee State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 690-697; In English; See also 20000032189
Report No.(s): 98URC125; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Observations of rapidly rotating chromospherically active stars provides the basis of the theory that these stars are highly spotted. Previously, we thought that the stars contained only two large spots at any one time. What appears to be two spots could actually be as many as 25 spots randomly distributed on a differentially rotting star as proposed. Initial tests of this random spot model produced all of the characteristic photometric variations of highly spotted stars. We have tested the random spot theory by measuring the differential rotation of the spots (k), the lifetimes (tau), and maximum and minimum periods of migration in approximately fifty data sets. These data sets consist of spots with an average lifetime of 2 years (cases 1- 21), 5 years (cases 26-38), and 10 years (cases 39- 49), Each data set spans 14 years, which is comparable to real stars that have been observed for about 20 years. The derived spot lifetimes in the two-spot model increased with assumed lifetimes of the random spots; specifically, median two-spot lifetimes were 0.7, 2.2, and 2.3 years, respectively for the actual random spot lifetimes of 2, 5, and 10 years. A median two-spot lifetime of 1.5 years for some actual stars were found. Therefore, if the random spot model is correct, actual spot lifetimes are probably somewhat shorter than 5 years. Furthermore, this result shows that random spots with reasonable lifetimes can fully reproduce the persistence of spots in the actual stars' light curves.
Author
Chromosphere; Stellar Rotation; Statistical Distributions; Star Distribution

20000032322 Tennessee State Univ., Center for Automated Space Science, Nashville, TN USA
Brightness Changes in Sun-like Stars
Henry, Stephen M., Tennessee State Univ., USA; Henry, Gregory W., Tennessee State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 889-894; In English; See also 20000032189
Contract(s)/Grant(s): NCC2-883; NCC5-228; NAG8-1014; NSF HRD-95-50561; NSF HRD-97-06268
Report No.(s): 98URC158; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Does the Sun's energy output vary with time? Are observable climatic changes on the earth caused by changes in the Sun? Can we gain greater insight into this relation-ship by studying other stars with properties similar to the Sun's? In recent years, satellite observations have shown that the solar irradiance varies in phase with the 1 l-year sunspot cycle. The Sun is brighter by about O.l% at the peak of the sunspot cycle when solar magnetic activity is at its maximum. Over longer intervals, changes in the cart h's climate and solar magnetic activity seem to be correlated. We are using automatic photoelectric telescopes to measure brightness changes in a sample of 150 Sun-like stars. Lowell Observatory astronomers have also observed about 30 of these same stars with a manual telescope in a program that began 10 years before ours. Since these two data sets were acquired with different instruments and so have significant systematic differences, we developed software to combine them accurately and, therefore, extend our observational time coverage. We show sample results of brightness variations over 14 years in several Sun-like stars with different ages. Longitudinal studies like these, combined with cross-sectional studies of the larger sample of stars, may eventually allow us to infer with confidence the Sun's long-term brightness history and its impact on the earth's climate.
Author
Observation; Solar Radiation; Brightness; Astronomical Observatories; Irradiance; Photometry; Solar Activity; Solar Energy; Telescopes

20000032971 NASA Marshall Space Flight Center, Huntsville, AL USA

The Fabrication of Replicated Optics for Hard X-Ray Astronomy

Speegle, C. O., Raytheon STX Corp., USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; Engelhaupt, D., Alabama Univ., USA; [2000]; 3p; In English; Optical Fabrication and Testing, 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

Fabrication; Reproduction (Copying); Lens Design; Lenses; Mirrors; Mandrels

20000032972 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Future Directions for Astronomical Image Display ***Final Report, 1 Feb. 1997 - 31 Jan. 2000***

Mandel, Eric, Smithsonian Astrophysical Observatory, USA; March 2000; 8p; In English

Contract(s)/Grant(s): NAG5-3996; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In the ”Future Directions for Astronomical Image Displav” project, the Smithsonian Astrophysical Observatory (SAO) and the National Optical Astronomy Observatories (NOAO) evolved our existing image display program into fully extensible. cross-platform image display software. We also devised messaging software to support integration of image display into astronomical analysis systems. Finally, we migrated our software from reliance on UNIX and the X Window System to a platform-independent architecture that utilizes the cross-platform Tcl/Tk technology.

Author

Astronomy; Computer Programs; Display Devices

20000033138 NASA Goddard Space Flight Center, Greenbelt, MD USA

GHRS Observations of Cool, Low-Gravity Stars, 5, The Outer Atmosphere and Wind of the Nearby K Supergiant Lambda Velorum

Carpenter, Kenneth G., NASA Goddard Space Flight Center, USA; Robinson, Richard D., NASA Goddard Space Flight Center, USA; Harper, Graham M., Colorado Univ., USA; Bennett, Philip D., Colorado Univ., USA; Brown, Alexander, Colorado Univ., USA; Mullan, Dermott J., Delaware Univ., USA; Astrophysical Journal; Aug. 10, 1999; Volume 521, pp. 382-406; In English

Contract(s)/Grant(s): NAS5-26555; NAG5-3226; NAG5-4804; NAG5-6905; NAG5-3033; Copyright; Avail: Issuing Activity

UV spectra of lambda Velorum taken with the Goddard High Resolution Spectrograph (GHRS) on the Hubble Space Telescope are used to probe the structure of the outer atmospheric layers and wind and to estimate the mass-loss rate from this K5 lb-II supergiant. VLA radio observations at lambda = 3.6 cm are used to obtain an independent check on the wind velocity and mass-loss rate inferred from the UV observations, Parameters of the chromospheric structure are estimated from measurements of UV line widths, positions, and fluxes and from the UV continuum flux distribution. The ratios of optically thin C II] emission lines indicate a mean chromospheric electron density of log N(sub e) approximately equal 8.9 +/- 0.2 /cc. The profiles of these lines indicate a chromospheric turbulence (v(sub 0) approximately equal 25-36 km/s), which greatly exceeds that seen in either the photosphere or wind. The centroids of optically thin emission lines of Fe II and of the emission wings of self-reversed Fe II lines indicate that they are formed in plasma approximately at rest with respect to the photosphere of the star. This suggests that the acceleration of the wind occurs above the chromospheric regions in which these emission line photons are created. The UV continuum detected by the GHRS clearly traces the mean flux-formation temperature as it increases with height in the chromosphere from a well-defined temperature minimum of 3200 K up to about 4600 K. Emission seen in lines of C III] and Si III] provides evidence of material at higher than chromospheric temperatures in the outer atmosphere of this noncoronal star. The photon-scattering wind produces self-reversals in the strong chromospheric emission lines, which allow us to probe the velocity field of the wind. The velocities to which these self-absorptions extend increase with intrinsic line strength, and thus height in the wind, and therefore directly map the wind acceleration. The width and shape of these self-absorptions reflect a wind turbulence of approximately equal 9-21 km/s. We further characterize the wind by comparing the observations with synthetic profiles generated with the Lamers et al. Sobolev with Exact Integration (SEI) radiative transfer code, assuming simple models of the outer atmospheric structure. These comparisons indicate that the wind in 1994 can be described by a model with a wind acceleration parameter beta approximately 0.9, a terminal velocity of 29-33 km/s, and a mass-loss rate approximately 3 x 10(exp -9) solar M/yr. Modeling of the 3.6 cm radio flux observed in 1997 suggests a more slowly accelerating wind (higher beta) and/or

a higher mass-loss rate than inferred from the UV line profiles. These differences may be due to temporal variations in the wind or from limitations in one or both of the models. The discrepancy is currently under investigation.
Author
Chromosphere; Supergiant Stars; K Stars; Stellar Winds; Solar Wind; Stellar Spectra

20000033139 NASA Goddard Space Flight Center, Greenbelt, MD USA
Design and Performance of the Astro-E/XRS Signal Processing System
Boyce, Kevin R., NASA Goddard Space Flight Center, USA; Audley, M. D., NASA Goddard Space Flight Center, USA; Baker, R. G., NASA Goddard Space Flight Center, USA; Dumonthier, J. J., NASA Goddard Space Flight Center, USA; Fujimoto, R., Tokyo Univ., Japan; Gendreau, K. C., NASA Goddard Space Flight Center, USA; Ishisaki, Y., Tokyo Metropolitan Univ., Japan; Kelley, R. L., NASA Goddard Space Flight Center, USA; Stahle, C. K., NASA Goddard Space Flight Center, USA; Szymkowiak, A. E., NASA Goddard Space Flight Center, USA; [1999]; 10p; In English, 18-23 Jul. 1999, Denver, CO, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We describe the signal processing system of the Astro-E XRS instrument. The Calorimeter Analog Processor (CAP) provides bias and power for the detectors and amplifies the detector signals by a factor of 20,000. The Calorimeter Digital Processor (CDP) performs the digital processing of the calorimeter signals, detecting X-ray pulses and analyzing them by optimal filtering. We describe the operation of pulse detection, Pulse height analysis. and risetime determination. We also discuss performance, including the three event grades (hi-res mid-res, and low-res). anticoincidence detection, counting rate dependence, and noise rejection.
Author
X Ray Astronomy; Calorimeters; Digital Systems; Signal Processing

20000033271 National Optical Astronomy Observatories, Tucson, AZ USA
Optical Design for A 1-Degree FOV, 30-Meter Telescope
Barden, Samuel C., National Optical Astronomy Observatories, USA; Harmer, Charles F. W., National Optical Astronomy Observatories, USA; Claver, Charles F., National Optical Astronomy Observatories, USA; Dey, Arjun, National Optical Astronomy Observatories, USA; March 2000; 9p; In English
Report No.(s): NOAO-Preprint-875; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We are exploring the feasibility of a very large telescope with a wide field of view for multi-object spectroscopic surveys. This paper presents a brief overview of the scientific need for such a facility, a possible optical design for such a telescope, and a description of how such a telescope might function for both wide-field, seeing-limited spectroscopy and narrow-field, high-Strehl imaging and spectroscopy. The science is primarily driven by the fact that imaging surveys are now capable of cataloguing vast numbers of targets that would take a formidable amount of time on currently existing telescopes for spectroscopic follow-up. The telescope design, a 4-mirror extension of the Paul concept, is a 30-meter telescope that delivers a full 1 deg field at f/4 with excellent image performance across the full field. The primary is an f/l, 30-meter. The secondary has a diameter of 5.3-meters and contains a pure conic surface that delivers an uncorrected focus between the primary and secondary. The tertiary mirror is located at the vertex of the primary and has a diameter of about 10.6-meters. The quaternary mirror, located at the position of the initial focus, is about 4.4-meters and images the final focus back at the vertex of the tertiary mirror. The initial design had both the tertiary and quaternary mirrors with high-order, even aspheric surfaces. Further study has led to a simplification of the design in which the tertiary is now a pure conic like the primary and secondary mirrors, and the quaternary mirror is something like a Schmidt corrector with only modest fourth and sixth order terms. Keywords: Extremely large telescopes, wide field telescopes, optical design.
Author
Design Analysis; Feasibility; Field of View; Imaging Techniques; Telescopes

20000033272 National Optical Astronomy Observatories, Tucson, AZ USA
Optimizing the Delivered Image Quality at the WIYN 3.5-Meter Telescope
Sawyer, David G., WIYN Observatory, USA; Corson, Charles, National Optical Astronomy Observatories, USA; Saha, Abi, National Optical Astronomy Observatories, USA; March 2000; 10p; In English
Report No.(s): NOAO-Preprint-874; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We discuss many enhancements and refinements to the WIYN Telescope that have demonstrably improved the imaging performance over the past few years. Currently, WIYN yields a median delivered image quality of 0.8 arc-seconds for 10 second exposures in the R-Band, and images better than 0.6 arc-seconds 20% of the time! WIYN is a 3.5 meter telescope sited on the south west ridge of Kitt Peak yielding excellent atmospheric seeing conditions. The telescope and enclosure were designed to exploit

the good seeing conditions with features such as superb optical components, a primary mirror that is actively controlled for low-order aberrations, a thermally controlled primary mirror, active and passive enclosure ventilation, real-time focus and collimation control, and precise tracking and guiding control. The WIYN organization is committed to continuously enhance the scientific performance of the observatory and through a long-term commitment of increased technical support we have made significant progress on many technical aspects for improved imaging performance. These improvements, which are described in this paper, include optimization of the wavefront curvature measurement process, better control of secondary tilt and piston (focus), feedback mechanisms for structural thermo-mechanical effects, careful tuning of the active thermal control for the primary mirror, damping of structural vibrations, and the implementation of a closed-loop focus sensor. WIYN is also developing an adaptive optics tip-tilt system which is described elsewhere in this conference.
Author
Active Control; Adaptive Optics; Detection; Feedback Control; Image Resolution; Imaging Techniques; Optical Equipment

20000033460 NASA Goddard Space Flight Center, Greenbelt, MD USA
An Ultraviolet/Optical Atlas of Bright Galaxies
Stecher, Theodore, NASA Goddard Space Flight Center, USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We present wide-field, imagery and photometry of 43 selected nearby galaxies of all morphology types at ultraviolet and optical wavelengths. The ultraviolet images, in two broad bands at 1500 Angstroms and 2500 Angstroms, were obtained by the Ultraviolet Imaging Telescope (UIT) during the Astro-1 Spacelab mission. The UV images have approx. 3” resolution, and the comparison sets of ground-based, CCD images (in one or more of B, V, R, and H alpha) have pixel scales and fields of view closely matching the UV frames. The atlas consists of multiband images together with plots of UV/optical radial surface brightnesses, colors and other associated photometric parameters such as half-light radii. In an appendix, we discuss the sensitivity of different wavebands to a galaxy’s star formation history in the form of ”history weighting functions” and the importance of UV observations as probes of evolution during the past 10-1000 Myr. We find that UV galaxy morphologies are usually significantly different from visible band morphologies as a consequence of spatially inhomogeneous stellar populations. Differences are quite pronounced for systems in the middle range of Hubble types, Sa through Sc, but less so for ellipticals or late-type disks. Normal ellipticals and large spiral bulges are fainter and more compact in the UV. They typically exhibit smooth and unresolved far-UV profiles with, however, far-UV/optical color gradients which are larger than any at optical/IR wavelengths. The far-UV light in these cases is probably produced by extreme horizontal branch stars and their descendants in the dominant, low-mass, metal-rich population.
Author
Brightness; Galaxies; Photometry; Ultraviolet Radiation; Morphology; Optical Properties

20000033614 California Inst. of Tech., Pasadena, CA USA
Noise Stability of SIS Receivers
Kooi, J. W., California Inst. of Tech., USA; Chattopadhyay, G., California Inst. of Tech., USA; Thielman, M., California Inst. of Tech., USA; Phillips, T. G., California Inst. of Tech., USA; Schieder, R., Cologne Univ., Germany; [2000]; 19p; In English
Contract(s)/Grant(s): NSF AST-96-15025
Report No.(s): Rept-2000-6; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

There is a strong interest in the submillimeter astronomy community to increase the IF bandwidth of SIS receivers in order to better facilitate broad spectral linewidth and continuum observations of extragalactic sources. However, with an increase in receiver IF bandwidth there is a decrease in the mixer stability. This in turn effects the integration efficiency and quality of the measurement. In this paper we address a variety of factors that degrade the noise stability of SIS receivers. The goal of this exercise is to make recommendations aimed at maximizing SIS receiver stability.
Author
Radio Receivers; SIS (Superconductors); Stability; Radio Astronomy; Noise (Sound)

20000033674 Eureka Scientific, Inc., Oakland, CA USA
The Origin of the EUV Emission in Her X-1
Leahy, D. A., Calgary Univ., Canada; Marshall, H., Massachusetts Inst. of Tech., USA; June 1999; 23p; In English
Contract(s)/Grant(s): NASA Order S-92511-Z
Report No.(s): NASA/CR-1999-209490; NAS 1.26:209490; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Her X-1 exhibits a strong orbital modulation of its EUV flux with a large decrease around time of eclipse of the neutron star, and a significant dip which appears at different orbital phases at different 35-day phases. We consider observations of Her X-1 in the EUVE by the Extreme Ultraviolet Explorer (EUVE), which includes data from 1995 near the end of the Short High state,

and date from 1997 at the start of the Short High state. The observed EUV lightcurve has bright and faint phases. The bright phase can be explained as the low energy tail of the soft x-ray pulse. The faint phase emission has been modeled to understand its origin. We find: the x-ray heated surface of HZ Her is too cool to produce enough emission; the accretion disk does not explain the orbital modulation; however, reflection of x-rays off of HZ Her can produce the observed lightcurve with orbital eclipses. The dip can be explained by shadowing of the companion by the accretion disk. We discuss the constraints on the accretion disk geometry derived from the observed shadowing.
Author
Extreme Ultraviolet Radiation; Emission; Ultraviolet Astronomy

90
ASTROPHYSICS

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

20000032153 NASA Goddard Space Flight Center, Greenbelt, MD USA
3-Dimensional Structure of Interplanetary Shocks
Smith, C. W., Delaware Univ., USA; Tokar, R. L., Los Alamos National Lab., USA; Skoug, R. M., Los Alamos National Lab., USA; Szabo, A., NASA Goddard Space Flight Center, USA; 19991108; 1p; In English; Chapman Conference on Space Weather, Clearwater, FL, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Using multi-spacecraft observations primarily from ACE and WIND and from IMP 8 and Geotail when available, the 3-dimensional structure of interplanetary shocks on the hundred Earth radii scale will be discussed. The complete magnetic field, and solar wind ion and electron data sets were used to fit the shocks with a full non-linear least squares fitting ”Rankine-Hugoniot” technique yielding the local shock surface normals and speeds with associated uncertainties. Multi-spacecraft results reveal that on the distance scale of ACE’s L1 halo orbit the shocks deviate from a simple planar geometry. This result has important consequences for the prediction of the exact arrival times of interplanetary shocks at the Earth’s magnetosphere, and hence, on the reliability of space weather predictions. It also has implications on the coherence scale of solar wind structures and their evolution from the Sun to Earth.
Author
Mechanical Shock; Earth Planetary Structure

20000032748 NASA Goddard Space Flight Center, Greenbelt, MD USA
ASCA Observations of ”Type 2” LINERs Evidence for a Stellar Source of Ionization
Terashima, Yuichi, NASA Goddard Space Flight Center, USA; Ho, Luis C., Carnegie Observatories, USA; Ptak, Andrew F., Carnegie-Mellon Univ., USA; Mushotzky, Richard F., NASA Goddard Space Flight Center, USA; Serlemitsos, Peter J., NASA Goddard Space Flight Center, USA; Yaqoob, Tahir, Universities Space Research Association, USA; Kunieda, Hideyo, Nagoya Univ., Japan; [1999]; 30p; In English
Contract(s)/Grant(s): NAS5-26555; GO-06837.01-95A; GO-07357.02-96A; AR-07527.02-96A; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present ASCA observations of LINERs without broad H.alpha emission in their optical spectra. The sample of ”type 2” LINERs consists of NGC 404, 4111, 4192, 4457, and 4569. We have detected X-ray emission from all the objects except for NGC 404; among the detected objects are two so-called transition objects (NGC 4192 and NGC 4569), which have been postulated to be composite nuclei having both an H II region and a LINER component. The images of NGC 4111 and NGC 4569 in the soft (0.5-2 keV) and hard (2-7 keV) X-ray bands are extended on scales of several kpc. The X-ray spectra of NGC 4111, NGC 4457 and NGC 4569 are well fitted by a two-component model that consists of soft thermal emission with kT approximately 0.65 keV and a hard component represented by a power law (photon index approximately 2) or by thermal bremsstrahlung emission (kT approximately several keV). The extended hard X-rays probably come from discrete sources, while the soft emission most likely originates from hot gas produced by active star formation in the host galaxy. We have found no clear evidence for the presence of active galactic nuclei (AGNs) in the sample. Using black hole masses estimated from host galaxy bulge luminosities, we obtain an upper limit on the implied Eddington ratios less than 5 x 10(exp -5). If an AGN component is the primary ionization source of the optical emission lines, then it must be heavily obscured with a column density significantly larger than 10(exp 23)/sq cm, since the observed X-ray luminosity is insufficient to drive the luminosities of the optical emission lines. Alternatively, the optical emission could be ionized by a population of exceptionally hot stars. This interpretation is consistent with the small [O I] lambda6300/H.alpha ratios observed in these sources, the ultraviolet spectral characteristics in the cases where such information

exists, and the X-ray results reported here. We also analyze the X-ray properties of NGC 4117, a low-luminosity Seyfert 2 galaxy serendipitously observed in the field of NGC 4111.
Author
Ionization; Nuclear Scattering; X Ray Spectra; Light Emission; Emission Spectra; H II Regions; Seyfert Galaxies; Spiral Galaxies; Active Galactic Nuclei

20000032750 NASA Goddard Space Flight Center, Greenbelt, MD USA
Metastable Eutectic Equilibrium in Natural Environments: Recent Development and Research Opportunities
Rietmeijer, Frans J. M., New Mexico Univ., USA; Nuth, Joseph A., III, NASA Goddard Space Flight Center, USA; Jablonska, Mariola, Silesia Univ., Poland; Karner, James M., New Mexico Univ., USA; Jan. 15, 2000; 45p; In English
Contract(s)/Grant(s): NAG5-4441; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Chemical ordering at metastable eutectics was recognized in non-equilibrium gas-to- solid condensation experiments to constrain 'silicate' dust formation in O-rich circumstellar environments. The predictable metastable eutectic behavior successfully predicted the observed ferromagnesiosilica compositions of circumstellar dust presolar and solar nebula grains in the matrix of the collected aggregate IDPs (Interplanetary Dust Particles). Many of the experimentally determined metastable eutectic solids match the fundamental building blocks of common rock-forming layer silicates: this could have implications for the origin of Life. The physical conditions conducive to metastable eutectic behavior, i.e. high temperature and (ultra) fast quenching, lead to unique amorphous, typically nano- to micrometer-sized, materials. The new paradigm of metastable eutectic behavior opens the door to new and exciting research opportunities in uncovering the many implications of these unique amorphous, and typically nano-to micrometer-sized, metastable eutectic materials.
Author
Eutectics; Metastable State; Chemical Equilibrium; Gas-Solid Interactions; Research and Development

20000032751 NASA Goddard Space Flight Center, Greenbelt, MD USA
Detection of CO and Ethane in Comet 21P/Giacobini-Zinner: Evidence for Variable Chemistry in the Outer Solar Nebula
Mumma, M. J., NASA Goddard Space Flight Center, USA; DiSanti, M. A., NASA Goddard Space Flight Center, USA; DelloRusso, N., NASA Goddard Space Flight Center, USA; Magee–Sauer, K., Rowan Univ., USA; Rettig, T. W., Notre Dame Univ., USA; [1999]; 10p; In English
Contract(s)/Grant(s): NAG5-7905; NAG5-7753; RTOP 344-32-30-07; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Ethane and carbon monoxide were detected in a short-period comet of probable Kuiper belt origin. Ethane is substantially less abundant compared with Hyakutake and Hale-Bopp, two comets from the giant-planets region of the solar nebula, suggesting a heliocentric gradient in ethane in pre-cometary ices. It is argued that processing by X-rays from the young sun may be responsible.
Author
Carbon Monoxide; Comets; Ethane; Planetary Nebulae; Detection

20000032810 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Relativistic Iron Line Profile in the Seyfert 1 Galaxy IC4329a
Done, C., Durham Univ., UK; Madejski, G. M., NASA Goddard Space Flight Center, USA; Zycki, P. T., Nicolaus Copernicus Astronomical Center, Poland; [2000]; 26p; In English
Contract(s)/Grant(s): NAG5-54106; KBN-2P03D01816
Report No.(s): astro-ph/0002023; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present simultaneous ASCA and RXTE data on the bright Seyfert 1 galaxy IC4329a. The iron line is significantly broadened, but not to the extent expected from an accretion disk which extends down to the last stable orbit around a black hole. We marginally detect a narrow line component, presumably from the molecular torus, but, even including this gives a line profile from the accretion disk which is significantly narrower that that seen in MCG-6-30-15, and is much more like that seen from the low/hard state galactic black hole candidates. This is consistent with the inner disk being truncated before the last stable orbit, forming a hot flow at small radii as in the ADAF models. However. we cannot rule out the presence of an inner disk which does not contribute to the reflected spectrum. either because of extreme ionisation suppressing the characteristic atomic features of the reflected spectrum or because the X-ray source is intrinsically anisotropic, so it does not illuminate the inner disk. The source was monitored by RXTE every 2 days for 2 months, and these snapshot spectra show that there is intrinsic spectral variability. The data are good enough to disentangle the power law from the reflected continuum and we see that the power law softens as the source brightens. The lack of a corresponding increase in the observed reflected spectrum implies that either the changes in disk inner

radial extent/ionization structure are small, or that the variability is actually driven by changes in the seed photons which are decoupled from the hard X-ray mechanism.
Author
Accretion Disks; Black Holes (Astronomy); Seyfert Galaxies; X Ray Sources; X Ray Astronomy

20000032970 Smithsonian Astrophysical Observatory, Cambridge, MA USA
An ASCA Study of the Composite Supernova Remnant G18.95-1.1 ***Final Report, 15 Mar. 1999 - 14 Mar. 2000***
Harrus, Ilana, Smithsonian Astrophysical Observatory, USA; March 2000; 12p; In English
Contract(s)/Grant(s): NAG5-8394; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the final report on the work done on Supernova Remnant (SNR) G18-95-1.1. The data were taken on April, 2. 1998 and delivered a couple of months later to the Principal Investigator (PI: Dr. Ilana Harrus). We received a CD-ROM containing the results of the standard processing pipeline and all the files needed for the analysis. We have analyzed the data and presented a poster on this object at the 194th American Astronomical Society Meeting in Chicago (June 1999). A copy of the poster is appended to this report. The poster presentation triggered several discussions and we are summarizing the analysis results and those discussions in a paper to be submitted soon to the Astrophysical Journal. We have appended the draft of the paper to this report. It must be noted that the paper is still in its early stages. In particular more work is needed in the physical implications of the results of the spectral analysis and in the comparison with theoretical models to understand the curious morphology of the remnant. The project should be completed within the next two months. Attachment: ”ASCA study of the centrally-peaked thermal supernova remnant: G18.95-1.1”.
Author
Data Processing; Mathematical Models; Spectrum Analysis; Supernova Remnants

20000033157 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Formation Age of Comets: Predicted Physical and Chemical Trends
Nuth, Joesph A., III, NASA Goddard Space Flight Center, USA; Hill, H. G. M., NASA Goddard Space Flight Center, USA; [2000]; 2p; In English; 31st; 31st Lunar and Planetary Science Conference, 12-17 Mar. 2000, Houston, TX, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The chemical composition of a comet has always been considered to be a function of where it formed in the nebula. We suggest that the most important factor in determining a comet’s chemistry might actually be when it formed. We present specific predictions of correlations between the dust and volatile components to test our hypothesis.
Author
Comets; Nebulae

20000033266 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Tethered Formation Flying Concept for the SPECS Mission
Quinn, David A., NASA Goddard Space Flight Center, USA; Folta, David C., NASA Goddard Space Flight Center, USA; [2000]; 15p; In English; 23rd; 23rd Guidance and Control Conference, 2-6 Feb. 2000, Breckenridge, CO, USA; Sponsored by American Astronautical Society, USA
Report No.(s): AAS-00-015; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Sub-millimeter Probe of the Evolution of Cosmic Structure (SPECS) is a bold new mission concept designed to address fundamental questions about the Universe, including how the first stars formed from primordial material, and the first galaxies from pre-galactic structures, how the galaxies evolve over time, and what the cosmic history of energy release, heavy element synthesis, and dust formation is. Half of the luminosity and 98% of the post Big-Bang photons exit in the sub-millimeter range. The spectrum of our own Milky Way Galaxy shows this, and many galaxies have even more pronounced long-wavelength emissions. There can be no doubt that revolutionary science will be enabled when we have tools to study the sub-millimeter sky with Hubble- Space-Telescope-class resolution and sensitivity. Ideally, a very large telescope with an effective aperture approaching one kilometer in diameter would be needed to obtain such high quality angular resolution at these long wavelengths. However, a single aperture one kilometer in diameter would not only be very difficult to build and maintain at the cryogenic temperatures required for good seeing, but could actually turn out to be serious overkill. Because cosmic sub-millimeter photons are plentiful and the new detectors will be sensitive, the observations needed to address the questions posed above can be made with an interferometer using well established aperture synthesis techniques. Possibly as few as three 3-4 meter diameter mirrors flying in precision formation could be used to collect the light. to mitigate the need for a great deal of propellant, tethers may be needed as well. A spin- stabilized, tethered formation is a possible configuration requiring a more advanced form of formation flying controller, where dynamics are coupled due to the existence of the tethers between nodes in the formation network. The

paper presents one such concept, a proposed configuration for a mission concept which combines the best features of structure, tethers and formation flying to meet the ambitious requirements necessary to make a future SPECS mission a success.
Author
Tethering; Mathematical Models; Spacecraft Configurations; Galactic Structure; Submillimeter Waves; Cosmology

20000033521 Birmingham Univ., School of Chemistry, UK
Rate Coefficients for Reactions of C((3)P) at Temperatures of Interstellar Clouds
Chastaing, D., Birmingham Univ., UK; James, P. L., Birmingham Univ., UK; Sims, I. R., Birmingham Univ., UK; Smith, I. W. M., Birmingham Univ., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 126-128; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Ground state atomic carbon, C (2p(sup 2)(3)P(sub j)), has been detected in a wide range of astronomical environments, and is particularly y abundant in dense interstellar clouds (ISCs). Dense by interstellar standards, where the average gas density is approx. 1/cc, these clouds correspond to the laboratory equivalent of an ultra high vacuum, with gas densities of the order of 10(exp 4)/cc. They are also extremely cold, with temperatures in the range 10 - 50 K. However, owing to their great size, they may contain typically the equivalent of 10 - 100 times the mass of our Sun, and it is within these clouds that the richest variety of interstellar molecules has been observed, including many carbon-containing radicals. The largest confirmed interstellar molecule is HC(11)N, but it is hit, My probable that much larger Species Such as polyaromatic hydrocarbons (PAHs) and fullerenes exist as well.
Derived from text
Molecular Clouds; Interstellar Matter; Carbon; Aromatic Compounds; Gas Density

91
LUNAR AND PLANETARY SCIENCE AND EXPLORATION

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

20000032458 Mars Program Independent Assessment Team, USA
Mars Program Independent Assessment Team Report
Young, Thomas, Lockheed Martin Corp., USA; Arnold, James, NASA Ames Research Center, USA; Brackey, Thomas, Hughes Space and Communications Group, USA; Carr, Michael, Geological Survey, USA; Dwoyer, Douglas, NASA Langley Research Center, USA; Fogleman, Ronald, Department of the Air Force, USA; Jacobson, Ralph, Department of the Air Force, USA; Kottler, Herbert, Massachusetts Inst. of Tech., USA; Lyman, Peter, Jet Propulsion Lab., California Inst. of Tech., USA; Maguire, Joanne, TRW, Inc., USA; Mar. 14, 2000; 65p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Mars Climate Orbiter failed to achieve Mars orbit on September 23, 1999. On December 3, 1999, Mars Polar Lander and two Deep Space 2 microprobes failed. As a result, the NASA Administrator established the Mars Program Independent Assessment Team (MPIAT) with the following charter: 1) Review and analyze successes and failures of recent Mars and Deep Space Missions which include: a) Mars Global Surveyor, b) Mars Climate Orbiter, c) Pathfinder, d) Mars Polar Lander, e) Deep Space 1, and f) Deep Space 2; 2) Examine the relationship between and among, NASA Jet Propulsion Laboratory (JPL), California Institute of Technology (Caltech), NASA Headquarters, and industry partners; 3) Assess effectiveness of involvement of scientists; 4) Identify lessons learned from successes and failures; 5) Review revised Mars Surveyor Program to assure lessons learned are utilized; 6) Oversee Mars Polar Lander and Deep Space 2 failure reviews; and 7) Complete by March 15, 2000. In-depth reviews were conducted at NASA Headquarters, JPL, and Lockheed Martin Astronautics (LMA). Structured reviews, informal sessions with numerous Mars Program participants, and extensive debate and discussion within the MPIAT establish the basis for this report. The review process began on January 7, 2000, and concluded with a briefing to the NASA Administrator on March 14, 2000. This report represents the integrated views of the members of the MPIAT who are identified in the appendix. In total, three related reports have been produced: a summary report, this report entitled ”Mars Program Independent Assessment Team Report,” and the ”Report on the Loss of the Mars Polar Lander and Deep Space 2 Missions”.
Derived from text
Mars Exploration; Feasibility; Mars Missions; Assessments

20000033628 NASA Goddard Space Flight Center, Greenbelt, MD USA

Mars Global Surveyor Thermal Emission Spectrometer (TES) Observations: Atmospheric Temperatures During Aerobraking and Science Phasing

Conrath, Barney J., Cornell Univ., USA; Pearl, John C., NASA Goddard Space Flight Center, USA; Smith, Michael D., NASA Goddard Space Flight Center, USA; Maguire, William C., NASA Goddard Space Flight Center, USA; Christensen, Philip R., Arizona State Univ., USA; Dason, Shymala, Solutio Internet Guides, USA; Kaelberer, Monte S., Raytheon ITSS, USA; [1999]; 40p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Between September 1997, when the Mars Global Surveyor spacecraft arrived at Mars, and September 1998 when the final aerobraking phase of the mission began, the Thermal Emission Spectrometer (TES) has acquired an extensive data set spanning approximately half of a Martian year. Nadir-viewing spectral measurements from this data set within the 15-micrometers CO2 absorption band are inverted to obtain atmospheric temperature profiles from the surface up to about the 0.1 mbar level. The computational procedure used to retrieve the temperatures is presented. Mean meridional cross sections of thermal structure are calculated for periods of time near northern hemisphere fall equinox, winter solstice, and spring equinox, as well as for a time interval immediately following the onset of the Noachis Terra dust storm. Gradient thermal wind cross sections are calculated from the thermal structure. Regions of possible wave activity are identified using cross sections of rms temperature deviations from the mean. Results from both near-equinox periods show some hemispheric asymmetry with peak eastward thermal winds in the north about twice the magnitude of those in the south. The results near solstice show an intense circumpolar vortex at high northern latitudes and waves associated with the vortex jet core. Warming of the atmosphere aloft at mid-northern latitudes suggests the presence of a strong cross-equatorial Hadley circulation. Although the Noachis dust storm did not become global in scale, strong perturbations to the atmospheric structure are found, including an enhanced temperature maximum aloft at high northern latitudes resulting from intensification of the Hadley circulation. TES results for the various seasonal conditions are compared with published results from Mars general circulation models, and generally good qualitative agreement is found.

Author

Mars Global Surveyor; Mars Atmosphere; Mars Surface; Thermal Emission; Spectrometers; Spectrum Analysis; Absorption Spectra; Dust Storms

92
SOLAR PHYSICS

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

20000032756 NASA Goddard Space Flight Center, Greenbelt, MD USA

Nonthermal Linewidths from Serts: Implications for Coronal Heating Models

Davila, Joseph M., NASA Goddard Space Flight Center, USA; [1999]; 4p; In English; 8th; Yohkoh 8th Anniversary Symposium, Japan; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Observations from Solar Extreme-ultraviolet Research Telescope and Spectrograph (SERTS) are used to determine the nonthermal velocity in the corona for active and quiet Sun regions in 1991 and 1993. A nonthermal velocity of 20-30 km/s is obtained in all solar structures observed at both observing times. These observations can be used to constrain coronal heating models. The idea that magnetic reconnection could provide energy to heat the non-transient corona is not supported by the data.

Author

Solar Corona; Heating; Solar Activity; Magnetic Field Reconnection; Solar Magnetic Field

20000032757 NASA Goddard Space Flight Center, Greenbelt, MD USA

Shock Wave and EUV Transient During a Flare

Gopalswamy, N., NASA Goddard Space Flight Center, USA; Kaiser, M. L., NASA Goddard Space Flight Center, USA; Sato, J., NASA Goddard Space Flight Center, USA; Pick, Monique, Observatoire de Paris-Meudon, France; High Energy Solar Physics: Anticipating HESSI; Jan. 01, 2000; 4p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A metric type II burst and a 'brow' type enhancement in EUV were observed during the hard X-ray flare of 1997 April 15 from a newly emerging region, AR 8032. The position of the type II burst obtained from the Nancay radioheliograph coincided with the EUV transient. The type II burst and the EUV transient were in the equatorial streamer region to the north of the flaring region. This observation suggests that the EUV transient may be the manifestation of the MHD shock responsible for the type II burst.

Author

Extreme Ultraviolet Radiation; Shock Waves; Type 2 Bursts; Solar Flares; Coronal Mass Ejection

20000032788 Raytheon STX Corp., Lanham, MD USA

Coronal Magnetography of Solar Active Regions Using Coordinated SOHO/CDS and VLA Observations ***Final Report, 6 Aug. 1998 - 5 Aug. 1999***

Brosius, Jeffrey W., Raytheon STX Corp., USA; [1999]; 11p; In English

Contract(s)/Grant(s): NASA Order W-91618; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this project is to apply the coronal magnetographic technique to SOHO (Solar Heliospheric Observatory) /CDS (Coronal Diagnostic Spectrometer) EUV (Extreme Ultraviolet Radiation) and coordinated VLA microwave observations of solar active regions to derive the strength and structure of the coronal magnetic field. A CDS observing plan was developed for obtaining spectra needed to derive active region differential emission measures (DEMs) required for coronal magnetography. VLA observations were proposed and obtained. SOHO JOP 100 was developed, tested, approved, and implemented to obtain coordinated CDS (Coronal Diagnostic Spectrometer)/EIT (Ultraviolet Imaging Telescope)/ VLA (Very Large Array)/ TRACE (Transition Region and Coronal Explorer)/ SXT (Solar X Ray Telescope) observations of active regions on April 12, May 9, May 13, and May 23. Analysis of all four data sets began, with heaviest concentration on COS data. It is found that 200-pixel (14 A in NIS1) wavelength windows are appropriate for extracting broadened Gaussian line profile fit parameters for lines including Fe XIV at 334.2, Fe XVI at 335.4, Fe XVI at 360.8, and Mg IX at 368.1 over the 4 arcmin by 4 arcmin CDS field of view. Extensive efforts were focused on learning and applying were focused on learning and applying CDS software, and including it in new IDL procedures to carry out calculations relating to coronal magnetography. An important step is to extract Gaussian profile fits to all the lines needed to derive the DEM in each spatial pixel of any given active region. The standard CDS absolute intensity calibration software was applied to derived intensity images, revealing that ratios between density-insensitive lines like Fe XVI 360.8/335.4 yield good agreement with theory. However, the resulting absolute intensities of those lines are very high, indicating that revisions to the CDS absolute intensity calibrations remain to be included in the CDS software, an essential step to deriving reliable coronal magnetograms. With lessons learned and high quality data obtained during the past year, coronal magnetography will be successfully pursued under my new SOHO GI program.

Author

SOHO Mission; Very Large Array (VLA); Magnetic Signatures; Extreme Ultraviolet Radiation; Solar Corona; Solar Activity

20000032969 NASA Marshall Space Flight Center, Huntsville, AL USA

The May 1997 SOHO-Ulysses Quadrature

Suess, Steven T., NASA Marshall Space Flight Center, USA; Poletto, G., Observatorie Astofisico di Arcetri, Italy; Romoli, M., Florence Univ., Italy; Neugebauer, M., Jet Propulsion Lab., California Inst. of Tech., USA; Goldstein, B. E., Jet Propulsion Lab., California Inst. of Tech., USA; Simnett, G., Birmingham Univ., UK; [2000]; 31p; In English; Sponsored in part by SWOOPS and UVCS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present results from the May 1997 SOHO-Ulysses quadrature, near sunspot minimum. Ulysses was at 5.1 AU, 100 north of the solar equator, and off the east limb. It was, by chance, also at the very northern edge of the streamer belt. Nevertheless, SWOOPS detected only slow, relatively smooth wind and there was no direct evidence of fast wind from the northern polar coronal hole or of mixing with fast wind. LASCO images show that the streamer belt at 10 N was narrow and sharp at the beginning and end of the two week observation interval, but broadened in the middle. A corresponding change in density, but not flow speed, occurred at Ulysses. Coronal densities derived from UVCS show that physical parameters in the lower corona are closely related to those in the solar wind, both over quiet intervals and in transient events on the limb. One small transient observed by both LASCO and UVCS is analyzed in detail.

Author

Ulysses Mission; SOHO Mission; Quadratures; Solar Spectrometers

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.

20000032181 Science Applications International Corp., Prospect, TN USA

Evaluation of Trapped Radiation Model Uncertainties for Spacecraft Design

Armstrong, T. W., Science Applications International Corp., USA; Colborn, B. L., Science Applications International Corp., USA; March 2000; 54p; In English

Contract(s)/Grant(s): NAS8-40294

Report No.(s): NASA/CR-2000-210072; NAS 1.26:210072; M-970; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The standard AP8 and AE8 models for predicting trapped proton and electron environments have been compared with several sets of flight data to evaluate model uncertainties. Model comparisons are made with flux, dose, and activation measurements made on various U.S. low-Earth orbit satellites (APEX, CRRES, DMSP, LDEF, NOAA) and Space Shuttle flights, on Russian satellites (Photon-8, Cosmos-1887, Cosmos-2044), and on the Russian Mir Space Station. This report gives a summary of the model-data comparisons-detailed results are given in a companion report. Results from the model comparisons with flic,ht data show, for example, the AP8 model underpredicts the trapped proton flux at low altitudes by a factor of about two (independent of proton energy and solar cycle conditions), and that the AE8 model overpredicts the flux in the outer electron belt by an order of magnitude or more.

Author

Radiation Trapping; Protons; Long Duration Exposure Facility; Mathematical Models; Solar Cycles

20000032183 NASA Goddard Space Flight Center, Greenbelt, MD USA

Electron Fluxes in the Outer Radiation Zone

Pesnell, W. D., Nomad Research, Inc., USA; Goldberg, R. A., NASA Goddard Space Flight Center, USA; Chenette, D. L., Lockheed Martin Corp., USA; Gaines, E. E., Lockheed Martin Corp., USA; Schulz, M., Lockheed Martin Corp., USA; [2000]; 1p; In English; 2000 Chapman Conference on Space Weather, Clearwater, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Highly relativistic electron events (HREs) are periods of intense, long-lived, energetic electron fluxes in the outer radiation zone. We are using measurements from the High Energy Particle Spectrometer (HEPS) on the Upper Atmosphere Research Satellite (UARS) to develop a database of the pitch-angle and energy-resolved electron fluxes with energies between 30 keV and 4.5 MeV. The data acquired by HEPS have overlapped the declining phase of solar cycle 22 making these data very important, since HREs are thought to peak in frequency and intensity during this phase of the solar cycle. We find a consistent scenario of electrons being injected into the radiation belts by a magnetic storm (deduced from Dst) and being slowly accelerated to ever higher energies over days to weeks. The energy dependence of the flux is an essential part of the analysis. Above 300 keV the most energetic electrons are the last to appear and the slowest to fade following an injection event.

Author

Outer Radiation Belt; Flux (Rate); Extraterrestrial Radiation

20000032216 University of Western Kentucky, Center for Automated Space Science, Bowling Green, KY USA

Observations of a Major Outburst of BL Lacertae in the Active Galactic Nuclei Monitoring Program in the Center for Automated Space Science

Carini, M. T., University of Western Kentucky, USA; Hackney, K. R., University of Western Kentucky, USA; Clements, S. D., University of Western Kentucky, USA; Culler, R. C., University of Western Kentucky, USA; Hackney, R. L., University of Western Kentucky, USA; Noble, J. C., University of Western Kentucky, USA; Gelderman, R. G., University of Western Kentucky, USA; Scott, R. L., University of Western Kentucky, USA; McGruder, C. H., III, University of Western Kentucky, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 57-60; In English; See also 20000032189

Contract(s)/Grant(s): NCC5-228; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

BL Lacertae (BL Lac) is the prototype for a class of Active Galactic Nuclei (AGN) known as BL Lac objects. These objects are characterized by a featureless optical continuum that is both highly polarized and extremely variable. Historically, this object is known to have an optical variability range of 5 magnitudes (Webb, et al., 1987, Carini, et al. 1992) and exhibits episodic periods in which the source is observed to be bright (V = 12.0) and other periods when the source is observed to be quite faint (V = 16.5). In May, 1997, we found, in the course of our routine monitoring of these objects, that BL Lac was in an elevated state, with a V magnitude peaking near V = 12.5. The purpose of this paper is to report on our observations of the behavior of the optical continuum flux of BL Lac during this major outburst.

Author

Active Galactic Nuclei; BL Lacertae Objects; Astronomical Photometry; Optical Properties; Astronomical Observatories

20000032257 University of Western Kentucky, Center for Automated Space Science, Bowling Green, KY USA

Intranight Variability During the 1997 Outburst of BL Lac

Clements, Sandra D., University of Western Kentucky, USA; Carini, Michael T., University of Western Kentucky, USA; Noble, John C., University of Western Kentucky, USA; NASA University Research Centers Technical Advances in Aeronautics, Space

Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 685-689; In English; See also 20000032189; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

The blazar BL Lac underwent a major outburst this summer. to search for intranight variability during the outburst, observations of BL Lac were made with the 30 inch telescope at the University of Florida's Rosemary Hill Observatory. During ten nights in July, nearly 300 CCD observations were made. BL Lac was seen to vary by more than 1.5 magnitudes over those ten nights. Substantial intranight variability was also observed. For example, on July 29, BL Lac increased in brightness by more than 0.5 magnitude in less than 2.5 hours. The observations of BL Lac taken in July are reported here and discussed in relation to the models intended to explain intranight variability.

Author

Variability; BL Lacertae Objects; Active Galactic Nuclei

20000032457 Science Applications International Corp., Prospect, TN USA

Trapped Radiation Model Uncertainties: Model-Data and Model-Model Comparisons ***Final Report***

Armstrong, T. W., Science Applications International Corp., USA; Colborn, B. L., Science Applications International Corp., USA; March 2000; 88p; In English

Contract(s)/Grant(s): NAS8-40294

Report No.(s): NASA/CR-2000-210071; NAS 1.26:210071; M-969; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The standard AP8 and AE8 models for predicting trapped proton and electron environments have been compared with several sets of flight data to evaluate model uncertainties. Model comparisons are made with flux and dose measurements made on various U.S. low-Earth orbit satellites (APEX, CRRES, DMSP, LDEF, NOAA) and Space Shuttle flights, on Russian satellites (Photon-8, Cosmos-1887, Cosmos-2044), and on the Russian Mir Space Station. This report gives the details of the model-data comparisons-summary results in terms of empirical model uncertainty factors that can be applied for spacecraft design applications are given in a combination report. The results of model-model comparisons are also presented from standard AP8 and AE8 model predictions compared with the European Space Agency versions of AP8 and AE8 and with Russian-trapped radiation models.

Author

Radiation Trapping; Mathematical Models; Protons; Photons; Space Transportation System Flights

20000032536 NASA Langley Research Center, Hampton, VA USA

Range and Energy Straggling in Ion Beam Transport

Wilson, John W., NASA Langley Research Center, USA; Tai, Hsiang, NASA Langley Research Center, USA; March 2000; 14p; In English

Contract(s)/Grant(s): RTOP 111-10-95-01

Report No.(s): NASA/TP-2000-209864; NAS 1.60:209864; L-17866; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A first-order approximation to the range and energy straggling of ion beams is given as a normal distribution for which the standard deviation is estimated from the fluctuations in energy loss events. The standard deviation is calculated by assuming scattering from free electrons with a long range cutoff parameter that depends on the mean excitation energy of the medium. The present formalism is derived by extrapolating Payne's formalism to low energy by systematic energy scaling and to greater depths of penetration by a second-order perturbation. Limited comparisons are made with experimental data.

Author

Ion Beams; Mathematical Models; Approximation; Extraterrestrial Radiation; Energy Dissipation; Normal Density Functions

20000032807 NASA Goddard Space Flight Center, Greenbelt, MD USA

Deconstructing the Spectrum of the Soft X-ray Background

Kuntz, K. D., Maryland Univ., USA; Snowden, S. L., NASA Goddard Space Flight Center, USA; [2000]; 32p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The soft X-ray background in the 0.1-1.0 keV band is known to be produced by at least three sources; the Local Hot Bubble (LHB), the extragalactic power law (EPL), and a seemingly galactic component that lies outside the bulk of the absorption that is due to the ISM of the galactic disk. This last component, which we call the Trans-Absorption Emission (TAE), has been modeled by a number of groups who have derived disparate measures of its temperature. The differences have arisen from differing assumptions about the structure of the emitting gas and unrecognized methodological difficulties. In particular, spectral fitting methods do not uniquely separate the TAE from the foreground emission that is due the LHB. This "degeneracy" can be resolved

using the angular variation of the absorption of the TAE. We show that the TAE cannot be characterized by a single thermal component; no single-component model can be consistent with both the spectral energy distribution of the TAE emission and the angular variation due to absorption by the galactic disk. We use the angular anticorrelation of the ROSAT All-Sky Survey with the galactic absorption to separate local from distant emission components, and to fit the spectral energy distribution of the resulting distant emission. We find that the emission is best described by a two-thermal-component model with logT(sub S) = 6.06(sup +0.14, sub -0.12) and log T(sub H) = 6.42(sup +0.14, sub -0.12). This two-thermal-component TAE fits the ROSAT spectral energy distribution significantly better than single-component models, and is consistent with both angular variation and spectral constraints.
Author
Fitting; Spectral Methods; Spectrum Analysis; Spectral Emission; X Rays; Background Radiation

20000032811 NASA Goddard Space Flight Center, Greenbelt, MD USA
Hard X-Ray Emission and the Ionizing Source in LINERs
Terashima, Yuichi, NASA Goddard Space Flight Center, USA; Ho, Luis C., Carnegie Observatories, USA; Ptak, Andrew F., Carnegie-Mellon Univ., USA; [2000]; 9p; In English
Contract(s)/Grant(s): NAS5-26555; NAG5-3556; NAG5-8083; GO-06837.01-95A; AR-07527.02-96A; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We report X-ray fluxes in the 2-10 keV band from LINERs (low-ionization nuclear emission-line regions) and low-luminosity Seyfert galaxies obtained with the ASCA satellite. Observed X-ray luminosities are in the range between 4 x 10(exp 39) and 5 x 10(exp 41) ergs/s, which are significantly smaller than that of the ”classical” low-luminosity Seyfert 1 galaxy NGC 4051. We found that X-ray luminosities in 2-10 keV of LINERs with broad H.alpha emission in their optical spectra (LINER 1s) are proportional to their Ha luminosities. This correlation strongly supports the hypothesis that the dominant ionizing source in LINER 1s is photoionization by hard photons from low-luminosity AGNs. On the other hand, the X-ray luminosities of most LINERs without broad H.alpha emission (LINER 2s) in our sample are lower than LINER 1s at a given H.alpha luminosity. The observed X-ray luminosities in these objects are insufficient to power their H.alpha luminosities, suggesting that their primary ionizing source is other than an AGN, or that an AGN, if present, is obscured even at energies above 2 keV.
Author
X Rays; Emission; Ionization; Active Galactic Nuclei; Seyfert Galaxies

20000032957 NASA Goddard Space Flight Center, Greenbelt, MD USA
Cosmic Ray Origin, Acceleration and Propagation
Baring, Matthew G., NASA Goddard Space Flight Center, USA; [2000]; 18p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper summarizes highlights of the OG3.1, 3.2 and 3.3 sessions of the 26th International Cosmic Ray Conference in Salt Lake City, which were devoted to issues of origin/composition, acceleration and propagation.
Author
Conferences; Cosmic Rays; Acceleration (Physics); Propagation (Extension)

20000033612 Alabama Univ., Dept. of Physics, Huntsville, AL USA
The Batse Gamma-Ray Burst Spectral Catalog, 1, High Time Resolution Spectroscopy of Bright Burst Using High Energy Resolution Data
Preece, R. D., Alabama Univ., USA; Briggs, M. S., Alabama Univ., USA; Mallozzi, R. S., Alabama Univ., USA; Pendleton, G. N., Alabama Univ., USA; Paciesas, W. S., Alabama Univ., USA; Band, D. L., California Univ., San Diego, USA; Astrophysical Journal Supplement Series; January 2000; Volume 126, pp. 19-36; In English; Copyright; Avail: Issuing Activity

This is the first in a series of gamma-ray burst spectroscopy catalogs from the Burst and Transient Source Experiment (BATSE) on the Compton Gamma Ray Observatory, each covering a different aspect of burst phenomenology. In this paper, we present time sequences of spectral fit parameters for 156 bursts selected for either their high peak flux or fluence. All bursts have at least eight spectra in excess of 45 sigma above background and span burst durations from 1.66 to 278 S. Individual spectral accumulations are typically 128 ms long at the peak of the brightest events but can be as short as 16 ms, depending on the type of data selected. We have used mostly high energy resolution data from the Large Area Detectors, covering an energy range of typically 28-1800 keV. The spectral model chosen is from a small empirically determined set of functions, such as the well-known ”GRB” function, that best fits the time- averaged burst spectra. Thus, there are generally three spectral shape parameters available for each of the 5500 total spectra: a low-energy power-law index, a characteristic break energy, and possibly a high-energy power-law index. We present the distributions of the observed sets of these parameters and comment on their implications. The

complete set of data that accompanies this paper is necessarily large and thus is archived in the electronic edition of the Astrophysical Journal.
Author
Gamma Ray Bursts; Gamma Ray Observatory; Mathematical Models; Spectrum Analysis; Astrophysics; Catalogs (Publications)

99
GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20000033204 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine, France
Agard Highlights 93/1, March 1993
March 1993; 59p; In English
Report No.(s): AGARD-Highlights-93/1; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

According to its Charter, the mission of AGARD is to bring together the leading personalities of the NATO nations in the fields of science and technology relating to aerospace for the following purposes: 1) Recommending effective ways for the member nations to use their research and development capabilities for the common benefit of the NATO community; 2) Providing scientific and technical advice and assistance to the Military Committee in the field of aerospace research and development (with particular regard to its military application); 3) Continuously stimulating advances in the aerospace sciences relevant to strengthening the common defence posture; 4) Improving the co-operation among member nations in aerospace research and development; 5) Exchange of scientific and technical information; 6) Providing assistance to member nations for the purpose of increasing their scientific and technical potential; and 7) Rendering scientific and technical assistance, as requested, to other NATO bodies and to member nations in connection with research and development problems in the aerospace field. The highest authority within AGARD is the National Delegates Board consisting of officially appointed senior representatives from each member nation. The mission of AGARD is carried out through the Panels which are composed of experts appointed by the National Delegates, the Consultant and Exchange Programme and the Aerospace Applications Studies Program. The results of AGARD work are reported to the member nations and the NATO Authorities through the AGARD series of publications of which this is one.
Derived from text
Research and Development; Aerospace Engineering; North Atlantic Treaty Organization (NATO); Netherlands

20000033257 Research and Technology Organization, Neuilly-sur-Seine, France
The AGARD History: 1952-1997
vanderBliek, Jan, Editor, Research and Technology Organization, France; Spring 1999; 215p; In English; Original contains color illustrations; ISBN 92-836-1079-2; Copyright Waived; Avail: CASI; A10, Hardcopy; A03, Microfiche

This book may be considered as a tribute to the works of Theodore Von Karman and Frank Wattendorf, his close associate and first Director of AGARD. Dr. Theodore von Karman (1881-1963), a well-known aeronautical scientist with friends in many countries, was intensely interested in international scientific cooperation. Soon after NATO was established in 1949, he conceived the idea of an Advisory Group for Aeronautical Research and Development (AGARD) under the umbrella of NATO, and he succeeded in starting it as a group of NATO early in 1952. It became the first scientific agency of NATO. As the first chairman of this NATO Agency, he developed a unique structure of technical-scientific Panels composed of scientists and engineers from the NATO countries who, on a voluntary basis, exchanged information, organized meetings, produced thousands of timely high quality publications, carried out joint projects, organized study groups for the NATO Military Committee and assisted each other in developing their research and development capabilities. Until his death in 1963, Von Karman, basically an aeronautical scientist but with much broader interests, tried to broaden the activities of AGARD. This did result, inter alia, in the formation of the Science Committee of NATO and the Defense Research Group, covering the broader areas of science and technology. AGARD itself grew to an organization with over 500 Panel members, and some 1300 people contributed annually to lectures, in working groups, in study teams, as consultants, etc. Indeed, it became a truly formidable technical-scientific supporting force backing the NATO community. In 1997, forty-five years after its formation, AGARD was amalgamated with the Defence Research Group of NATO (DRG), to form the Research and Technology Organization (RTO). This book records the deliberations of the AGARD National

Delegates Board, and aspects of the work of the Aerospace Applications Studies Committee (mostly concerned with military strategic aeronautical matters) and of the Technical Panels, which constituted the main activity of AGARD.
Derived from text
North Atlantic Treaty Organization (NATO); Research and Development; Aeronautical Engineering; Histories

20000033402 NASA, Washington, DC USA
NASA Historical Data Book, Volume 6, NASA Space Applications, Aeronautics and Space Research and Technology, Tracking and Data Acquisition/Support Operations, Commercial Programs and Resources, 1979-1988
Rumerman, Judy A., NASA, USA; 2000; 642p; In English
Report No.(s): NASA/SP-2000-4012/VOL6; NAS 1.21:4012/VOL6; ISBN 0-16-050266-7; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

This sixth volume of the NASA Historical Data Book is a continuation of those earlier efforts. This fundamental reference tool presents information, much of it statistical, documenting the development of several critical areas of NASA responsibility for the period between 1979 and 1988. This volume includes detailed information on the space applications effort, the development and operation of aeronautics and space research and technology programs, tracking and data acquisition/space operations, commercial programs, facilities and installations, personnel, and finances and procurement during this era. Special thanks are owed to the student research assistants who gathered and input much of the tabular material-a particularly tedious undertaking. There are numerous people at NASA associated with historical study, technical information, and the mechanics of publishing who helped in myriad ways in the preparation of this historical data book.
Derived from text
Data Acquisition; Procurement; Technology Utilization; Research; Tables (Data)

Subject Term Index

A

ABLATION, 43
ABSORPTION SPECTRA, 55, 127, 283, 284, 306, 331
ABSORPTION SPECTROSCOPY, 114, 127
ACCELERATION (PHYSICS), 35, 72, 112, 335
ACCELERATION PROTECTION, 230
ACCELERATION STRESSES (PHYSIOLOGY), 209, 210, 211, 230, 231
ACCELERATION TOLERANCE, 209, 210, 230, 231
ACCELEROMETERS, 72
ACCEPTABILITY, 224
ACCEPTOR MATERIALS, 64
ACCESS CONTROL, 91, 247
ACCRETION DISKS, 329
ACOUSTIC MEASUREMENT, 110, 205
ACOUSTIC PROPERTIES, 67
ACOUSTO–OPTICS, 121
ACTIVATED CARBON, 51
ACTIVE CONTROL, 21, 42, 143, 326
ACTIVE GALACTIC NUCLEI, 328, 333, 334, 335
ACTIVITY CYCLES (BIOLOGY), 207
ACTUATORS, 143
ADAPTATION, 223, 224
ADAPTIVE CONTROL, 21, 108, 257, 263, 264, 316
ADAPTIVE FILTERS, 106, 235
ADAPTIVE OPTICS, 136, 326
ADDING CIRCUITS, 243
ADDITIVES, 58, 116, 305
ADIABATIC FLOW, 114
ADSORPTION, 50, 51, 307
ADVANCED MICROWAVE SOUNDING UNIT, 39, 72, 98, 99, 100, 106, 115, 138
ADVANCED VERY HIGH RESOLUTION RADIOMETER, 259
AERIAL PHOTOGRAPHY, 318
AEROACOUSTICS, 273
AERODYNAMIC CHARACTERISTICS, 5
AERODYNAMIC COEFFICIENTS, 7
AERODYNAMIC CONFIGURATIONS, 12, 268
AERODYNAMIC FORCES, 229
AERODYNAMIC LOADS, 6
AERODYNAMIC NOISE, 273
AERODYNAMIC STABILITY, 25
AERODYNAMICS, 4
AEROELASTICITY, 3, 6
AERONAUTICAL ENGINEERING, 19, 337
AERONAUTICS, 265, 314, 319
AEROSOLS, 115, 166, 186
AEROSPACE ENGINEERING, 314, 318, 336
AEROSPACE ENVIRONMENTS, 97
AEROSPACE MEDICINE, 207, 209, 216, 221, 226, 231, 321
AEROSPACE SAFETY, 27
AEROSPACE SCIENCES, 319
AEROSPIKE ENGINES, 25
AFRICA, 166
AGE FACTOR, 222
AGGREGATES, 146
AGING (MATERIALS), 41
AGRICULTURE, 152, 153, 155, 156
AIR BAG RESTRAINT DEVICES, 8
AIR BREATHING ENGINES, 20
AIR CURRENTS, 199
AIR JETS, 190
AIR LAUNCHING, 18, 32
AIR POLLUTION, 186, 187
AIR QUALITY, 186, 187
AIR TRANSPORTATION, 9
AIR WATER INTERACTIONS, 188, 199
AIRBORNE EQUIPMENT, 116, 188
AIRCRAFT CONSTRUCTION MATERIALS, 68
AIRCRAFT CONTROL, 21
AIRCRAFT DESIGN, 12, 13, 16, 17, 26, 76
AIRCRAFT EQUIPMENT, 14
AIRCRAFT LANDING, 17
AIRCRAFT MANEUVERS, 2, 208, 209, 213
AIRCRAFT NOISE, 273
AIRCRAFT PERFORMANCE, 2
AIRCRAFT PILOTS, 1, 14, 18, 213, 219, 232
AIRCRAFT RELIABILITY, 2, 15, 45, 141
AIRCRAFT SAFETY, 9
AIRCRAFT STRUCTURES, 2, 9, 12, 16, 19, 45, 141, 142, 144
AIRCRAFT TIRES, 17
AIRCRAFT WAKES, 3
AIRFRAMES, 56
AIRLINE OPERATIONS, 8, 10
ALERTNESS, 216, 221, 223
ALGEBRA, 312
ALGORITHMS, 11, 90, 106, 143, 167, 190, 192, 196, 235, 237, 238, 239, 243, 244, 245, 246, 248, 250, 256, 258, 267, 268, 289, 317, 320, 322
ALIGNMENT, 278, 281, 307
ALKOXIDES, 60
ALKYL COMPOUNDS, 285
ALPHA PARTICLES, 292
ALTERNATING CURRENT, 99
ALTERNATIVES, 239
ALUMINUM, 127
ALUMINUM ALLOYS, 58
ALUMINUM ANTIMONIDES, 308
ALUMINUM COATINGS, 122
ALUMINUM GALLIUM ARSENIDE LASERS, 122
ALUMINUM GALLIUM ARSENIDES, 313
ALUMINUM OXIDES, 48, 59, 60, 109, 274
AMBIGUITY, 11
AMINO ACIDS, 220
AMMONIUM NITRATES, 51
AMORPHOUS MATERIALS, 69
AMORPHOUS SILICON, 61, 69, 168, 173, 176
AMOUNT, 125
AMPHETAMINES, 216, 220
AMPLIFICATION, 134, 136, 302
AMPLIFIERS, 121
ANALOG DATA, 235
ANALOG TO DIGITAL CONVERTERS, 78
ANGLE OF ATTACK, 10
ANGULAR DISTRIBUTION, 279, 280, 281, 299, 300
ANGULAR MOMENTUM, 99, 106, 199
ANIMALS, 213
ANISOLE, 303
ANISOTROPY, 278, 279, 287, 288
ANNEALING, 63, 101, 175, 286
ANOMALIES, 36
ANTENNA ARRAYS, 89, 96
ANTENNA COMPONENTS, 89
ANTHROPOMETRY, 207, 226, 227
ANTIREFLECTION COATINGS, 170
APPLICATIONS OF MATHEMATICS, 237
APPLICATIONS PROGRAMS (COMPUTERS), 17, 39, 43, 142, 148, 239, 240, 288, 318

APPROXIMATION, 75, 245, 268, 334
ARC JET ENGINES, 64
ARC LAMPS, 123
ARCHAEOLOGY, 184
ARCHITECTURE (COMPUTERS), 85, 235, 236, 240, 244, 250
ARGON LASERS, 154
ARGON PLASMA, 294
ARITHMETIC AND LOGIC UNITS, 246, 251
ARIZONA, 147
ARMED FORCES, 86
ARMED FORCES (UNITED STATES), 23
AROMATIC COMPOUNDS, 330
ARRAYS, 41, 181
ARRIVALS, 317
ARTIFICIAL INTELLIGENCE, 43, 95, 226, 255, 257, 259, 263, 264, 316
ARTIFICIAL SATELLITES, 37
ARTILLERY, 80
ASSEMBLING, 28, 35
ASSESSMENTS, 316, 330
ASSIMILATION, 197
ASSOCIATIVE MEMORY, 90
ASTRONAUT PERFORMANCE, 35
ASTRONAUT TRAINING, 32
ASTRONAUTICS, 319
ASTRONAUTS, 27, 29, 31, 35, 225
ASTRONOMICAL OBSERVATORIES, 24, 323, 333
ASTRONOMICAL PHOTOMETRY, 333
ASTRONOMY, 319, 324
ASTROPHYSICS, 27, 336
ASYNCHRONOUS MOTORS, 101
ATLANTIS (ORBITER), 27, 28, 30
ATMOSPHERIC CHEMISTRY, 277
ATMOSPHERIC COMPOSITION, 182, 188, 200
ATMOSPHERIC EFFECTS, 277
ATMOSPHERIC MODELS, 188
ATMOSPHERIC PHYSICS, 166
ATMOSPHERIC PRESSURE, 47
ATMOSPHERIC RADIATION, 97
ATMOSPHERIC SOUNDING, 115
ATOMIC ENERGY LEVELS, 131
ATOMIC FORCE MICROSCOPY, 63, 276
ATOMIC LAYER EPITAXY, 309
ATOMIC PHYSICS, 298
ATOMIC RECOMBINATION, 53
ATOMIC STRUCTURE, 130
ATOMS, 59, 282
AUDITORY PERCEPTION, 274, 275
AUDITORY SIGNALS, 275
AUGMENTATION, 257
AUTOMATA THEORY, 254
AUTOMATIC CONTROL, 10, 24, 33, 203, 253, 255, 323
AUTONOMY, 254, 255, 256, 259
AVIONICS, 28
AXIOMS, 258
AXISYMMETRIC BODIES, 111

B

BACKGROUND NOISE, 275
BACKGROUND RADIATION, 335
BALLOON–BORNE INSTRUMENTS, 188
BALLOONING MODES, 292
BANDPASS FILTERS, 159
BANDWIDTH, 91, 132
BARIUM COMPOUNDS, 302
BARIUM TITANATES, 305, 306
BAROCLINIC WAVES, 112
BARORECEPTORS, 230
BASIC (PROGRAMMING LANGUAGE), 313
BAYES THEOREM, 157
BEAM SPLITTERS, 134
BEAM STEERING, 96
BEAMS (RADIATION), 129
BEES, 202
BENZENE, 280
BETA PARTICLES, 180, 283
BINDERS (MATERIALS), 146
BINOCULAR VISION, 271
BINOMIAL COEFFICIENTS, 270
BIOASSAY, 52
BIOCHEMISTRY, 205, 206, 223
BIODEGRADABILITY, 225
BIODEGRADATION, 42, 201, 202
BIODYNAMICS, 207, 210, 213, 227, 228, 229, 230, 232
BIOLOGICAL DIVERSITY, 149
BIOLOGICAL EFFECTS, 71, 211
BIOLOGICAL MODELS (MATHEMATICS), 208, 227, 228, 229
BIOMASS, 201, 203, 204
BIONICS, 316
BIOREACTORS, 42, 202
BIREFRINGENCE, 308
BL LACERTAE OBJECTS, 333, 334
BLACK HOLES (ASTRONOMY), 329
BLAST LOADS, 213
BLASTS, 229
BLOCKING, 112
BLOOD FLOW, 209
BLOOD PRESSURE, 209
BLOWING, 4
BLUNT BODIES, 144
BODY TEMPERATURE, 216
BODY–WING CONFIGURATIONS, 4, 5
BOILING, 59
BOLTED JOINTS, 46
BOLTS, 46
BONES, 201, 228
BORATES, 48
BOTSWANA, 166
BOUNDARY CONDITIONS, 267
BOUNDARY LAYER SEPARATION, 4
BOUNDARY LAYERS, 194
BOW WAVES, 300
BRAGG ANGLE, 306
BRAIN, 316
BRAIN CIRCULATION, 209
BREATHING APPARATUS, 232
BREMSSTRAHLUNG, 299
BRIDGMAN METHOD, 303
BRIGHTNESS, 323, 326
BRIGHTNESS TEMPERATURE, 150
BROADBAND, 89, 274
BROADCASTING, 89
BROKEN SYMMETRY, 67
BROMINE, 52, 53, 281
BSCCO SUPERCONDUCTORS, 309
BUBBLES, 189
BUCKLING, 142
BUILDINGS, 76, 113, 284
BUOYANCY, 47
BURNS (INJURIES), 212
BY–PRODUCTS, 184
BYPASS RATIO, 4
BYPASSES, 20

C

C–135 AIRCRAFT, 45
CADMIUM SULFIDES, 170
CADMIUM TELLURIDES, 48, 173, 304
CAFFEINE, 217
CALCIUM COMPOUNDS, 120
CALCULUS, 265
CALIBRATING, 177
CALORIMETERS, 325
CAMERAS, 118
CAMOUFLAGE, 159, 160, 162, 163, 166, 219, 242
CAPACITANCE, 109
CAPACITORS, 92, 214
CAPE KENNEDY LAUNCH COMPLEX, 29
CAPILLARY TUBES, 122
CAPILLARY WAVES, 199
CARBON, 330
CARBON COMPOUNDS, 58
CARBON CYCLE, 187

CARBON DIOXIDE, 55, 203
CARBON DISULFIDE, 280
CARBON MONOXIDE, 328
CARBON STEELS, 57
CARBON–CARBON COMPOSITES, 64
CARDIAC VENTRICLES, 207
CARDIOVASCULAR SYSTEM, 201, 207, 208, 209, 224
CARRIER DENSITY (SOLID STATE), 104, 174
CARRIER LIFETIME, 311
CARRIER WAVES, 11
CASUALTIES, 211, 212, 213
CATALOGS (PUBLICATIONS), 336
CATALYSTS, 50, 65
CATALYTIC ACTIVITY, 50, 205
CATHODES, 103
CAVITY RESONATORS, 119
CCD CAMERAS, 54
CELL DIVISION, 201
CELLS (BIOLOGY), 71
CELLULOSE, 63
CENTER OF GRAVITY, 72
CENTER OF MASS, 199
CENTRAL NERVOUS SYSTEM, 222
CENTRAL NERVOUS SYSTEM STIMULANTS, 216
CERAMICS, 48, 59, 60, 70, 116
CERTIFICATION, 140, 232, 316
CESIUM 137, 185
CHANGE DETECTION, 158
CHANNEL CAPACITY, 91
CHANNEL FLOW, 113, 148
CHAOS, 268, 313
CHARACTER RECOGNITION, 192, 245, 246, 320
CHARACTERIZATION, 60, 132, 153
CHARGE COUPLED DEVICES, 234, 242, 283
CHARGE DISTRIBUTION, 109
CHARGE TRANSFER, 52, 58
CHARGED PARTICLES, 97, 136, 191
CHELATES, 51
CHEMICAL ANALYSIS, 52, 281
CHEMICAL BONDS, 131, 282
CHEMICAL CLEANING, 74
CHEMICAL COMPOUNDS, 276
CHEMICAL EQUILIBRIUM, 328
CHEMICAL PROPERTIES, 51, 185
CHEMICAL PROPULSION, 41
CHEMICAL REACTIONS, 50, 55, 98, 277, 282
CHEMILUMINESCENCE, 53
CHICKENS, 184, 185
CHIPS, 54
CHIPS (ELECTRONICS), 90, 107
CHIPS (MEMORY DEVICES), 306
CHLORINE, 53, 186
CHLORINE COMPOUNDS, 64
CHLORINE OXIDES, 53
CHROMIUM, 61
CHROMIUM COMPOUNDS, 58
CHROMIUM OXIDES, 59
CHROMOPHORES, 42, 60, 62
CHROMOSPHERE, 323, 325
CIRCADIAN RHYTHMS, 207, 217, 221
CIRCUITS, 92, 278
CIRRUS CLOUDS, 196
CIVIL AVIATION, 12
CLASSIFICATIONS, 239
CLASSIFIERS, 318
CLEAN ROOMS, 28
CLEANLINESS, 65
CLIENT SERVER SYSTEMS, 251
CLIMATE, 190
CLIMATE CHANGE, 183, 194, 195
CLIMATE MODELS, 187, 198
CLIMATOLOGY, 147, 190, 195
CLOSED CYCLES, 291
CLOUD COVER, 197
CLOUDS (METEOROLOGY), 166
CLUSTER ANALYSIS, 239, 266, 269
CLUTTER, 160, 161
CMOS, 90, 105, 108, 246
COASTAL PLAINS, 156
COASTS, 89
COATING, 136
COATINGS, 49, 54, 176, 182
COCKPITS, 10
CODE DIVISION MULTIPLE ACCESS, 92, 105
CODING, 77, 91, 107, 238
COEFFICIENTS, 256
COERCIVITY, 236
COGNITION, 85, 159, 220
COHERENT ELECTROMAGNETIC RADIATION, 101
COHERENT LIGHT, 262
COHERENT RADIATION, 128, 130
COLD PLASMAS, 294
COLLIMATION, 124
COLLIMATORS, 288
COLLISION AVOIDANCE, 193
COLLISION RATES, 279
COLLISIONAL PLASMAS, 294
COLLISIONLESS PLASMAS, 291
COLLISIONS, 282, 300
COLLOIDS, 63
COLOR, 166, 234
COLUMBIA (ORBITER), 29
COMBAT, 79, 81, 82, 86, 165, 212
COMBINATORIAL ANALYSIS, 151, 243, 245
COMBUSTION, 47, 50, 137
COMBUSTION PRODUCTS, 47, 186
COMETS, 328, 329
COMMAND AND CONTROL, 22, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 269
COMMAND LANGUAGES, 239
COMMERCIAL SPACECRAFT, 17
COMMERCIALIZATION, 179, 238
COMMUNICATING, 265
COMMUNICATION, 78, 82, 85, 86, 87, 88, 321
COMMUNICATION EQUIPMENT, 89
COMMUNICATION NETWORKS, 91, 101, 178, 246
COMPATIBILITY, 33
COMPETITION, 313
COMPILERS, 237
COMPLEX COMPOUNDS, 55
COMPLEX NUMBERS, 246
COMPLEX SYSTEMS, 76, 267
COMPOSITE MATERIALS, 9, 45, 146, 306
COMPOSITE STRUCTURES, 43, 45, 46, 242
COMPOSTING, 184, 185
COMPRESSIBLE FLUIDS, 233
COMPRESSING, 127
COMPRESSION WAVES, 189
COMPRESSIVE STRENGTH, 146
COMPUTATION, 19, 174, 248, 266, 282
COMPUTATIONAL ELECTROMAGNETICS, 93
COMPUTATIONAL FLUID DYNAMICS, 5, 111
COMPUTATIONAL GRIDS, 156, 157
COMPUTER AIDED DESIGN, 12, 13, 73, 74, 75, 76, 141, 225, 239, 240
COMPUTER AIDED MANUFACTURING, 12, 13, 75
COMPUTER COMPONENTS, 97
COMPUTER CONFERENCING, 236
COMPUTER DESIGN, 232
COMPUTER GRAPHICS, 240
COMPUTER INFORMATION SECURITY, 247, 320
COMPUTER NETWORKS, 236, 250, 321
COMPUTER PROGRAMMING, 238, 249, 313
COMPUTER PROGRAMS, 6, 82, 85, 88, 107, 144, 154, 160, 162, 203, 212, 216, 228, 233, 237, 238, 242, 252, 256, 279, 322, 324
COMPUTER STORAGE DEVICES, 250, 306

COMPUTER SYSTEMS PERFORMANCE, 244
COMPUTER TECHNIQUES, 18, 78, 82, 89, 160, 239, 240, 242, 269, 313
COMPUTER VISION, 255, 258
COMPUTERIZED SIMULATION, 8, 14, 36, 39, 44, 79, 80, 81, 82, 83, 87, 88, 96, 111, 156, 160, 177, 195, 197, 207, 209, 210, 211, 213, 215, 225, 227, 228, 229, 230, 231, 232, 233, 238, 257, 258, 262, 265, 271, 289, 300, 301
COMPUTERS, 133, 203
CONCENTRATORS, 36, 41, 169, 178
CONCRETE STRUCTURES, 76, 146
CONCRETES, 146
CONCURRENT ENGINEERING, 12, 13, 75, 240
CONDUCTIVE HEAT TRANSFER, 212
CONFERENCES, 2, 8, 29, 41, 74, 75, 76, 77, 78, 95, 101, 159, 182, 183, 314, 335
CONFINEMENT, 122
CONFORMAL MAPPING, 282
CONIFERS, 147
CONSERVATION, 147
CONSERVATION EQUATIONS, 273
CONSTRUCTION, 76, 134, 135, 136
CONTAMINANTS, 114
CONTAMINATION, 188
CONTINUITY EQUATION, 114
CONTINUOUS WAVE LASERS, 119
CONTOURS, 163
CONTROL DATA (COMPUTERS), 107
CONTROL EQUIPMENT, 290
CONTROL SYSTEMS DESIGN, 17, 21, 22, 34, 108, 138, 143, 204, 253, 254, 256, 257, 261
CONTROL THEORY, 253, 258, 260, 261, 263
CONTROLLABILITY, 25, 288
CONTROLLED ATMOSPHERES, 28
CONTROLLERS, 108, 138, 204, 254, 256, 257, 260, 261
CONVECTION, 198
CONVERGENCE, 106, 248, 250, 265
CONVEXITY, 261
COPOLYMERIZATION, 60, 64, 65
COPOLYMERS, 49, 60
COPPER, 51
COPPER SELENIDES, 172
CORN, 156, 195
CORONAL MASS EJECTION, 331
CORRECTION, 277
CORROSION, 58
CORROSION RESISTANCE, 59
COSMIC RAYS, 34, 335
COSMOLOGY, 330
COSMONAUTS, 30
COST ANALYSIS, 56, 80
COST EFFECTIVENESS, 81, 187
COSTS, 133
COTTON, 184, 195
COULOMB COLLISIONS, 280
COULOMB POTENTIAL, 296
COUNTDOWN, 26
COUNTERFLOW, 49
COUNTERMEASURES, 75, 216
COVALENT BONDS, 60
CRACK INITIATION, 242
CRACK PROPAGATION, 9, 15, 16, 141, 142, 144
CRACKS, 9, 15, 16, 141, 144, 145
CRANES, 253, 257
CRASHES, 226, 228, 229, 230
CRASHWORTHINESS, 230
CREEP ANALYSIS, 70
CREEP PROPERTIES, 70
CREW PROCEDURES (PREFLIGHT), 27, 28, 30, 31, 32
CREWS, 8, 227, 229
CROP GROWTH, 151, 153, 195, 201, 202
CROSS CORRELATION, 311
CROSS FLOW, 111
CRUDE OIL, 188
CRUSTAL FRACTURES, 191
CRYOGENIC TEMPERATURE, 52
CRYPTOGRAPHY, 320
CRYSTAL DEFECTS, 312
CRYSTAL GROWTH, 56, 62, 303, 305, 307
CRYSTAL OPTICS, 288
CRYSTAL STRUCTURE, 305
CRYSTALLINITY, 69, 168
CRYSTALLIZATION, 48
CRYSTALS, 61, 304, 306
CURRENT DENSITY, 109
CURRENT REGULATORS, 105
CYANIDES, 282
CYANO COMPOUNDS, 55
CYCLES, 133
CYCLIC HYDROCARBONS, 295
CYCLOHEXANE, 55, 280
CYLINDRICAL BODIES, 301
CYLINDRICAL SHELLS, 242
CYTOLOGY, 71
CZOCHRALSKI METHOD, 303

D

DAMAGE, 2, 9, 12, 15, 16, 19, 20, 45, 141, 145, 176, 182, 242, 266, 283
DAMAGE ASSESSMENT, 44, 46, 143
DAMPING, 254
DATA ACQUISITION, 17, 113, 114, 136, 151, 154, 178, 189, 200, 337
DATA BASE MANAGEMENT SYSTEMS, 148
DATA BASES, 148, 185, 202, 207, 318, 319
DATA COMPRESSION, 238, 249
DATA CONVERTERS, 235
DATA MANAGEMENT, 200
DATA PROCESSING, 107, 151, 155, 156, 177, 178, 210, 235, 252, 329
DATA REDUCTION, 151, 158
DATA RETRIEVAL, 249, 289, 321
DATA STORAGE, 247
DATA STRUCTURES, 243, 318, 319
DATA SYSTEMS, 107, 319
DATA TRANSFER (COMPUTERS), 192
DATA TRANSMISSION, 18, 105
DEBRIS, 31
DECEPTION, 242
DECISION MAKING, 75, 80, 83, 84, 85, 86, 88, 183, 240, 254, 255, 316
DECISION SUPPORT SYSTEMS, 1, 13, 76, 78, 80, 84, 86, 88, 89, 183, 206, 240, 252
DECISION THEORY, 241, 248
DECODERS, 249
DECODING, 249
DECOMPRESSION SICKNESS, 213
DEFECTS, 174, 302
DEFENSE PROGRAM, 78, 85, 106
DEFLECTION, 4
DEFORMATION, 8, 191
DEGRADATION, 45, 290
DEHYDROGENATION, 64
DELAMINATING, 45
DELTA MODULATION, 78, 260
DEMAGNETIZATION, 58
DENSE PLASMAS, 298
DENSITY (MASS/VOLUME), 43
DENSITY (NUMBER/VOLUME), 109
DEOXYRIBONUCLEIC ACID, 206, 283
DEPLOYMENT, 40, 117
DEPOSITION, 43, 122
DESENSITIZING, 40
DESIGN ANALYSIS, 10, 17, 22, 23, 31, 34, 36, 39, 41, 42, 73, 74, 85, 104, 112, 117, 141, 145, 173, 175, 229, 240, 241, 248, 255, 261, 288, 301, 322, 325
DESORPTION, 50, 307
DETECTION, 44, 159, 160, 218, 266, 269, 326, 328
DETONATION WAVES, 300
DIAMAGNETISM, 297

DIAMOND FILMS, 49
DIAMONDS, 193
DIASTOLIC PRESSURE, 214
DIATOMIC MOLECULES, 53, 280
DIELECTRICS, 78
DIFFERENTIAL ABSORPTION LIDAR, 116
DIFFUSION, 98, 101, 112, 170
DIFFUSION FLAMES, 49
DIGITAL COMPUTERS, 248
DIGITAL FILTERS, 235
DIGITAL SIMULATION, 24
DIGITAL SYSTEMS, 251, 325
DIGITAL TECHNIQUES, 246
DIMENSIONAL ANALYSIS, 233
DIODES, 104
DIRECT CURRENT, 105, 256
DIRECT NUMERICAL SIMULATION, 47, 233
DIRECTIONAL CONTROL, 101
DISCOVERY (ORBITER), 29, 31
DISCRIMINANT ANALYSIS (STATISTICS), 246
DISCRIMINATION, 162
DISLOCATIONS (MATERIALS), 307
DISPLACEMENT, 176, 191
DISPLAY DEVICES, 102, 232, 310, 324
DISSIPATION, 293
DISSOCIATION, 132, 279
DISTANCE, 161, 258
DISTORTION, 137
DISTRIBUTED FEEDBACK LASERS, 121
DISTRIBUTED PARAMETER SYSTEMS, 261
DISTRIBUTED PROCESSING, 251, 252
DISTRIBUTION FUNCTIONS, 277
DIURNAL VARIATIONS, 217
DOCUMENTS, 320
DOPED CRYSTALS, 61, 120, 123, 174, 287, 304, 306
DOSAGE, 176
DOSIMETERS, 211
DRAINAGE, 148, 158
DRAWINGS, 244
DRIFT RATE, 293
DRILLING, 123, 137
DRILLS, 137
DRONE VEHICLES, 18
DROP TESTS, 46, 228
DRUGS, 206, 216
DRYING, 202
DUMMIES, 228, 230
DURABILITY, 19, 177
DUST STORMS, 331
DYNAMIC CHARACTERISTICS, 38, 215
DYNAMIC MODELS, 229, 248
DYNAMIC PROGRAMMING, 322
DYNAMIC RANGE, 311
DYNAMIC RESPONSE, 7, 37
DYNAMIC STRUCTURAL ANALYSIS, 20, 37
DYNAMIC TESTS, 36, 38, 228
DYNAMICAL SYSTEMS, 106, 262, 267, 268

E

EARTH GRAVITATION, 199
EARTH OBSERVATIONS (FROM SPACE), 154
EARTH OBSERVING SYSTEM (EOS), 39, 99, 106, 138, 155, 166, 189
EARTH PLANETARY STRUCTURE, 327
EARTH ROTATION, 193
EARTH SCIENCES, 148, 184, 314
EARTH SURFACE, 30, 150, 155, 194
EARTH TERMINALS, 24
EARTHQUAKE RESISTANT STRUCTURES, 75
EARTHQUAKES, 191, 194
ECHO SUPPRESSORS, 262
ECOLOGY, 147
ECOSYSTEMS, 149
EDDY CURRENTS, 266
EDGE DETECTION, 91, 107, 268
EDUCATION, 10, 23, 184, 313, 314, 315, 321
EFFICIENCY, 54, 175, 179, 299
EH–101 HELICOPTER, 9, 16
EIGENVALUES, 233, 266, 269
EIGENVECTORS, 266
EJECTION INJURIES, 229
EJECTION SEATS, 229
EL NINO, 188, 195
ELASTIC DEFORMATION, 143
ELASTIC PROPERTIES, 214
ELASTIC SCATTERING, 272
ELASTOSTATICS, 142
ELECTRIC BATTERIES, 58, 64, 99, 100
ELECTRIC CURRENT, 109, 177, 284
ELECTRIC GENERATORS, 178
ELECTRIC MOTORS, 103
ELECTRIC POTENTIAL, 121
ELECTRIC POWER PLANTS, 182
ELECTRIC STIMULI, 215
ELECTRICAL ENGINEERING, 90
ELECTRICAL IMPEDANCE, 116
ELECTRICAL MEASUREMENT, 125
ELECTRICAL RESISTIVITY, 42, 93, 104, 204, 275
ELECTRO–OPTICAL EFFECT, 310
ELECTRO–OPTICS, 62, 310
ELECTROCHEMISTRY, 58, 64, 99
ELECTRODES, 104, 108, 278
ELECTRODYNAMICS, 35, 66
ELECTROLUMINESCENCE, 68
ELECTROLYSIS, 188
ELECTROLYTIC CELLS, 201
ELECTROMAGNETIC FIELDS, 90, 217, 279, 313
ELECTROMAGNETIC INTERACTIONS, 125, 126, 130, 299
ELECTROMAGNETIC INTERFERENCE, 92, 290
ELECTROMAGNETIC PULSES, 93
ELECTROMAGNETIC RADIATION, 211
ELECTROMAGNETIC WAVE FILTERS, 275
ELECTROMECHANICS, 73
ELECTROMIGRATION, 57
ELECTROMYOGRAPHY, 215
ELECTRON BEAMS, 271, 284
ELECTRON CAPTURE, 126
ELECTRON COUNTERS, 53
ELECTRON EMISSION, 103, 284
ELECTRON ENERGY, 277, 283
ELECTRON IRRADIATION, 175, 182
ELECTRON OPTICS, 271
ELECTRON PLASMA, 298
ELECTRON SPIN, 313
ELECTRON STATES, 281
ELECTRON TRANSFER, 52, 124, 126, 130, 284
ELECTRON TUNNELING, 103
ELECTRONIC EQUIPMENT, 141
ELECTRONIC WARFARE, 90, 96
ELECTRONS, 177
ELECTROPLATING, 122
ELEMENTARY EXCITATIONS, 109
ELLIPSOIDS, 272
EMERGENCIES, 8
EMISSION, 49, 327, 335
EMISSION SPECTRA, 182, 283, 311, 328
EMITTANCE, 102, 176, 180, 281, 299, 300
EMITTERS, 102, 168
ENERGETIC PARTICLES, 292
ENERGY ABSORPTION, 129
ENERGY CONSERVATION, 21, 294
ENERGY CONVERSION EFFICIENCY, 170, 180, 181
ENERGY DISSIPATION, 334

ENERGY GAPS (SOLID STATE), 62, 172, 311
ENERGY METHODS, 146
ENERGY STORAGE, 74
ENERGY TECHNOLOGY, 106, 170
ENERGY TRANSFER, 126, 137, 282
ENGINE DESIGN, 39
ENGINE NOISE, 273
ENGINE PARTS, 70, 114
ENGINE TESTS, 40
ENGINEERING, 315
ENGINEERING MANAGEMENT, 249
ENVIRONMENT MODELS, 191
ENVIRONMENT SIMULATION, 227
ENVIRONMENTAL LABORATORIES, 51
ENVIRONMENTAL MONITORING, 149, 185
ENVIRONMENTAL TESTS, 314
EPITAXY, 103, 120, 171, 302, 307, 308, 311, 312
EPOXY MATRIX COMPOSITES, 46
EQUATIONS OF MOTION, 110
EQUILIBRIUM, 198
EQUILIBRIUM EQUATIONS, 146, 297
EQUILIBRIUM FLOW, 292
EQUILIBRIUM METHODS, 146
EQUIPMENT, 100
ERBIUM, 304
ERGODIC PROCESS, 91
ERROR ANALYSIS, 157, 189, 233
ERRORS, 93, 222
ESCAPE SYSTEMS, 229
ESTIMATING, 77, 198, 223
ETHANE, 328
ETHYLENE COMPOUNDS, 284
ETHYLENEDIAMINETETRAACETIC ACIDS, 51
EUCLIDEAN GEOMETRY, 317
EULER BUCKLING, 145
EULER EQUATIONS OF MOTION, 293
EUROPEAN SPACE AGENCY, 169
EUROPIUM, 61, 287
EUTECTICS, 328
EVAPORATION, 65, 195
EVAPOTRANSPIRATION, 185
EXCIMER LASERS, 133
EXCITATION, 55, 58, 101, 130, 193, 277, 281, 282, 284
EXHAUST EMISSION, 186, 187
EXHAUST GASES, 186, 187
EXPANSION, 111, 267
EXPEDITIONS, 35
EXPERIMENT DESIGN, 75, 76, 128, 177, 255
EXPERIMENTATION, 101, 113, 118, 136, 177, 182, 272, 280, 281, 298
EXPERT SYSTEMS, 13, 43, 79, 84, 248, 249, 318
EXPLOSIVES, 213
EXPOSURE, 186
EXTINCTION, 50
EXTRASOLAR PLANETS, 323
EXTRATERRESTRIAL RADIATION, 176, 333, 334
EXTRAVEHICULAR ACTIVITY, 225
EXTREME ULTRAVIOLET RADIATION, 127, 327, 331, 332
EYE (ANATOMY), 204, 212

F

FABRICATION, 41, 54, 60, 69, 102, 114, 116, 120, 135, 170, 172, 173, 176, 178, 179, 181, 206, 276, 291, 302, 306, 324
FACTORIALS, 270
FAIL–SAFE SYSTEMS, 145, 267
FAILURE, 14
FAILURE MODES, 15, 70, 242
FALLOUT, 185
FARADAY EFFECT, 298
FARM CROPS, 156, 202, 225
FATIGUE (BIOLOGY), 218, 221, 224
FATIGUE (MATERIALS), 2, 20, 45, 178
FATIGUE LIFE, 15
FATIGUE TESTS, 15, 20
FAULT DETECTION, 107, 242
FEASIBILITY, 325, 330
FEASIBILITY ANALYSIS, 56, 128, 239
FEED SYSTEMS, 41
FEEDBACK, 138, 195, 264
FEEDBACK CONTROL, 25, 143, 257, 291, 326
FEEDFORWARD CONTROL, 108, 316
FEMALES, 218, 226, 228
FERROELECTRICITY, 308
FERROMAGNETIC FILMS, 116, 272
FERTILIZERS, 185
FIBER COMPOSITES, 9, 45, 46
FIBER LASERS, 121
FIBER OPTICS, 288
FIELD EFFECT TRANSISTORS, 96, 103, 105
FIELD OF VIEW, 325
FIELD THEORY (ALGEBRA), 267, 312
FILM COOLING, 114
FILM THICKNESS, 59
FILTERS, 274
FINITE DIFFERENCE THEORY, 114
FINITE DIFFERENCE TIME DOMAIN METHOD, 93
FINITE ELEMENT METHOD, 8, 25, 31, 70, 142, 143, 145, 208, 228, 230, 265
FINITE VOLUME METHOD, 268
FINS, 113
FIRING (IGNITING), 40
FISSION, 285
FITTING, 335
FLAME PROPAGATION, 47
FLAME RETARDANTS, 68
FLAME STABILITY, 47
FLAMMABILITY, 50, 68
FLEXIBILITY, 41, 146
FLEXIBLE SPACECRAFT, 37
FLIGHT CHARACTERISTICS, 2, 213, 232
FLIGHT CONTROL, 2, 21, 22, 25, 232
FLIGHT CREWS, 8, 209, 210, 211, 214, 218, 221, 230, 231
FLIGHT FATIGUE, 213, 214, 219, 232
FLIGHT INSTRUMENTS, 14
FLIGHT MECHANICS, 2
FLIGHT OPERATIONS, 8, 10, 214
FLIGHT OPTIMIZATION, 269
FLIGHT RECORDERS, 177
FLIGHT SIMULATION, 14, 21, 218, 219
FLIGHT STRESS (BIOLOGY), 214, 219, 232
FLIGHT TESTS, 15, 96
FLOW CHARACTERISTICS, 4
FLOW DISTRIBUTION, 5, 50, 139, 199
FLOW MEASUREMENT, 111, 155
FLOW THEORY, 17
FLOW VISUALIZATION, 120
FLUID DYNAMICS, 233, 297
FLUID FLOW, 114
FLUORESCENCE, 54, 55, 61
FLUORINE, 59
FLUORINE COMPOUNDS, 120
FLUOROCARBONS, 168
FLUTTER ANALYSIS, 31
FLUX (RATE), 333
FLUX DENSITY, 127
FOAMS, 127, 300
FOCUSING, 134, 271
FOIL BEARINGS, 19
FOKKER–PLANCK EQUATION, 279
FORESTS, 147, 149, 155, 168
FORMALISM, 247, 265
FORWARD SCATTERING, 298
FOSSILS, 184
FOUR–WAVE MIXING, 128
FOURIER TRANSFORMATION, 302
FRACTALS, 238
FRACTURE MECHANICS, 15, 144, 145

FRACTURING, 16, 46, 145
FRAGMENTS, 131, 280
FRANCK–CONDON PRINCIPLE, 132
FREE ELECTRON LASERS, 179
FREE ELECTRONS, 125
FREE FLIGHT, 32
FREE FLOW, 4
FREEZE DRYING, 225
FREEZING, 303
FREQUENCIES, 68, 301
FREQUENCY DISTRIBUTION, 99
FREQUENCY MEASUREMENT, 90
FREQUENCY SCANNING, 92
FREQUENCY SHIFT, 121
FREQUENCY STABILITY, 123
FRETTING, 139
FRICTION, 113
FRICTION REDUCTION, 19
FRICTION WELDING, 139
FUEL CAPSULES, 30
FUEL CELLS, 76, 77
FUEL INJECTION, 138
FUEL–AIR RATIO, 138
FULLERENES, 276
FUNCTIONS (MATHEMATICS), 266
FUSELAGES, 56
FUSION REACTORS, 73
FUZZY SYSTEMS, 94, 238, 248, 254, 256, 257, 258, 260, 262, 264, 317

G

GALACTIC STRUCTURE, 34, 330
GALAXIES, 326
GALILEO SPACECRAFT, 28, 30
GALLIUM ALLOYS, 56
GALLIUM ANTIMONIDES, 308
GALLIUM ARSENIDES, 96, 120, 171, 172, 175, 176, 288, 307, 308
GALLIUM NITRIDES, 283, 304, 311
GALLIUM PHOSPHIDES, 175, 180
GAME THEORY, 75, 270
GAMMA RAY BURSTS, 336
GAMMA RAY OBSERVATORY, 336
GAMMA RAYS, 299
GAS DENSITY, 330
GAS DETECTORS, 49, 115, 116
GAS EXCHANGE, 203
GAS EXPANSION, 282
GAS FLOW, 55
GAS GENERATORS, 41
GAS IONIZATION, 132, 279
GAS MIXTURES, 295
GAS PRESSURE, 7
GAS SPECTROSCOPY, 182
GAS TEMPERATURE, 47
GAS TURBINE ENGINES, 20
GAS–SOLID INTERACTIONS, 328
GATES (CIRCUITS), 103, 104, 107
GAUGE THEORY, 312
GEARS, 140
GENE EXPRESSION, 207
GENERATION, 125
GENETIC ALGORITHMS, 238, 243, 253, 254, 256, 262
GENETIC ENGINEERING, 200
GENETICS, 200
GEODYNAMICS, 193
GEOGRAPHIC DISTRIBUTION, 147
GEOGRAPHIC INFORMATION SYSTEMS, 148, 153, 156, 183
GEOLOGICAL FAULTS, 191
GEOLOGICAL SURVEYS, 147, 152, 202
GEOMAGNETIC TAIL, 191, 295
GEOPHYSICS, 113, 166, 190
GERMANIUM, 128
GLACIERS, 191
GLASS, 10, 48, 67, 69, 124
GLASS COATINGS, 288
GLASS FIBER REINFORCED PLASTICS, 137
GLASS FIBERS, 122
GLOBAL POSITIONING SYSTEM, 11, 18, 153
GRAFTING, 63
GRAIN BOUNDARIES, 121
GRAMMARS, 94
GRAPH THEORY, 243, 244, 267
GRAPHITE–EPOXY COMPOSITES, 44, 46, 242
GRASSES, 150
GRASSLANDS, 150, 167
GRAVITATION, 204, 224, 313
GRAVITATIONAL EFFECTS, 23, 71, 208, 209, 210, 213, 227, 230, 231
GRAVITATIONAL FIELDS, 199
GRAVITATIONAL PHYSIOLOGY, 210
GRAVITROPISM, 204
GREENHOUSE EFFECT, 187
GRID GENERATION (MATHEMATICS), 142
GROUND BASED CONTROL, 22
GROUND CREWS, 27
GROUND EFFECT (AERODYNAMICS), 3
GROUND OPERATIONAL SUPPORT SYSTEM, 22
GROUND TESTS, 32
GROUND TRUTH, 150
GROUND WATER, 156
GROUND WIND, 7, 145
GROUP THEORY, 267, 312, 317
GUANINES, 283
GUIDE VANES, 4
GUSTS, 253

H

H II REGIONS, 328
HALOGENATION, 286
HANDBOOKS, 316
HARDWARE, 34, 234
HARDWARE–IN–THE–LOOP SIMULATION, 96
HARMONIC CONTROL, 105
HARMONIC GENERATIONS, 129, 280, 283, 311
HARMONICS, 299
HEAD (ANATOMY), 227, 229
HEAD MOVEMENT, 275
HEALTH, 210, 232
HEART, 214
HEART FUNCTION, 208
HEART IMPLANTATION, 214
HEART RATE, 224
HEAT EXCHANGERS, 168
HEAT PIPES, 112, 113
HEAT PUMPS, 168
HEAT RESISTANT ALLOYS, 59, 139
HEAT SHIELDING, 37
HEAT STORAGE, 76
HEAT TRANSFER, 51, 59, 113
HEAT TRANSFER COEFFICIENTS, 111, 114, 180
HEATING, 137, 331
HEATING EQUIPMENT, 285
HEAVY IONS, 300
HELICOPTER DESIGN, 9, 45, 141, 144, 145
HELICOPTERS, 5, 9, 10, 15, 45, 81, 141
HELIOTRONS, 292
HELIUM, 279
HELIUM ISOTOPES, 51
HELMETS, 227
HERMITIAN POLYNOMIAL, 233
HETEROCYCLIC COMPOUNDS, 42
HEURISTIC METHODS, 256
HIERARCHIES, 319
HIGH ALTITUDE, 178
HIGH CURRENT, 109
HIGH ENERGY ELECTRONS, 126
HIGH FREQUENCIES, 103
HIGH GRAVITY ENVIRONMENTS, 201
HIGH LEVEL LANGUAGES, 133

HIGH POWER LASERS, 123, 124, 125, 126, 127, 133, 134, 136, 298
HIGH PRESSURE, 40
HIGH RESOLUTION, 158
HIGH SPEED PHOTOGRAPHY, 31
HIGH TEMPERATURE, 19
HIGH TEMPERATURE PLASMAS, 297, 301
HIGH TEMPERATURE SUPERCONDUCTORS, 99, 109, 116
HIGH VOLTAGES, 180
HISTOGRAMS, 197
HISTORIES, 87, 337
HOLES (MECHANICS), 133
HOMOJUNCTIONS, 101, 170
HORIZONTAL TAIL SURFACES, 10
HOT CORROSION, 59
HOT ELECTRONS, 283
HUBBLE SPACE TELESCOPE, 27, 28, 29
HUMAN BEINGS, 211, 228
HUMAN BODY, 8, 208, 216, 226, 230, 232
HUMAN CENTRIFUGES, 213
HUMAN FACTORS ENGINEERING, 1, 8, 10, 14, 87, 206, 208, 210, 213, 218, 219, 224, 225, 229, 231, 232, 316
HUMAN PERFORMANCE, 161, 163, 211, 212, 214, 218, 220, 223, 241, 252
HUMAN TOLERANCES, 210, 226, 228
HUMAN–COMPUTER INTERFACE, 1, 85, 95, 219, 232, 236
HURRICANES, 196, 197
HYBRID CIRCUITS, 256
HYBRID COMPOSITES, 143
HYBRID COMPUTERS, 263
HYDROCARBONS, 168
HYDROGEN, 132, 133, 279, 282, 291, 311
HYDROGEN CHLORIDES, 182
HYDROGEN PEROXIDE, 70
HYDROGEN PLASMA, 307
HYDROGEN SULFIDE, 279
HYDROLOGICAL CYCLE, 158
HYDROLOGY, 150, 152, 156, 195, 314
HYDROLOGY MODELS, 149, 155, 156, 157, 158
HYDROXYL RADICALS, 277
HYPERSONIC FLIGHT, 18
HYPERSONIC SHOCK, 294
HYPERSONICS, 20
HYPERVELOCITY IMPACT, 64
HYPERVELOCITY PROJECTILES, 64
HYPNOSIS, 216

I

ICE, 6, 31
ICE FORMATION, 5, 6
ILLUMINATION, 179
ILMENITE, 303
IMAGE ANALYSIS, 161, 245
IMAGE CLASSIFICATION, 197, 259
IMAGE CONTRAST, 161, 163, 164
IMAGE FILTERS, 237
IMAGE PROCESSING, 107, 127, 148, 160, 162, 204, 234, 245, 249
IMAGE RESOLUTION, 326
IMAGERY, 161, 163, 164, 166, 234, 242
IMAGES, 151, 159, 238, 290
IMAGING TECHNIQUES, 90, 127, 129, 133, 259, 288, 289, 325, 326
IMPACT ACCELERATION, 207, 227, 230
IMPACT DAMAGE, 8, 9, 45, 142
IMPACT LOADS, 228, 300
IMPACT RESISTANCE, 45, 143
IMPACT TESTS, 30, 44, 46, 64, 207, 228, 230
IMPACT TOLERANCES, 19
IMPACTORS, 142
IMPEDANCE MATCHING, 78
IMPROVEMENT, 133
IMPULSES, 262
IMPURITIES, 302
IN–FLIGHT SIMULATION, 32
INCOMPRESSIBLE FLOW, 4
INDENTATION, 46
INDEPENDENT VARIABLES, 129
INDEXES (DOCUMENTATION), 321
INDIUM ARSENIDES, 307, 308
INDIUM COMPOUNDS, 172
INDIUM GALLIUM ARSENIDES, 122, 170, 174, 179, 180
INDIUM PHOSPHATES, 170, 171
INDIUM PHOSPHIDES, 101, 170, 171, 174, 175, 180, 307
INDUCTION MOTORS, 108
INDUCTORS, 105
INDUSTRIES, 75
INERTIA, 222, 313
INERTIAL CONFINEMENT FUSION, 124, 125
INERTIAL NAVIGATION, 18
INFESTATION, 153
INFLATABLE SPACE STRUCTURES, 36, 38
INFLATABLE STRUCTURES, 8, 37, 38
INFORMATION, 82
INFORMATION ADAPTIVE SYSTEM, 244
INFORMATION DISSEMINATION, 80, 207
INFORMATION FLOW, 86
INFORMATION MANAGEMENT, 85, 148, 149, 251
INFORMATION RESOURCES MANAGEMENT, 320
INFORMATION RETRIEVAL, 148, 244, 321
INFORMATION SYSTEMS, 80, 81, 84, 86, 88, 251, 321
INFORMATION THEORY, 270
INFORMATION TRANSFER, 251
INFRARED ABSORPTION, 49
INFRARED RADIATION, 49, 68, 154
INFRARED SPECTRA, 53, 118, 302
INFRARED SPECTROSCOPY, 48, 49, 52, 53, 182
INHOMOGENEITY, 301
INITIATION, 65
INJECTION LASERS, 123
INJECTION LOCKING, 123
INJECTORS, 40, 292
INJURIES, 8, 211, 212, 213, 226, 227, 228, 230
INLET FLOW, 4
INSECTS, 153, 204
INSERTION LOSS, 275
INSPECTION, 137
INSTRUCTORS, 314
INSULATORS, 66
INTAKE SYSTEMS, 4
INTEGRATED CIRCUITS, 54, 78, 97, 104, 105
INTELLIGENCE, 78, 85, 86
INTERDIGITAL TRANSDUCERS, 274
INTERFACIAL TENSION, 63
INTERFEROMETRY, 120
INTERLAMINAR STRESS, 43
INTERMETALLICS, 58
INTERNAL COMBUSTION ENGINES, 137
INTERNATIONAL SPACE STATION, 34, 35, 71
INTERNETS, 244, 320
INTERNUCLEAR PROPERTIES, 131
INTERSTELLAR MATTER, 330
INTRAMOLECULAR STRUCTURES, 283
INVARIANCE, 261
INVENTORIES, 149
INVERSIONS, 266
INVERTERS, 105
IODIDES, 305
ION ACOUSTIC WAVES, 278
ION BEAMS, 334

ION CYCLOTRON RADIATION, 292
ION DISTRIBUTION, 278
ION EMISSION, 125
ION IMPLANTATION, 306
ION IRRADIATION, 43
ION SOURCES, 291
ION TEMPERATURE, 293
IONIC COLLISIONS, 279
IONIZATION, 124, 176, 328, 335
IONIZED GASES, 294
IONIZING RADIATION, 283
IONS, 279
IRON, 49
IRRADIANCE, 323
IRRADIATION, 101, 124, 133, 174, 176, 288, 300
ISING MODEL, 67
ISOLATORS, 104
ISOMERIZATION, 52
ISOTROPIC MEDIA, 294

J

JAMMING, 290
JAVA (PROGRAMMING LANGUAGE), 247
JET AIRCRAFT NOISE, 110
JET FLOW, 111
JET LAG, 222
JET STREAMS (METEOROLOGY), 190
JOINTS (JUNCTIONS), 71, 131
JOSEPHSON EFFECT, 309
JOSEPHSON JUNCTIONS, 121, 309
JOURNAL BEARINGS, 138
JUNCTION DIODES, 311

K

K LINES, 283
K STARS, 325
KALAHARI BASIN (AFRICA), 166
KALMAN FILTERS, 157, 188
KERR CELLS, 55
KERR MAGNETOOPTICAL EFFECT, 67
KINETIC EQUATIONS, 293
KNOWLEDGE BASED SYSTEMS, 13, 37, 95, 244, 258
KNOWLEDGE BASES (ARTIFICIAL INTELLIGENCE), 238, 265
KNOWLEDGE REPRESENTATION, 318
KRYPTON FLUORIDE LASERS, 69

L

LABORATORIES, 140
LAMINAR FLOW, 111, 114
LAMINAR FLOW AIRFOILS, 5
LAMINATES, 44, 46
LAND USE, 152, 158, 166
LANDING GEAR, 14
LANDSAT 4, 261
LANDSAT 5, 261
LANDSAT SATELLITES, 151
LANTHANUM OXIDES, 309
LARGE SCALE INTEGRATION, 133, 246
LASER ALTIMETERS, 113, 166
LASER ANNEALING, 69, 133
LASER APPLICATIONS, 120, 123, 133
LASER BEAMS, 118, 120, 124, 126, 129, 131, 132, 133, 134, 280, 291
LASER CAVITIES, 134
LASER DRILLING, 132, 133
LASER INDUCED FLUORESCENCE, 277
LASER MATERIALS, 120
LASER OUTPUTS, 118, 119, 129, 130, 131, 136, 279
LASER PLASMA INTERACTIONS, 124, 125, 126, 299, 300, 301
LASER PLASMAS, 125, 206, 298
LASER POWER BEAMING, 120, 173
LASER PUMPING, 122, 123
LASER SPECTROSCOPY, 281
LASER TARGETS, 136
LASER WEAPONS, 119
LASERS, 131, 134, 135, 294
LATENT HEAT, 196
LATTICE PARAMETERS, 307
LAUNCH VEHICLE CONFIGURATIONS, 25
LAUNCH VEHICLES, 7
LAUNCHERS, 29
LAUNCHING, 26
LAUNCHING PADS, 29
LEAD (METAL), 305
LEAD TITANATES, 305
LEADING EDGE FLAPS, 7
LEARNING, 154, 314
LEAST SQUARES METHOD, 266
LECTURES, 1
LENS DESIGN, 324
LENSES, 324
LIAPUNOV FUNCTIONS, 260, 262, 264
LIFE CYCLE COSTS, 169, 240
LIFE SCIENCES, 71
LIFE SUPPORT SYSTEMS, 60, 201
LIFTING REENTRY VEHICLES, 25
LIGANDS, 58, 284
LIGHT AMPLIFIERS, 136
LIGHT BEAMS, 129, 179, 283
LIGHT EMISSION, 128, 304, 328
LIGHT MODULATORS, 121
LIGHT SOURCES, 180, 304
LIGHT TRANSMISSION, 122
LIGHTNING, 289
LINE OF SIGHT, 165
LINE SPECTRA, 295
LINEAR ENERGY TRANSFER (LET), 176
LINEAR QUADRATIC GAUSSIAN CONTROL, 261
LINEAR SYSTEMS, 233, 261, 269
LINEARITY, 97, 280
LINEARIZATION, 138, 264
LINKAGES, 190
LIPOPROTEINS, 53
LIQUEFACTION, 75, 194
LIQUID AMMONIA, 34
LIQUID CRYSTALS, 102, 262, 278, 289, 290, 307, 308, 310
LIQUID FLOW, 72
LIQUID HELIUM, 51
LIQUID PHASE EPITAXY, 171
LIQUID PROPELLANT ROCKET ENGINES, 39
LIQUID ROCKET PROPELLANTS, 70
LIQUID–LIQUID INTERFACES, 68, 72
LIQUIDS, 72, 205
LISP (PROGRAMMING LANGUAGE), 237, 244, 257
LITHIUM, 277
LITHIUM BATTERIES, 99
LITHIUM NIOBATES, 122, 275
LITHOGRAPHY, 54
LIVER, 201
LOAD TESTS, 117
LOADS (FORCES), 8, 20, 76
LOGARITHMS, 265
LOGIC CIRCUITS, 192, 251
LOGIC DESIGN, 73, 141, 250
LOGIC PROGRAMMING, 141, 250, 258, 317
LONG DURATION EXPOSURE FACILITY, 29, 333
LONG TERM EFFECTS, 184
LOOP ANTENNAS, 92
LOUDSPEAKERS, 262
LOW CONDUCTIVITY, 43
LOW COST, 24, 69, 171, 181
LOW FREQUENCIES, 217
LOW TEMPERATURE, 301, 302
LUBRICATION, 19

LUMINANCE, 163
LYMAN ALPHA RADIATION, 206

M

MACH NUMBER, 7, 12
MACH REFLECTION, 112
MACH–ZEHNDER INTERFEROMETERS, 115
MACHINE LEARNING, 167, 263, 264, 316
MACHINE TOOLS, 123
MACHINING, 137
MAGNESIUM, 52
MAGNESIUM ALLOYS, 56
MAGNETIC BEARINGS, 289
MAGNETIC DISKS, 236
MAGNETIC FIELD CONFIGURATIONS, 296, 298
MAGNETIC FIELD RECONNECTION, 331
MAGNETIC FIELDS, 116, 124, 126, 291, 296, 299
MAGNETIC FLUX, 291
MAGNETIC MATERIALS, 58
MAGNETIC MEASUREMENT, 296
MAGNETIC NOZZLES, 296
MAGNETIC PERMEABILITY, 99
MAGNETIC PROPERTIES, 58, 67, 193, 272
MAGNETIC RECORDING, 90, 236
MAGNETIC SIGNATURES, 332
MAGNETIC STORAGE, 236
MAGNETIZATION, 65, 193
MAGNETO–OPTICS, 67
MAGNETOHYDRODYNAMIC FLOW, 295, 296
MAGNETOHYDRODYNAMIC STABILITY, 278, 292, 297
MAGNETOHYDRODYNAMIC WAVES, 126, 292, 295
MAGNETOHYDRODYNAMICS, 20, 292, 297
MAGNETOSHEATH, 191, 295
MAGNETOSTATIC FIELDS, 99
MAGNETOSTATICS, 271
MAJORITY CARRIERS, 174
MALES, 218, 226
MAN MACHINE SYSTEMS, 84
MANAGEMENT INFORMATION SYSTEMS, 242, 252
MANAGEMENT PLANNING, 79, 321
MANAGEMENT SYSTEMS, 81, 86, 95
MANDRELS, 324
MANGANESE, 69
MANGANESE ALLOYS, 304
MANGANESE OXIDES, 53
MANIPULATORS, 258, 262
MANUAL CONTROL, 18
MANUALS, 89
MANUFACTURING, 41, 56, 69, 118, 133, 179, 181
MANURES, 185
MARKING, 94
MARKOV PROCESSES, 264, 268, 275
MARS ATMOSPHERE, 331
MARS EXPLORATION, 330
MARS GLOBAL SURVEYOR, 331
MARS MISSIONS, 330
MARS SURFACE, 331
MASKS, 54
MASS DISTRIBUTION, 199
MASS SPECTROSCOPY, 131
MATCHED FILTERS, 105, 164, 278
MATERIALS SCIENCE, 56, 140
MATHEMATICAL MODELS, 5, 8, 13, 17, 25, 34, 42, 44, 51, 59, 75, 76, 79, 80, 81, 82, 83, 84, 87, 88, 100, 111, 123, 138, 139, 142, 143, 144, 145, 150, 160, 161, 162, 163, 164, 165, 166, 167, 173, 189, 197, 198, 204, 209, 210, 211, 212, 213, 215, 228, 229, 230, 232, 233, 240, 241, 248, 252, 253, 255, 259, 263, 265, 275, 287, 294, 317, 329, 330, 333, 334, 336
MATRICES (MATHEMATICS), 233, 251, 267
MAXIMUM LIKELIHOOD ESTIMATES, 197
MAZE LEARNING, 244
MEASUREMENT, 123
MEASURING INSTRUMENTS, 134, 284
MECHANICAL PROPERTIES, 17, 143, 225, 287
MECHANICAL SHOCK, 210, 327
MELTS (CRYSTAL GROWTH), 303
MEMBRANES, 112
MEMORY, 263
MEMORY (COMPUTERS), 235, 244, 250, 306
MENTAL PERFORMANCE, 214, 218, 223
MERCURY COMPOUNDS, 305
MESSAGE PROCESSING, 95
METABOLIC WASTES, 185
METAL FILMS, 65, 108, 294, 317
METAL HYDRIDES, 58
METAL IONS, 51, 61, 99, 306
METAL OXIDE SEMICONDUCTORS, 103, 105, 235
METALLURGY, 56
METALORGANIC CHEMICAL VAPOR DEPOSITION, 170, 171, 307
METALS, 20, 56, 141, 144
METASTABLE STATE, 328
METEORITIC DAMAGE, 178
METEOROIDS, 144
METEOROLOGICAL PARAMETERS, 155
METEOROLOGICAL SATELLITES, 39, 106
METHANE, 47, 53, 114
METHOD OF CHARACTERISTICS, 263
METHOD OF MOMENTS, 109
METHOXY SYSTEMS, 303
METHYL COMPOUNDS, 55, 65, 281, 284
METROLOGY, 289
MEXICO, 152
MICROBALANCES, 49, 115
MICROBEAMS, 304
MICROCRYSTALS, 168
MICROELECTRONICS, 73, 108
MICROGRAVITY, 47, 71, 72, 201, 204, 288
MICROMECHANICS, 242, 287
MICROSCOPES, 118
MICROSCOPY, 53, 273
MICROSTRUCTURE, 57, 63, 64, 65, 67, 303, 312
MICROWAVE CIRCUITS, 78, 100
MICROWAVE IMAGERY, 150, 167
MICROWAVE REFLECTOMETERS, 296
MICROWAVE SENSORS, 167
MICROWAVES, 90
MIDAIR COLLISIONS, 193
MIGRATION, 202
MILITARY OPERATIONS, 79, 83, 85, 86, 217, 220, 221, 222, 223, 270
MILITARY TECHNOLOGY, 106
MILLIMETER WAVES, 104
MIM (SEMICONDUCTORS), 65
MINERALS, 203, 204
MINING, 200
MINORITIES, 184
MINORITY CARRIERS, 311
MIR SPACE STATION, 35
MIRRORS, 289, 324
MIS (SEMICONDUCTORS), 306, 308
MISSION PLANNING, 23, 81, 83
MIXING RATIOS, 116
MIXTURES, 168
MOBILE COMMUNICATION SYSTEMS, 94, 95
MODAL RESPONSE, 228
MODELS, 31, 142, 144, 210, 211, 213, 231, 275
MODEMS, 92

MODULATION, 93, 94, 195
MODULES, 237
MOISTURE CONTENT, 150, 156, 184, 190
MOLECULAR BEAM EPITAXY, 50, 308
MOLECULAR CHAINS, 64, 288
MOLECULAR CLOUDS, 330
MOLECULAR DYNAMICS, 131, 301
MOLECULAR GASES, 49
MOLECULAR IONS, 131, 132
MOLECULAR RELAXATION, 282
MOLECULAR STRUCTURE, 59, 131, 276, 279, 282
MOLTEN SALT ELECTROLYTES, 64
MONOCHROMATIC RADIATION, 130
MONOMERS, 65
MONTE CARLO METHOD, 269, 288
MORPHOLOGY, 304, 312, 326
MOTION, 317
MOTION PICTURES, 93
MOTION SICKNESS, 211
MOTORS, 257
MOUNTAINS, 168
MOVING TARGET INDICATORS, 164
MULTIDISCIPLINARY DESIGN OPTIMIZATION, 13, 16, 73
MULTIDISCIPLINARY RESEARCH, 12, 265, 314
MULTIGRID METHODS, 268
MULTIPHOTON ABSORPTION, 279
MULTIPLE ACCESS, 91
MULTISPECTRAL PHOTOGRAPHY, 318
MUSCLES, 226
MUSCULOSKELETAL SYSTEM, 71, 215

N

NANOCRYSTALS, 305, 308
NANOSTRUCTURES (DEVICES), 308
NASA PROGRAMS, 1, 42, 186, 265
NASTRAN, 42, 145
NATURAL LANGUAGE PROCESSING, 247
NAVIER–STOKES EQUATION, 114, 268
NAVIGATION, 255, 257
NAVIGATION SATELLITES, 11
NEAR FIELDS, 92
NEAR INFRARED RADIATION, 120, 133
NEBULAE, 329
NECK (ANATOMY), 227, 228, 229
NEGATIVE CONDUCTANCE, 98
NEGATIVE IONS, 291, 297
NEGATIVE RESISTANCE DEVICES, 98
NEODYMIUM LASERS, 133
NETHERLANDS, 336
NETWORK CONTROL, 320
NEURAL NETS, 75, 216, 226, 256, 259, 262, 263, 316
NEURONS, 263
NEUROPHYSIOLOGY, 230
NEUTRON ACTIVATION ANALYSIS, 299
NEUTRONS, 284
NEW MEXICO, 190
NEXT GENERATION SPACE TELESCOPE PROJECT, 37, 322
NICKEL, 130, 136
NICKEL ALLOYS, 56, 58
NICKEL COMPOUNDS, 58
NIOBIUM ALLOYS, 109
NITRIC ACID, 49
NITRIC OXIDE, 182
NITRIDES, 62
NITROGEN, 50, 133
NITROGEN COMPOUNDS, 205
NITROGEN OXIDES, 279
NITROGEN PLASMA, 310
NITROSYLS, 282
NOISE (SOUND), 272, 326
NOISE REDUCTION, 110, 138, 273
NONDESTRUCTIVE TESTS, 266
NONLINEAR OPTICS, 60, 62, 286, 305, 310
NONLINEAR PROGRAMMING, 191
NONLINEAR SYSTEMS, 41, 248, 260, 264, 268
NONLINEARITY, 42, 68, 93, 97, 121, 135, 146, 205, 256, 263, 265, 276, 286, 303
NORMAL DENSITY FUNCTIONS, 334
NORMS, 259
NORTH AMERICA, 147, 202
NORTH ATLANTIC TREATY ORGANIZATION (NATO), 336, 337
NUCLEAR ELECTRIC POWER GENERATION, 233
NUCLEAR FUELS, 285
NUCLEAR FUSION, 291
NUCLEAR PROPULSION, 41
NUCLEAR RADIATION, 48
NUCLEAR REACTIONS, 53
NUCLEAR SCATTERING, 328
NUCLEAR WEAPONS, 270
NUCLEATION, 307
NUMERICAL ANALYSIS, 99, 130, 132, 272, 280, 281
NUTRITION, 203

O

OBJECT–ORIENTED PROGRAMMING, 82, 239, 245, 247
OBSERVATION, 59, 127, 314, 323
OCCUPATIONAL DISEASES, 210, 232
OCEAN BOTTOM, 189
OCEAN MODELS, 188
OCEANOGRAPHY, 198
OCEANS, 199
OIL RECOVERY, 64
OILS, 225
ON–LINE SYSTEMS, 167, 249, 251, 268
ONBOARD DATA PROCESSING, 249
ONBOARD EQUIPMENT, 115
OPACITY, 127
OPERATING COSTS, 27
OPERATING TEMPERATURE, 180
OPERATIONAL HAZARDS, 210
OPERATIONAL PROBLEMS, 119
OPERATOR PERFORMANCE, 164
OPTICAL COMMUNICATION, 95, 108, 121
OPTICAL COMPUTERS, 262
OPTICAL CONTROL, 291
OPTICAL DISKS, 317
OPTICAL EQUIPMENT, 117, 276, 285, 289, 291, 306, 322, 326
OPTICAL FIBERS, 121, 154, 287, 288
OPTICAL FILTERS, 288
OPTICAL INTERCONNECTS, 108
OPTICAL MATERIALS, 276, 285, 303
OPTICAL MEASUREMENT, 150, 290
OPTICAL MEASURING INSTRUMENTS, 290
OPTICAL MEMORY (DATA STORAGE), 287, 317
OPTICAL POLARIZATION, 288
OPTICAL PROPERTIES, 42, 128, 276, 286, 288, 305, 326, 333
OPTICAL PUMPING, 308
OPTICAL RADAR, 114, 116
OPTICAL REFLECTION, 283
OPTICAL RESONATORS, 104
OPTICAL TRACKING, 159, 160, 161, 162, 163, 164
OPTICAL WAVEGUIDES, 289, 306
OPTIMAL CONTROL, 253, 261, 262
OPTIMIZATION, 12, 19, 75, 193, 245, 256
OPTOELECTRONIC DEVICES, 283, 308
ORGANIC CHEMISTRY, 280
ORGANIC COMPOUNDS, 65, 202, 305
ORGANIC MATERIALS, 184, 285, 286, 303

ORGANIC PEROXIDES, 64
ORGANIC PHOSPHORUS COMPOUNDS, 220
ORGANOMETALLIC COMPOUNDS, 52, 53, 54, 285
OSCILLATIONS, 113, 195, 254, 302
OSCILLATOR STRENGTHS, 130
OSCILLATORS, 97, 134
OSCILLOSCOPES, 114
OUTER RADIATION BELT, 333
OVENS, 202
OXIDATION, 51, 55, 64, 65, 295
OXIDATION RESISTANCE, 59
OXIDATION–REDUCTION REACTIONS, 68
OXIDE FILMS, 65
OXYGEN, 47, 133
OXYGEN ATOMS, 277, 295
OZONE, 53, 188, 189, 200
OZONE DEPLETION, 200
OZONOMETRY, 188
OZONOSPHERE, 200

P

P–N JUNCTIONS, 101, 120, 170, 171, 175, 311
PACKING DENSITY, 63
PAINTS, 64
PALLADIUM, 63, 98
PALLADIUM COMPOUNDS, 98
PANEL METHOD (FLUID DYNAMICS), 17
PANELS, 44
PAPER (MATERIAL), 60
PARABOLAS, 134
PARALLEL PROCESSING (COMPUTERS), 191, 192, 235, 244, 250, 251, 268
PARALLEL PROGRAMMING, 191, 250
PARALYSIS, 215
PARAMETER IDENTIFICATION, 255
PARAMETRIC AMPLIFIERS, 122
PARTIAL PRESSURE, 309
PARTICLE ENERGY, 295
PARTICLE SPIN, 67
PARTICLE THEORY, 312
PASSIVITY, 48
PATENT APPLICATIONS, 40
PATHOLOGY, 213
PATHS, 243
PATTERN RECOGNITION, 197, 218, 237, 239, 241, 245, 263, 266
PAYLOADS, 29
PEGASUS AIR–LAUNCHED BOOSTER, 18, 32
PENCIL BEAMS, 120
PENETRATION, 128, 144
PERCEPTION, 252
PERCUSSION, 132
PERFORMANCE PREDICTION, 5, 6, 40, 116, 159, 160, 161, 162, 167, 174, 180, 225, 241
PERFORMANCE TESTS, 4, 24, 30, 36, 72, 91, 96, 98, 99, 100, 112, 115, 118, 134, 170, 173, 176, 182
PERIODIC VARIATIONS, 194
PERIPHERAL VISION, 165
PERMANENT MAGNETS, 271
PERMITTIVITY, 184
PERSONAL COMPUTERS, 95, 133, 227
PERSONALITY, 218
PERSONNEL, 216, 220, 222, 223
PERTURBATION, 23, 72
PERTURBATION THEORY, 23, 277
PETRI NETS, 270
PH, 42, 203
PHASE CONTROL, 260
PHASE LOCKED SYSTEMS, 107, 260
PHASE SHIFT, 72, 96
PHASE SHIFT CIRCUITS, 96
PHASE SHIFT KEYING, 94
PHASE TRANSFORMATIONS, 51
PHASED ARRAYS, 96
PHENOLS, 53
PHENYLS, 65
PHONEMES, 94
PHOSPHINES, 309
PHOSPHORS, 69, 133
PHOSPHORUS, 286
PHOSPHORUS ISOTOPES, 277
PHOTOCHEMICAL REACTIONS, 53, 55, 186, 281, 286
PHOTODISSOCIATION, 281
PHOTOELECTRON SPECTROSCOPY, 63
PHOTOELECTRONS, 281
PHOTOGRAPHS, 219, 234
PHOTOIONIZATION, 279, 281
PHOTOLUMINESCENCE, 68, 304, 305, 311
PHOTOMETRY, 323, 326
PHOTON–ELECTRON INTERACTION, 119
PHOTONICS, 95, 304, 308
PHOTONS, 334
PHOTORECEPTORS, 204
PHOTOREFRACTIVITY, 304
PHOTOSYNTHESIS, 203
PHOTOVOLTAGES, 120, 177
PHOTOVOLTAIC CELLS, 61, 178, 179
PHOTOVOLTAIC CONVERSION, 40, 41, 101, 168, 169, 170, 173, 178, 179, 181
PHTHALOCYANIN, 285, 286
PHYSICAL CHEMISTRY, 56
PHYSICAL PROPERTIES, 51
PHYSIOLOGICAL EFFECTS, 71, 213, 214
PHYSIOLOGICAL FACTORS, 14
PHYSIOLOGICAL RESPONSES, 8, 207, 208, 210, 213, 227, 229, 231
PHYSIOLOGICAL TESTS, 219
PIEZOELECTRIC CRYSTALS, 49
PIEZOELECTRICITY, 143, 274
PILOT PERFORMANCE, 14, 213, 219
PILOT SELECTION, 219
PILOT TRAINING, 1, 10, 219
PILOTLESS AIRCRAFT, 18, 178
PINS, 113
PIPE FLOW, 111, 114
PIPELINING (COMPUTERS), 192
PIXELS, 259, 318
PLANE WAVES, 112
PLANETARY NEBULAE, 328
PLANNING, 317
PLANT STRESS, 153
PLANTS (BOTANY), 195
PLASMA ANTENNAS, 295
PLASMA CLOUDS, 296
PLASMA CONTROL, 291, 292
PLASMA DENSITY, 294, 298
PLASMA DIAGNOSTICS, 177, 296
PLASMA ELECTRODES, 291
PLASMA ETCHING, 296
PLASMA FREQUENCIES, 294
PLASMA INTERACTIONS, 177, 294
PLASMA POTENTIALS, 294
PLASMA WAVES, 294
PLASMAS (PHYSICS), 118, 128, 129, 177, 278, 292, 294, 295, 297, 299, 300, 301
PLASTIC FLOW, 139
PLATES (STRUCTURAL MEMBERS), 143
PLATING, 122
POLAR WANDERING (GEOLOGY), 193
POLARITONS, 122
POLARIZATION, 287
POLARIZATION (WAVES), 290, 297
POLARIZED RADIATION, 298
POLLUTION CONTROL, 187
POLLUTION MONITORING, 115, 149, 187
POLYACRYLONITRILE, 43
POLYAMIDE RESINS, 62
POLYATOMIC MOLECULES, 131, 282
POLYCRYSTALS, 172, 173, 193
POLYGONS, 267

POLYIMIDES, 62, 69
POLYMER MATRIX COMPOSITES, 46
POLYMERIC FILMS, 66, 69, 122, 278, 288
POLYMERIZATION, 68
POLYMERS, 64
POLYMETHYL METHACRYLATE, 60
POLYSTYRENE, 65
POLYTETRAFLUOROETHYLENE, 59
POPULATIONS, 222
POROSITY, 50, 193
PORPHYRINS, 286
POSITION (LOCATION), 161, 162, 218, 247, 264
POSITIONING, 11
POSTLAUNCH REPORTS, 29
POTATOES, 60, 203, 204
POTENTIAL FLOW, 17
POWER AMPLIFIERS, 100
POWER CONVERTERS, 103, 120
POWER LIMITERS, 285
POWER SUPPLIES, 214
POWER TRANSMISSION, 105
PRASEODYMIUM, 52
PRECIPITATES, 67
PRECIPITATION (METEOROLOGY), 196
PRECIPITATION HARDENING, 67
PRECISION, 123
PREDICTION ANALYSIS TECHNIQUES, 268
PREDICTIONS, 188, 212
PREFLIGHT OPERATIONS, 29, 32
PRELAUNCH PROBLEMS, 26
PREMIXED FLAMES, 47
PREPROCESSING, 263
PRESERVING, 225
PRESSURE BREATHING, 210, 230, 231
PRESSURE EFFECTS, 113
PRESSURE GRADIENTS, 4
PRESSURE SUITS, 210, 230, 231
PRETREATMENT, 185
PRINCIPAL COMPONENTS ANALYSIS, 151
PRIORITIES, 1
PRISMS, 113
PROBABILITY DISTRIBUTION FUNCTIONS, 269
PROBABILITY THEORY, 42, 269
PROBLEM SOLVING, 248
PROCEDURES, 130, 134, 136, 188, 224, 248, 253
PROCUREMENT, 100, 337
PRODUCT DEVELOPMENT, 60, 170, 172, 173, 206, 240
PRODUCTIVITY, 166, 223
PROGRAM VERIFICATION (COMPUTERS), 238
PROGRAMMING ENVIRONMENTS, 249
PROGRAMMING LANGUAGES, 82, 239, 245, 250
PROJECT MANAGEMENT, 1, 79, 249
PROJECTILES, 94, 144
PROPAGATION (EXTENSION), 118, 335
PROPORTIONAL CONTROL, 256, 260
PROPULSION SYSTEM CONFIGURATIONS, 21
PROPULSION SYSTEM PERFORMANCE, 21, 39, 41, 70, 285
PROPULSIVE EFFICIENCY, 103
PROPYLENE, 113
PROTECTION, 117, 212, 229
PROTECTIVE CLOTHING, 208
PROTECTIVE COATINGS, 59, 66
PROTEINS, 201, 225
PROTOCOL (COMPUTERS), 259, 320
PROTONS, 174, 176, 299, 333, 334
PROTOTYPES, 41, 281
PSYCHOPHYSIOLOGY, 161
PULLING, 288
PULSE CODE MODULATION, 234
PULSE DURATION, 131, 284
PULSE RADAR, 124, 135
PULSED LASER DEPOSITION, 62
PULSED LASERS, 130, 131, 134, 173, 179, 283, 285, 299, 301
PURIFICATION, 305
PURITY, 67, 305
PUSH–PULL AMPLIFIERS, 105
PYROELECTRICITY, 305
PYROTECHNICS, 212

Q

Q FACTORS, 119
QUADRATURES, 332
QUALIFICATIONS, 140
QUANTITATIVE ANALYSIS, 103, 131, 169, 226
QUANTUM THEORY, 312
QUANTUM WELLS, 313
QUARTZ CRYSTALS, 49, 115
QUEUEING THEORY, 246
QUOTIENTS, 90

R

RADAR DATA, 168
RADAR IMAGERY, 30
RADAR MAPS, 30
RADAR MEASUREMENT, 196
RADAR RECEIVERS, 94
RADAR TRANSMITTERS, 94
RADIATION DAMAGE, 175, 212
RADIATION DETECTORS, 48
RADIATION DOSAGE, 211, 212
RADIATION EFFECTS, 97, 98, 175
RADIATION INJURIES, 212
RADIATION PRESSURE, 23
RADIATION SOURCES, 128
RADIATION SPECTRA, 290
RADIATION TOLERANCE, 171, 176, 180
RADIATION TRAPPING, 333, 334
RADIATIVE HEAT TRANSFER, 198
RADIATIVE TRANSFER, 200
RADICALS, 62
RADIO ANTENNAS, 92
RADIO ASTRONOMY, 326
RADIO COMMUNICATION, 94
RADIO FREQUENCIES, 33, 78, 100, 108, 295
RADIO RECEIVERS, 326
RADIO TRANSMISSION, 92
RADIOBIOLOGY, 132, 206
RADIOISOTOPE BATTERIES, 30, 180
RADIOMETERS, 167
RADOME MATERIALS, 46
RADOMES, 46
RAIN, 185, 196
RAMAN SPECTRA, 154, 196, 298, 301, 302
RAMAN SPECTROSCOPY, 48, 54, 305
RANDOM ACCESS MEMORY, 235
RANDOM NUMBERS, 269
RAPID EYE MOVEMENT STATE, 215
RARE EARTH ELEMENTS, 102
RARE GASES, 277
RAYLEIGH WAVES, 189
REACTION KINETICS, 50, 53, 277
REAL TIME OPERATION, 79, 84, 91, 115, 143, 204, 231, 238, 248, 321
RECEIVERS, 108
RECOMBINATION REACTIONS, 311
RECONNAISSANCE, 269
RECORDS, 222
RECOVERABLE LAUNCH VEHICLES, 25, 26
RECOVERABLE SPACECRAFT, 25
RECTANGULAR PANELS, 113
RECYCLING, 51, 60
REDUCED ORDER FILTERS, 188
REENTRY, 253
REFLECTANCE, 176, 194
REFLECTED WAVES, 112, 294
REFRACTOMETERS, 290

REFRACTORY METALS, 59
REFRIGERANTS, 59
REGULATIONS, 186
REINFORCED PLASTICS, 46
REINFORCEMENT (STRUCTURES), 146
REJECTION, 54
RELATIVISTIC ELECTRON BEAMS, 129
RELAXATION (MECHANICS), 307
RELIABILITY, 30, 133
RELIABILITY ANALYSIS, 91, 140, 182
RELIABILITY ENGINEERING, 140
REMOTE CONTROL, 255
REMOTE SENSING, 49, 106, 114, 148, 150, 153, 155, 156, 157, 167, 184, 190
REMOTE SENSORS, 138, 166
REMOTELY PILOTED VEHICLES, 18
REMOVAL, 188
REPLENISHMENT, 203, 204
REPRESENTATIONS, 244
REPRODUCTION (COPYING), 324
REPUBLIC OF SOUTH AFRICA, 166
REQUIREMENTS, 22
RESCUE OPERATIONS, 14
RESEARCH, 1, 53, 68, 132, 176, 184, 251, 281, 301, 337
RESEARCH AND DEVELOPMENT, 1, 32, 36, 100, 238, 284, 291, 313, 328, 336, 337
RESEARCH FACILITIES, 124, 134, 135, 136
RESEARCH MANAGEMENT, 101
RESEARCH VEHICLES, 32
RESONANT TUNNELING, 98, 103, 104
RESONATORS, 274
RESOURCES MANAGEMENT, 149, 183, 251
RESPIRATORY PHYSIOLOGY, 207
RESPIRATORY SYSTEM, 207
RETARDING, 277
RETINA, 119
REUSABLE LAUNCH VEHICLES, 25, 26
REUSABLE ROCKET ENGINES, 70
REUSABLE SPACECRAFT, 26
REUSE, 201
REYNOLDS AVERAGING, 268
REYNOLDS NUMBER, 7
RHEOLOGY, 191
RHYTHM (BIOLOGY), 206
RIGID STRUCTURES, 56
RIO GRANDE (NORTH AMERICA), 190
ROBOT CONTROL, 254, 255
ROBOT DYNAMICS, 263
ROBOTICS, 255, 256, 258, 313, 316
ROBOTS, 254, 255, 257, 258, 261, 264
ROBUSTNESS (MATHEMATICS), 74, 76, 240, 261, 269
ROCKET ENGINE DESIGN, 20, 40
ROCKET ENGINES, 33, 39, 40, 41
ROCKET FLIGHT, 39
ROCKET LAUNCHING, 39
ROCKET OXIDIZERS, 51
ROOFS, 145
ROOM TEMPERATURE, 48, 302
ROTARY WING AIRCRAFT, 2, 3, 6, 10, 15, 16, 141, 144, 145, 242
ROTARY WINGS, 45
ROTATING DISKS, 241
ROTATING FLUIDS, 50, 112
ROTATION, 248
ROTOR AERODYNAMICS, 15
ROTOR SPEED, 108
ROTORS, 5
RUSSIAN SPACE PROGRAM, 30

S

S MATRIX THEORY, 267
S WAVES, 295
SAFETY, 253
SAFETY DEVICES, 208, 229
SAFETY FACTORS, 8, 229
SAFETY MANAGEMENT, 9, 230
SANDS, 189
SANDWICH STRUCTURES, 44, 45
SAPPHIRE, 116
SATELLITE COMMUNICATION, 89
SATELLITE DESIGN, 24, 181
SATELLITE IMAGERY, 151, 152, 184, 197, 198, 261
SATELLITE OBSERVATION, 186
SATELLITE SOUNDING, 106, 138
SATELLITE–BORNE INSTRUMENTS, 155
SCALE MODELS, 3, 10, 229
SCALING, 267
SCANNERS, 118, 196
SCANNING, 102
SCANNING TUNNELING MICROSCOPY, 63
SCENE ANALYSIS, 160
SCENE GENERATION, 242
SCHEDULING, 191, 322
SCHLIEREN PHOTOGRAPHY, 120
SCHOTTKY DIODES, 98
SCIENCE, 154, 315
SEA FLOOR SPREADING, 200
SEA SURFACE TEMPERATURE, 195
SEALERS, 117
SEARCHING, 320
SEATS, 228, 230
SECONDARY EMISSION, 284
SECONDARY FLOW, 4
SECURITY, 100
SEDIMENTS, 155, 158, 189
SEISMOLOGY, 193, 194
SELECTION, 158
SELF PROPAGATION, 298
SEMANTICS, 247, 258
SEMICONDUCTING FILMS, 309
SEMICONDUCTOR DEVICES, 303, 304
SEMICONDUCTOR JUNCTIONS, 109
SEMICONDUCTOR LASERS, 121, 122, 123
SEMICONDUCTOR PLASMAS, 296, 311
SEMICONDUCTORS (MATERIALS), 62, 93, 104, 109, 120, 173, 283, 286, 294, 304, 307, 308, 309, 310, 313
SENSITIVITY, 55, 158, 198
SENSORS, 116
SEQUENCING, 268
SERVICE LIFE, 70, 140
SERVOMECHANISMS, 255, 260
SEX FACTOR, 222
SEYFERT GALAXIES, 328, 329, 335
SHADOWGRAPH PHOTOGRAPHY, 118
SHAFTS (MACHINE ELEMENTS), 138
SHAPES, 6, 258
SHEAR PROPERTIES, 43
SHOCK LOADS, 127
SHOCK TUBES, 273
SHOCK WAVE INTERACTION, 273, 294
SHOCK WAVE PROPAGATION, 124, 127
SHOCK WAVES, 112, 273, 294, 300, 331
SHUTTLE IMAGING RADAR, 30
SIBERIA, 168
SIGNAL ANALYSIS, 107
SIGNAL DETECTION, 164
SIGNAL DETECTORS, 192
SIGNAL DISTORTION, 90
SIGNAL MEASUREMENT, 92, 214, 215
SIGNAL PROCESSING, 11, 78, 93, 215, 234, 325
SIGNAL TO NOISE RATIOS, 236
SIGNATURE ANALYSIS, 159, 160
SIGNS AND SYMPTOMS, 222
SILICA GLASS, 286
SILICATES, 287
SILICON, 74, 78, 306
SILICON CARBIDES, 55, 63, 98, 302, 311, 312

SILICON DIOXIDE, 61, 274, 286
SILICON FILMS, 43, 50, 61, 66, 69
SILICON NITRIDES, 63, 66
SILICONE RUBBER, 117
SILOXANES, 64
SILVER, 288, 306
SIMULATED ANNEALING, 268
SIMULATION, 21, 72, 89, 100, 112, 159, 165, 208, 234, 242, 253, 279, 293
SIMULATORS, 17, 39, 89, 135, 285
SINGLE CRYSTALS, 139, 303, 309
SIS (SUPERCONDUCTORS), 109, 326
SKIN (ANATOMY), 212
SLEEP, 206, 215, 216, 217, 220, 221, 222, 224
SLEEP DEPRIVATION, 217, 220, 222, 223
SLEEVES, 138
SLENDER BODIES, 172
SLIPSTREAMS, 112
SLOT ANTENNAS, 78
SMALL SATELLITE TECHNOLOGY, 66
SOCIOLOGY, 317
SODIUM CHLORIDES, 64
SOFTENING, 137
SOFTWARE DEVELOPMENT TOOLS, 238, 259
SOFTWARE ENGINEERING, 6, 148, 238, 239, 247, 249
SOHO MISSION, 332
SOI (SEMICONDUCTORS), 103, 107
SOIL MOISTURE, 150, 151, 152, 154, 155, 156, 157, 167, 184, 190
SOIL SAMPLING, 152
SOIL SCIENCE, 150, 151, 166, 184, 185, 200
SOILS, 152, 156, 185, 188, 201
SOL–GEL PROCESSES, 60, 276
SOLAR ACTIVITY, 323, 331, 332
SOLAR ARRAYS, 22, 40, 41, 169, 177, 178
SOLAR CELLS, 69, 101, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 182, 307
SOLAR COLLECTORS, 38
SOLAR CORONA, 331, 332
SOLAR CYCLES, 333
SOLAR ENERGY, 323
SOLAR FLARES, 331
SOLAR GENERATORS, 178
SOLAR INSTRUMENTS, 323
SOLAR MAGNETIC FIELD, 331
SOLAR RADIATION, 23, 200, 323
SOLAR SPECTROMETERS, 332
SOLAR WIND, 191, 295, 325
SOLID ELECTROLYTES, 64
SOLID STATE LASERS, 120, 123
SOLID WASTES, 184
SOLIDS, 299
SOLITARY WAVES, 294
SOLUBILITY, 59
SOLVENT EXTRACTION, 63
SOOT, 47
SOUND LOCALIZATION, 275
SOUND WAVES, 262, 273
SOUNDING, 158
SOUNDING ROCKETS, 39
SOUTHERN HEMISPHERE, 188
SOUTHERN OSCILLATION, 195
SPACE DEBRIS, 23, 144
SPACE EXPLORATION, 23
SPACE FLIGHT, 23, 73
SPACE MISSIONS, 31, 203
SPACE PERCEPTION, 91, 219, 274
SPACE PLASMAS, 177
SPACE RENDEZVOUS, 24
SPACE SHUTTLE MISSIONS, 35
SPACE SHUTTLE ORBITERS, 27, 137, 253
SPACE SHUTTLES, 27, 29, 33
SPACE STORAGE, 40
SPACE TRANSPORTATION, 26
SPACE TRANSPORTATION SYSTEM, 26, 27, 28, 29, 30, 31, 33, 70
SPACE TRANSPORTATION SYSTEM FLIGHTS, 27, 28, 29, 30, 31, 334
SPACE VEHICLE CHECKOUT PROGRAM, 26
SPACE–TIME FUNCTIONS, 273, 312
SPACEBORNE ASTRONOMY, 27, 38
SPACEBORNE EXPERIMENTS, 37, 204
SPACECRAFT ANTENNAS, 96
SPACECRAFT CHARGING, 109
SPACECRAFT COMMUNICATION, 22
SPACECRAFT COMPONENTS, 73
SPACECRAFT CONFIGURATIONS, 34, 37, 330
SPACECRAFT DESIGN, 23, 33, 37, 141
SPACECRAFT DOCKING, 24
SPACECRAFT MAINTENANCE, 27
SPACECRAFT PROPULSION, 33
SPACECRAFT REENTRY, 25
SPACECRAFT STRUCTURES, 37
SPACECREWS, 26, 27, 28, 29, 30, 31
SPATIAL DEPENDENCIES, 44, 91, 263
SPATIAL DISTRIBUTION, 150, 156, 318
SPECIFICATIONS, 24
SPECTRAL BANDS, 153, 259
SPECTRAL EMISSION, 102, 335
SPECTRAL METHODS, 335
SPECTRAL REFLECTANCE, 154
SPECTRAL RESOLUTION, 48, 132
SPECTROMETERS, 55, 331
SPECTROSCOPIC ANALYSIS, 120
SPECTROSCOPY, 55, 58, 277
SPECTRUM ANALYSIS, 89, 102, 329, 331, 335, 336
SPEECH, 77
SPEECH RECOGNITION, 91, 94, 252, 275
SPEED CONTROL, 108
SPEED REGULATORS, 140
SPHEROMAKS, 292
SPIN GLASS, 67
SPINE, 227
SPIRAL GALAXIES, 328
SPONTANEOUS EMISSION, 130
SPREAD SPECTRUM TRANSMISSION, 92, 105
SPUTTERING, 65, 67, 107, 122, 272
STABILITY, 118, 129, 176, 256, 298, 326
STABILITY TESTS, 25, 248, 260
STABILIZATION, 290
STANDARDIZATION, 169
STANDARDS, 100
STANDING WAVE RATIOS, 78
STAR DISTRIBUTION, 323
STATIC STABILITY, 41
STATISTICAL ANALYSIS, 75, 141, 159, 160, 189, 202
STATISTICAL DISTRIBUTIONS, 162, 195, 323
STATISTICAL MECHANICS, 268
STELLAR ROTATION, 323
STELLAR SPECTRA, 325
STELLAR WINDS, 325
STELLARATORS, 291, 292
STEREOSCOPIC VISION, 192, 219, 271
STIMULATED EMISSION, 311
STIMULATION, 201, 215, 301
STOCHASTIC PROCESSES, 42
STRAIN GAGES, 117
STRAIN RATE, 228
STRATEGY, 31
STRATIGRAPHY, 190
STRATOSPHERE, 186, 200
STRESS (BIOLOGY), 223
STRESS (PHYSIOLOGY), 208, 215
STRESS (PSYCHOLOGY), 215
STRESS ANALYSIS, 42, 139, 145, 146, 219
STRESS CYCLES, 145
STRESS–STRAIN RELATIONSHIPS, 46, 146
STRETCHING, 69

STRING THEORY, 312
STRONTIUM 90, 51
STRUCTURAL ANALYSIS, 20, 42, 44, 46, 143, 146, 273
STRUCTURAL BASINS, 190
STRUCTURAL DESIGN, 13, 31, 73
STRUCTURAL DESIGN CRITERIA, 145
STRUCTURAL FAILURE, 2, 16, 20, 57
STRUCTURAL MEMBERS, 239
STRUCTURAL RELIABILITY, 2, 16, 76
STRUCTURAL STABILITY, 284
STRUCTURAL VIBRATION, 284
STUDENTS, 184, 315
STYRENES, 63
SUBGROUPS, 267
SUBMILLIMETER WAVES, 34, 93, 104, 109, 330
SUBROUTINE LIBRARIES (COMPUTERS), 233
SUBSONIC SPEED, 5
SUBSTRATES, 54, 61, 78, 106, 116, 302
SULFUR COMPOUNDS, 277
SULFUR DIOXIDES, 182
SUN, 323
SUPERCONDUCTING FILMS, 116, 309
SUPERCONDUCTIVITY, 109, 116
SUPERCRITICAL FLUIDS, 53
SUPERGIANT STARS, 325
SUPERGRAVITY, 312
SUPERHETERODYNE RECEIVERS, 90
SUPERNOVA REMNANTS, 300, 329
SUPERSONIC AIRCRAFT, 16
SUPERSONIC FLOW, 296
SUPERSONIC JET FLOW, 110
SUPERSONIC SPEED, 12
SUPERSONIC TRANSPORTS, 7, 12, 13, 76, 110
SUPERSYMMETRY, 312
SUPPORT SYSTEMS, 37, 81, 236
SURFACE ACOUSTIC WAVE DEVICES, 65, 105, 106, 108, 274
SURFACE DEFECTS, 266
SURFACE ENERGY, 155
SURFACE LAYERS, 307
SURFACE PROPERTIES, 310
SURFACE REACTIONS, 51, 205, 301
SURFACE ROUGHNESS, 199
SURFACE TEMPERATURE, 151
SURFACE VEHICLES, 163
SURFACE WATER, 184, 202
SURFACE WAVES, 115
SURFACTANTS, 68
SURVEILLANCE, 100, 178, 269
SURVEYS, 14, 186
SWITCHING, 58
SYNCHRONISM, 217, 245, 268
SYNCHRONOUS MOTORS, 101
SYNCHRONOUS SATELLITES, 37
SYNCHROTRON RADIATION, 288
SYNTHESIS (CHEMISTRY), 42, 50, 60, 286
SYNTHETIC APERTURE RADAR, 168
SYSTEM EFFECTIVENESS, 83
SYSTEM IDENTIFICATION, 143, 215, 255
SYSTEMS ANALYSIS, 88, 94, 239, 248
SYSTEMS ENGINEERING, 12, 13, 24, 73, 83, 85, 239, 240, 241, 265
SYSTEMS HEALTH MONITORING, 2, 15, 16, 20
SYSTEMS INTEGRATION, 22, 191, 192, 226, 240
SYSTOLIC ARRAYS, 250

T

TABLES (DATA), 98, 337
TALKING, 28, 30
TANTALUM, 65, 103
TARGET ACQUISITION, 159, 160, 161, 162, 163, 164, 165, 166, 219, 241, 242
TARGET RECOGNITION, 159, 160, 161, 162, 163, 164, 165, 166, 218, 219, 241, 242, 269
TARGETS, 124, 144
TASK PLANNING (ROBOTICS), 316
TAXONOMY, 147
TDR SATELLITES, 24, 33
TECHNOLOGY ASSESSMENT, 60, 69, 106, 134, 136, 172, 173, 180, 181, 224
TECHNOLOGY TRANSFER, 169
TECHNOLOGY UTILIZATION, 26, 40, 43, 169, 170, 172, 173, 174, 175, 178, 179, 226, 307, 337
TELECOMMUNICATION, 89, 91, 96
TELECONFERENCING, 95
TELEMETRY, 33
TELEOPERATORS, 255
TELESCOPES, 118, 289, 323, 325
TEMPERATURE CONTROL, 202
TEMPERATURE DEPENDENCE, 98, 99
TEMPERATURE EFFECTS, 283, 297
TEMPERATURE GRADIENTS, 293, 303
TEMPERATURE MEASUREMENT, 125, 295
TEMPERATURE PROFILES, 116, 150
TEMPERATURE RATIO, 180
TEMPORAL DISTRIBUTION, 150, 263
TENSILE PROPERTIES, 69
TERMINOLOGY, 319
TERPHENYLS, 55
TEST CHAMBERS, 33
TEST FACILITIES, 138
TEST STANDS, 143
TETHERING, 34, 35, 330
TETHERLINES, 35, 66
TEXTS, 252
TEXTURES, 91, 162, 163
THEMATIC MAPPERS (LANDSAT), 261
THEMATIC MAPPING, 152, 153, 261
THEOREMS, 265
THEORETICAL PHYSICS, 312, 313
THERMAL ANALYSIS, 68, 114
THERMAL DIFFUSIVITY, 292
THERMAL EMISSION, 331
THERMAL ENERGY, 76, 77
THERMAL ENVIRONMENTS, 34
THERMAL PROTECTION, 31
THERMAL RADIATION, 34
THERMAL VACUUM TESTS, 38, 113
THERMODYNAMIC CYCLES, 20
THERMODYNAMIC PROPERTIES, 59
THERMODYNAMICS, 56
THERMOELECTRIC GENERATORS, 30
THERMONUCLEAR REACTIONS, 73
THERMOPHOTOVOLTAIC CONVERSION, 102
THERMOPLASTICITY, 68, 69
THERMOREGULATION, 217
THESAURI, 319
THICKNESS, 6, 236
THIN FILMS, 50, 61, 62, 63, 65, 66, 67, 69, 98, 103, 108, 109, 115, 116, 122, 133, 172, 173, 274, 294, 302, 306, 309, 311, 312, 317
THREE DIMENSIONAL BODIES, 17, 163
THREE DIMENSIONAL MODELS, 233, 271, 297
THREE DIMENSIONAL MOTION, 292, 293
THRESHOLD GATES, 250
THRESHOLD LOGIC, 192
THRESHOLD VOLTAGE, 250
THRUST CHAMBERS, 40
TIME DEPENDENCE, 53, 55, 281, 283
TIME DOMAIN ANALYSIS, 275, 317
TIME FUNCTIONS, 52, 53, 55, 58, 311
TIME LAG, 269
TIME MEASUREMENT, 298
TIN OXIDES, 116
TISSUES (BIOLOGY), 205

TITANIA, 283
TITANIUM, 136, 142
TOKAMAK DEVICES, 291, 292, 297
TOLERANCES (MECHANICS), 2, 9, 15, 16, 45, 141, 144, 145, 242
TOLUENE, 63
TOMOGRAPHY, 226
TOPOGRAPHY, 30, 155, 156
TOPOLOGY, 12
TOROIDAL PLASMAS, 291
TORQUE, 99, 101, 103, 106, 229
TOTAL OZONE MAPPING SPECTROMETER, 36, 194, 200
TOUGHNESS, 57, 60
TOXIC HAZARDS, 49
TRACE CONTAMINANTS, 182
TRACKING (POSITION), 159
TRACKING FILTERS, 159
TRAILING EDGES, 4
TRAJECTORIES, 186, 253
TRAJECTORY CONTROL, 253
TRAJECTORY PLANNING, 263, 317
TRANSDUCERS, 274
TRANSFER FUNCTIONS, 274
TRANSFORMATIONS (MATHEMATICS), 202, 263
TRANSISTOR LOGIC, 250
TRANSISTORS, 104, 235, 278
TRANSMISSION LINES, 78
TRANSMISSION LOSS, 92
TRANSMISSIONS (MACHINE ELEMENTS), 138, 140
TRANSMITTANCE, 276
TRANSMITTER RECEIVERS, 94, 100
TRANSONIC SPEED, 112
TRANSONIC WIND TUNNELS, 3, 5, 7
TRANSPIRATION, 185
TRANSPORT AIRCRAFT, 8, 10
TRANSPORT PROPERTIES, 51, 111
TRANSPORT THEORY, 72, 293
TRANSPORTATION ENERGY, 299
TRAPPING, 307
TRAVELING WAVES, 130
TREES (MATHEMATICS), 248, 267
TREES (PLANTS), 147
TREND ANALYSIS, 89
TRIATOMIC MOLECULES, 280
TRITIUM, 185
TRIVALENT IONS, 61
TRMM SATELLITE, 196
TROPICAL REGIONS, 196, 198
TROPISM, 204
TRUSSES, 16
TSUNAMI WAVES, 134
TUNABLE LASERS, 120, 123
TUNGSTEN, 136
TUNNEL DIODES, 98
TUNNEL JUNCTIONS, 109, 278
TURBINE BLADES, 114, 139
TURBINE ENGINES, 12, 139
TURBINE PUMPS, 137
TURBINES, 132
TURBOFAN ENGINES, 4
TURBOFANS, 4
TURBOMACHINERY, 19
TURBULENCE, 137, 297
TURBULENCE EFFECTS, 113
TURBULENT FLAMES, 47, 50
TURBULENT FLOW, 4, 155, 294
TURBULENT MIXING, 110
TWO DIMENSIONAL MODELS, 297
TWO FLUID MODELS, 233
TYPE 2 BURSTS, 331
TYROSINE, 220

U

ULTRASONIC RADIATION, 67
ULTRASONICS, 190, 205, 214, 264, 274
ULTRAVIOLET ASTRONOMY, 327
ULTRAVIOLET DETECTORS, 182
ULTRAVIOLET RADIATION, 119, 194, 200, 326
ULTRAVIOLET SPECTRA, 127
ULYSSES MISSION, 332
UNDERWATER ACOUSTICS, 189
UNIFIED FIELD THEORY, 312
UNIFORM FLOW, 113
UNIQUENESS, 271
UNITED STATES, 166
UNIVERSE, 27, 314
UNSTEADY FLOW, 145
UNSTRUCTURED GRIDS (MATHEMATICS), 268
UPPER ATMOSPHERE RESEARCH SATELLITE (UARS), 186
URANIUM, 277
URBAN DEVELOPMENT, 166
USER REQUIREMENTS, 321

V

VACUUM CHAMBERS, 38, 136
VACUUM SYSTEMS, 73
VAPOR DEPOSITION, 49, 55, 308, 309, 312
VAPOR PHASE EPITAXY, 170, 171
VAPOR PHASES, 49
VAPORS, 49, 115, 280
VARIABILITY, 152, 190, 334
VARIATIONS, 197
VECTOR QUANTIZATION, 235, 246
VEGETATION, 150, 155, 166
VEGETATION GROWTH, 203, 204
VELOCITY, 190
VELOCITY DISTRIBUTION, 198
VELOCITY MEASUREMENT, 111, 295
VENTURESTAR LAUNCH VEHICLE, 17, 25, 26
VERTEBRAE, 226
VERY LARGE ARRAY (VLA), 332
VERY LARGE SCALE INTEGRATION, 57, 74, 90, 191, 192, 193, 246
VIABILITY, 128
VIBRATION, 71, 72, 115, 207, 232
VIBRATION DAMPING, 107, 143, 284
VIBRATION EFFECTS, 72, 282
VIBRATION ISOLATORS, 34, 72, 138
VIBRATION MEASUREMENT, 71, 214
VIBRATION MODE, 255
VIBRATION TESTS, 32, 39, 284
VIBRATIONAL SPECTRA, 68
VIBRATIONAL STATES, 282
VIBRATORY LOADS, 6
VIDEO COMMUNICATION, 95, 252
VIDEO DATA, 153
VIEWING, 159
VINYL COPOLYMERS, 65
VINYLIDENE, 64
VISCOSITY, 59
VISCOUS FLOW, 294
VISIBILITY, 163
VISUAL ACUITY, 164, 242
VISUAL DISCRIMINATION, 165, 219, 241
VISUAL OBSERVATION, 163, 164, 218, 219
VISUAL PERCEPTION, 162, 163, 164, 165, 218, 241, 242
VISUAL TASKS, 164
VOICE DATA PROCESSING, 77, 91
VOLTAGE CONVERTERS (DC TO DC), 120
VORTICES, 3, 112, 113, 197
VULNERABILITY, 96, 182

W

WAFERS, 54, 74, 120
WAKEFULNESS, 220, 221, 223
WAKES, 4, 113
WAR GAMES, 165
WARFARE, 79, 80, 81, 86, 88, 211, 270
WARNING SYSTEMS, 272
WASTE UTILIZATION, 185
WATER, 153, 168, 282
WATER FLOW, 158
WATER INJECTION, 110
WATER RESOURCES, 183, 184

WATER TREATMENT, 64
WATER TUNNEL TESTS, 229
WATER VAPOR, 116, 196
WATERSHEDS, 155, 158
WAVE EQUATIONS, 110
WAVE EXCITATION, 128, 295
WAVE INTERACTION, 199, 200
WAVE PROPAGATION, 93, 275
WAVE REFLECTION, 273
WAVEGUIDES, 89, 115
WAVELENGTHS, 136
WAVELET ANALYSIS, 107
WEAR, 138
WEAR RESISTANCE, 60
WEATHER, 185
WEDGES, 112
WEIGHT (MASS), 12, 172
WEIGHT REDUCTION, 169
WELDED STRUCTURES, 57
WHEAT, 42
WIDE AREA NETWORKS, 242
WILDLIFE, 147
WIND (METEOROLOGY), 195, 199
WIND EFFECTS, 145
WIND MEASUREMENT, 191
WIND TUNNEL TESTS, 5, 7, 145
WIND VARIATIONS, 191
WINGS, 7, 13, 16
WIRE, 111
WIRELESS COMMUNICATION, 100
WIRING, 111
WORKLOADS (PSYCHOPHYSIOLOGY), 18
WORLD WIDE WEB, 249

X

X RAY ANALYSIS, 288
X RAY ASTRONOMY, 38, 325, 329
X RAY ASTROPHYSICS FACILITY, 38
X RAY DIFFRACTION, 305, 306
X RAY LASERS, 128, 129, 130, 132, 136, 283
X RAY SOURCES, 54, 127, 132, 206, 329
X RAY SPECTRA, 328
X RAY SPECTROSCOPY, 63
X RAY TELESCOPES, 28
X RAYS, 118, 134, 335
X–33 REUSABLE LAUNCH VEHICLE, 17, 25, 26, 31, 32
X–34 REUSABLE LAUNCH VEHICLE, 20, 32
X–38 CREW RETURN VEHICLE, 14, 32
X–43 VEHICLE, 18
XENON, 107

Y

YAG LASERS, 132
YBCO SUPERCONDUCTORS, 116, 121
YTTRIUM, 60, 287
YTTRIUM–ALUMINUM GARNET, 102

Z

ZAMBIA, 166
ZEEMAN EFFECT, 277
ZEOLITES, 50
ZERO POINT ENERGY, 313
ZINC SELENIDES, 304
ZINC SULFIDES, 69
ZINC TELLURIDES, 48
ZIRCONIUM, 58, 60
ZONAL FLOW (METEOROLOGY), 199

Author Index

A

Abarbanel, Henry, 200
Abatan, Ayu, 142
Abdi, Frank, 242
Abe, Fumitake, 95
Abe, Masahide, 235
Abell, Sean P., 252
Abid, M., 46
Achatz, R. J., 99
Adachi, Takashi, 112
Adamovsky, Grigory, 115, 120
Adams, D. O., 140
Adams, Mike, 36
Addy, Harold E., Jr., 4
Adetona, Olawale, 256, 259
Aggarwal, M. D., 190, 303
Aglan, H., 42, 203, 224
Ahmad, Samir S., 261
Ahumada, A. J., Jr., 162
Akaoka, K., 277
Akbarzadeh–T, M.–R., 238, 257
Akgun, Mehmet A., 11, 18
Akimoto, Kazushi, 261
Akiyama, R., 291
Alaways, LeRoy, 218
Albano, J. P., 210
Albery, W., 213, 219
Alfano, Jean–Pierre, 36
Alfsen, K. H., 187
Aljundi, B., 230
Allen, A. M., 127
Allen, Douglas, 181
Allen, Douglas M., 168
Allen, Janet K., 74, 75, 240
Alloott, R., 297
Allott, R., 118, 124, 133, 298, 311
Allott, R. M., 134, 136, 301
Allott, Ric, 123
Alvarado, Lori, 182
Alvarez, Elms, 147
Alvarez, Marino C., 314
Amai, Robert L. S., 60, 286
Amakasu, Tetsuo, 94
Amano, H., 185
Anand, Inder, 207
Anderson, Beth, 226
Anderson, K. H., 147
Anderson, William E., 70
Antipin, Mikhail Yu., 305
Aoki, Toshinori, 196
Appartaim, R., 293
Arakere, Nagaraj K., 139
Ardalan, Shojah S., 97
Arendt, Josephine, 217
Argyros, Greg, 212
Armstrong, Joseph H., 40, 172
Armstrong, T. W., 332, 334
Arnaud, G., 5
Arnold, Jack H., 177
Arnold, James, 330
Arnot, N. R., 118
Arrhenius, G., 205
Arrigo, Kevin, 199
Asano, E., 291
Ashby, Dale L., 16
Ashforth, M., 242
Ashino, Masakazu, 65
Ashton, M., 81
Askari, V., 209, 231
Attia, J., 97
Audley, M. D., 325
Aung, K., 46
Austen, I., 144
Aviram, G., 161
Avula, Xavier J. R., 8
Aw–Musse, A., 182
Ax, L., 41
Ayala, Idelisa, 276
Ayala, Samuel, 41

B

Babu, S., 116
Baghdadchi, J., 257
Baghdadchi, Jalal, 316
Bahng, R., 72, 99, 106
Bailey, J. C., 289
Bailey, S., 170
Bainum, Peter M., 114
Baker, R. G., 325
Balestra, V., 222
Ballabrera–Poy, Joaquim, 188
Ballevre, O., 217
Band, D. L., 335
Bandyopadhyay, C., 182
Banks, C., 305
Banks, H., 96
Banks, H. T., 266
Banks, R. D., 213
Bansemir, H., 45
Barber, Edward, 272
Barden, Samuel C., 325
Bardet, J. P., 74
Baring, Matthew G., 335
Barker, Charles, 112
Barnes, Michael J., 18
Barnes, P., 281
Barnett, Allen M., 172, 179
Barr, H. C., 129, 300
Barr, Thomas A., 285
Barrett, Charles A., 58
Barrington, Jason, 255
Bartholomay, R. C., 51
Bartlein, P. J., 147
Barto, R., 73
Barto, Rod L., 141
Barton, David, 147
Basol, B. M., 171
Bass, C. R., 228
Batejat, D., 217
Batejat, Denise, 222
Bateman, Alison, 85
Battle, D., 257
Beauchamp, W. T., 176
Beaumier, P., 5
Beaumont, B., 283, 310
Beaumont, M., 217
Beaumont, Maurice, 222
Bedat, Benoit, 47
Bedewi, Paul G., 230
Bedrossian, Herand, 32
Beelke, M., 222
Beg, F. N., 125, 126, 298, 299, 300
Behdinan, K., 208
Belay, K., 293
Belisle, W., 153
Belkin, Michael, 119
Bell, A. R., 124
Bely, P., 289
Bemporad, Alberto, 263
Benloss, Angela, 286
Benner, John P., 178
Bennett, Philip D., 324
Bennett, Robert, 87
Benniston, A. C., 281
Bensaoula, A., 170, 174
Benson, Jonathan W., 272
Berenty, Jerry, 314
Berkoff, T., 116
Bernstein, E. L., 139
Berntsen, T., 187

Berry, G. J., 53
Berry, John D., 10
Bertini, Mario, 222
Bertness, K. A., 175
Betts, M., 156
Bhalla, P. N., 39
Bianchi, M. A., 173
Bigbee, Anthony J., 88
Bikdash, M., 255
Bikdash, Marwan, 143, 253, 257, 266
Birkemark, Christian M., 160
Bisby, R. H., 53
Bityurin, Valentine A., 19
Blackwell, William C., 191, 295
Blakeslee, R. J., 289
Blaszkewicz, Meinolf, 216, 223
Bles, W., 210, 213
Boba, A., 133
Bogus, Klaus P., 169
Bohn, C. C., 148
Bomar, John B., Jr., 227
Bonilla–Gonzalez, Eliud, 24
Borghesi, M., 124, 126
Bos, J. E., 210
Bosah, F., 71
Bosah, Francis N., 201
Boucarut, Ray, 322
Bouche, Jean–Paul, 82
Boucher, Robert L., 71
Bousman, William G., 6
Bowen, Brent D., 1
Bowers, Chuck, 322
Bowers, David, 258
Bowers, J., 68
Boyce, Kevin R., 325
Boyd, T. J. M., 300
Brackey, Thomas, 330
Bradley, J., 48
Brasunas, J. C., 116
Brathen, Karsten, 81
Braun, Scott A., 197
Bremer, Maximilian K., 182
Briggs, M. S., 335
Brinker, D. J., 170
Brinker, David J., 177, 179
Brockett, Roger, 263
Brooks, M., 48
Brosius, Jeffrey W., 332
Brown, Alexander, 324
Brown, F., 306
Brown, Geoff, 302
Browne, M. T., 127
Bruno, Maria I., 249
Brunty, Joseph, 20, 25
Bryan, Frank O., 199
Bryan, W. A., 131
Bryant, E., 62, 98
Bryant, Mark A., 190
Bu, Xiu R., 42, 62
Buckley, C. J., 118
Buhrman, John R., 207
Buller, R., 144
Bumble, Bruce, 109
Burg, R., 289
Burge, J., 289
Burge, R. E., 127
Burger, A., 48, 62, 98, 303, 304
Burger, Arnold, 294
Burke, David A., 270
Burke, Edward A., 171, 176
Burke, P. G., 278
Burnett, P. D. S., 127
Burton, Dawn, 60
Burton, Russell R., 210
Busalacchi, Antonio J., 188
Busby, Michael R., 314
Butler, Dan, 112
Butler, Kathy, 70
Buzyna, G., 272
Byrd, P., 132

C

Cagle, Corey D., 3
Cain, N. J., 310
Cairns, G. F., 127
Cairns, J. A., 53
Caldwell, J. Lynn, 223
Caldwell, John A., 216
Calhoun, G. L., 232
Calhoun, M., 42
Calhoun, Philip, 24
Calise, A. J., 21
Calise, Anthony J., 284
Callan, Curtis, 200
Calvignac, J., 39
Camacho, R., 314
Cameron, B. J., 210
Campbell, James, 317
Camulaire, Frantz, 137
Candiani, Luigi, 9
Canosa–Mas, C. E., 53
Cappelletti, R. L., 284
Carabe, J., 168
Cardelino, Beatriz H., 276, 286
Cardirola, M., 196
Carini, M. T., 333
Carini, Michael T., 333
Carlegrim, B., 89
Carpenter, Kenneth G., 324
Carr, Michael, 330
Carr, Stacy, 185
Cartron, J. L. E., 147
Caruso, Salvadore V., 186
Carver, B., 211
Casagrande, Maria, 221, 222, 223
Cassanho, Arlete, 123
Castellin, C., 5
Castillejo, M., 279
Castro, Lymari, 61
Catrycke, Marc, 222
Caulfield, John, 154, 156, 157
Caveny, Leonard H., 168
Celani, F., 99
Celarier, E., 193
Cetin, Selim, 85
Chaar, Yamil, 239
Chakraborty, Ajay, 108
Chamis, Christos C., 46, 242
Chamuel, Jacques R., 189
Chan, Philemon C., 229
Chandra, S., 3, 110
Chang, Chung, 51
Chang, Chung–Hsing, 113
Chang, Mei–Shiang, 317
Chang, Sin–Chung, 273
Chang, Tien–Tsai, 57
Changfan, Hung, 146
Chao, B. F., 193
Chao, Dennis C., 63
Chao, Yi, 199
Charalambous, P., 127
Chastaing, D., 330
Chatterjee, B., 306
Chattopadahyay, K., 304
Chattopadhyay, G., 326
Chattopadhyay, K., 48, 303, 304
Chauffard, F., 217
Chazen, M. L., 39
Chekmasov, Maxim, 147
Chen, Chaio–Shiung, 264
Chen, H., 48, 62, 98, 303, 304
Chen, Henry, 294
Chen, How–Ji, 76
Chen, Huey–Kuo, 317
Chen, J., 60
Chen, Jian, 109
Chen, K. T., 304
Chen, K.–T., 304
Chen, Shinn–Horng, 248
Chen, Wei, 74, 240
Chen, Wei–Fah, 76
Chen, Wen–Liang, 264
Chen, Xirong, 276

Chen, Y.–F., 304
Chen, Ya–Chin, 77
Chenette, D. L., 333
Cheng, Chii–Meng, 113
Cheng, Ju–Chuan, 146
Cheng, Ping, 76, 77
Cheng, Robert K., 47
Cheng, T., 148
Cheng, Yuying, 276
Chi, Ren–Chau, 76
Chiba, Takafumi, 290
Child, N. S., 134
Chin, Harrison, 15
Chinda, Yusuke, 122
Cho, Eungchun, 198
Choi, J., 190, 303
Chou, Jyh–Horng, 248, 269
Chrisley, James C., 194
Christensen, Eric R., 20
Christensen, Philip R., 331
Chu, Julio, 6
Chuang, Tung–Han, 57
Chubb, Donald, 179
Chubb, Donald L., 102
Chung, James, 6
Chung, James J., 4
Chute, Rebecca D., 9
Chyba, T. H., 114, 119
Chyba, Thomas H., 301
Cirovic, S., 207, 208
Clark, E., 125, 126, 299
Clark, E. L., 118, 124, 297, 298, 300
Clark, I. P., 52, 68
Clark, R., 305
Clark, Ronald D., 60, 276, 285, 286, 303, 305
Clark–Ingram, Marceia A., 186
Clarke, John T., 39
Clarke, R., 133
Clarke, R. J., 301
Claver, Charles F., 325
Cleaveland, Rance, 247
Clements, S. D., 333
Clements, Sandra D., 333
Clouse, Jeff, 315
Clutter, L. K., 284
Co, Elizabeth L., 213
Codling, K., 130
Coe, H. H., 139
Coffey, J., 318
Colborn, B. L., 332, 334
Cole, M., 304
Cole, Stanley R., 7
Coleman, T., 150, 152, 158, 184
Coleman, T. L., 149, 153, 156
Coleman, Tommy, 158, 185, 318
Coleman, Tommy L., 183, 313
Colgan, J., 278
Collier, J., 134, 311
Collier, J. L., 133, 134, 136, 301
Collins, Sandra R., 171
Collins, W. E., 62, 98, 276, 302
Collins, William E., 321
Colon, Edward, 195
Conklin, A., 212
Connes, A., 312
Conrath, Barney J., 331
Cook, R, 144
Cook, Thomas S., 251
Cooke, Daniel E., 237
Cooke, K., 163
Copeland, Anthony C., 241
Cordelli, A., 222
Cornelissen, Germaine, 207
Coroneos, Rula M., 146
Corson, Charles, 325
Cotal, H. L., 174
Craft, William J., 44
Craig, James I., 12, 240
Crandall, J. R., 228
Cranton, W., 69
Crawford, Kamau, 201
Crenshaw, T., 48
Crocket, Dave, 70
Crosson, W., 150
Crosson, W. L., 149
Crosson, William, 158
Crosson, William L., 154, 156, 157
Cruz, Magda, 303
Cruzen, Craig, 23
Cuddihy, E., 287
Culler, R. C., 333
Cummings, John R., 172
Curley, M., 305
Curley, Michael, 115
Curry, Donald M., 63
Curtis, C. V., 253
Cushman, G. M., 116

D

Dabney, Richard, 23
Daemi, Ali, 255
Dalke, R. A., 99
Dally, William, 200
Dangor, A. E., 118, 124, 125, 297, 298, 299, 300
Danilin, M. Y., 185
Danson, C., 311
Danson, C. N., 133, 134, 136, 301
Danson, Colin, 123
Dashiell, Michael W., 172
Dason, Shymala, 331
Daugherty, Robert H., 17
David, R. T., 119
Davidson, M. R., 53
Davidson, Mario, 143
Davies, G. A. O., 45
Davies, J. R., 124, 125, 299
Davila, Joseph M., 331
Davila, P., 289
Davila, Pam, 322
Davis, D., 203
Davis, Edward G., 211
Davis, M. R., 153
Davis, Victoria A., 176
Day, John, 22
Dean, Bruce, 322
DeCarli, F., 222
Decker, William L., 87
Degen, Gisela, 216, 223
DeGennaro, Luigi, 222
Deguchi, Tomoya, 317
Deijen, J. Berend, 220
DeJesus, W., 314
Delgado, Shannon M., 256
DellaCorte, C., 19
DelloRusso, N., 328
Demoz, B., 196
deNalda, R., 279
Deng, Chunyang, 104
Denga, Xiao–Hua, 60
Denmark, D., 286
DeOliveira, Marco A. A., 256
DeSilva, U. P., 137
Deutsch, Robert D., 84
Dey, Arjun, 325
Di Gioacchino, D., 99
Diaz–Serrano, Javier, 33
Dickens, John D., 138
Dickens, Ricky, 285
Dickey, Jean O., 199
DiCuccio, M., 226
Dietz, David, 93
Digges, Kennerly H., 230
Diggs, Darnell, 115
DiNetta, Louis C., 171, 172, 179
DiSanti, M. A., 328
Dischinger, H. Charles, Jr., 225
Divall, E., 131
Divall, E. J., 134, 279, 290
Djaoui, A., 128
Dobosz, S., 127, 128
Dogan, N., 203

Doireau, P., 217
Doll, Theodore J., 159
Domanski, P. A., 168
Dompke, Uwe K. J., 81
Done, C., 328
Dorsey, John T., 25
Douglas, Michael J., 45
Dowdye, E., 182
Dozier, Gerry, 316
Drachman, Richard J., 277
Drake, Jeffrey T., 94
Duma, S. M., 228
Dumont, R., 296
Dumonthier, J. J., 325
Dunn, K., 186
Duval, Walter M. B., 72
Dwoyer, Douglas, 330
Dyer, J., 318
Dyson, Freeman, 200
Dzierzanowski, Kenneth, 86

E

Eastin, Robert G., 15
Eaton, Erroll L., 111
Eaton, Joel A., 323
Ebina, Akira, 95
Ebina, Taku, 245
Edwards, C. B., 134, 136, 301
Ehara, Kenji, 288
Ehrhart, Lee Scott, 88
Eker, G., 129
El–Zein, A., 131
Elber, W., 14
Elshot, K., 62, 98
Emmerling, S., 45
Endo, Takashi, 98
Endo, Takayuki, 250
Engberg, Robert, 37
Engberg, Robert C., 36
Engelhaupt, D., 324
Enriquez, Alfredo, 184
Enslen, M., 217
Ent, R., 119
Eom, Gwang–Moon, 215
Erickson, K., 73, 141
Ericson, N., 290
Eriksson, M., 218
Escobar, D. E., 153
Esterline, Albert, 259, 265, 316, 317
Esterline, Albert C., 258
Estes, Maurice G., Jr., 183
Evans, K. D., 196
Evans, Steven W., 191, 295
Everett, R. A., Jr., 14
Everitt, J. H., 153

F

Faeth, G. M., 47
Fahsi, A., 149, 151, 156, 158, 184
Fahsi, Ahmed, 318
Fang, X., 131, 279, 280
Farmer, Serene C., 102
Farrell, I. R., 52, 54, 58
Fasanella, Edwin L., 13
Fatehi, Fereshteh, 254
Fatemi, N. S., 170
Fatemi, Navid S., 179
Faur, Maria, 170
Faur, Mircea, 170
Fdez–Valdivia, J., 159
Fdez–Vidal, Xose R., 159
Feet, Else Helene, 81
Feliz, Daniel, 182
Feltz, W., 196
Fenbert, James W., 12
Ferguson, Dale C., 177
Ferguson, Frederick, 265
Ferguson, Paul, 255
Fernandez, Felix E., 62
Fernandez, Francisco G., 237
Fernandez, Gianna, 151
Fernandez–Sein, Rafael, 24, 33
Ferrara, Michele, 221, 222, 223
Ferrari–Trecate, Giancarlo, 263
Ferrillo, F., 222
Fesq, Lorraine, 36
Fettig, R., 116
Feuz, L., 69
Fialho, Ian J., 33
Fickett, F. R., 140
Field, T. A., 280
Figueroa, Ricardo R., 259
Filbee, D., 241
Finch, D. M., 147
Finckenor, Miria M., 66
Fiorello, Alan P., 252
Fitzgerald, A. G., 53
Fitzgerald, Mark, 178
Fitzmaurice, Mark, 322
Fletcher, R. S., 153
Floch, Jean–Pierre, 82
Flood, D. J., 170
Fogarty, T. N., 97, 306
Fogarty, Thomas N., 61
Fogleman, Ronald, 330
Folta, David C., 34, 329
Ford, W. F., 265
Fowler, Samuel B., 31
Fraas, Lewis M., 41
Frady, Greg, 20
Fraser, W. D., 207, 208, 209, 230, 231
Frasinski, L. J., 130
Frazier, D., 276
Frazier, Donald O., 303
French, Jonathan, 222
French, P. W., 132
Freundlich, A., 170, 174
Fujii, Tetsu, 103
Fujimoto, Noboru, 51
Fujimoto, R., 325
Fukamachi, Tomoe, 288, 306
Fukuda, Kenji, 51
Fukumoto, N., 292
Fukumoto, Takenori, 215
Fukushi, Kenji, 296
Fukuyama, A., 291
Fulford, J., 206
Funaba, Tadayuki, 289
Funston, Monica Gayle, 238
Furuse, Norio, 215

G

Gaddy, Edward, 22
Gaffney, Kelly, 169
Gagnon, Colleen M., 87
Gaines, E. E., 333
Gallegos, Marcelina, 78
Gallogly, Donald P., 163
Gandia, J., 168
Ganeshan, A. S., 37
Garbarino, S., 222
Garcia, Ephrahim, 256, 259
Garcia, J. A., 159
Garcia, Oracio, 256
Gardner, Barbara M., 176
Garg, Vijay K., 114
Gaskell, D., 119
Gaskin, J. G., 265
Gates, Ann Q., 182, 237
Gauthier–Blum, C., 93
Gay, P., 109
Geary, J., 289
Gebre, T., 303
Gehling, Russell N., 40
Geis, Jack, 177
Geiselhart, Karl A., 12
Geisler, Wilson S., 163
Gelderman, R. G., 333
Gendreau, K. C., 325

George, M. W., 52
George, T., 303
Gerhart, G., 162
Geri, George A., 164
Gerlach, Lothar, 178, 180
Gerstle, Walter, 142, 238
Gibart, P., 283, 310
Gibson, Richard B., 83
Giles, Sammie, Jr., 120
Gill, John, 15
Gillespie, Cindy L., 190
Gilman, J. W., 67
Gilmore, M. A., 241
Girard, N., 134, 135
Girmay–Gwahid, B., 152
Giruzzi, G., 296
Gladhill, R. L., 316
Glass, D. H., 278
Glassco, Roy G., 18
Gluesing, Julia, 321
Godfroy, Tom, 285
Goldberg, R. A., 333
Goldstein, B. E., 332
Golka, Klaus, 216, 223
Gong, Yuchuan, 276
Good, Brian S., 102
Goodhead, D. T., 132, 206
Goodman, Steven, 313
Goodwin, Thomas A., 171
Gopalswamy, N., 331
Goradia, C., 170
Gorton, Susan Althoff, 10
Gotsis, Pascal K., 46
Gounder, Ramasamy S., 258
Gowdy, V., 230
Graham, P., 131, 279, 280
Grainger, P. L., 87
Grau, J. Y., 219
Gray, Bob, 182
Grazioso, Ron, 287
Green, Scott, 34
Gregory, James, 155
Gregory, Kevin B., 213
Grener, Doreen, 314
Griefahn, Barbara, 216, 223
Gross, R. S., 193
Gross, Richard S., 199
Grossman, B., 16
Grover, Ronald O., Jr., 43
Gryko, J., 97
Guido, L. J., 307
Guo, Huai–Song, 285
Guo, Huaisong, 286
Gutierrez, Daniel, 287
Gutierrez, M., 168
Gutierrez, Martha, 147
Gutman, S. I., 196
Gyekenyesi, J. P., 70

H

Haapala, C., 138
Habte, Kahsay, 49
Hachkowski, M. Roman, 117
Hackney, K. R., 333
Hackney, R. L., 333
Hada, Kazuyoshi, 267
Haftka, Raphael T., 11
Haga, Futoshi, 236
Hagen, L. O., 187
Hagiwara, Tokio, 64
Hagopian, John, 322
Haines, M. G., 130
Haisch, Bernhard, 313
Halani, A., 171
Halberg, Franz, 207
Hale, Mark, 240
Hale, Mark A., 12, 239, 240
Hall, A., 311
Hamada, M., 74
Hamana, Hiroshi, 64
Hamilton, Casey, 202
Hamilton, David W., 2
Hampton, Roy W., 145
Hamsa, Irene Schulz, 314
Han, Jiande, 276
Han, Jongil, 2
Hanada, Toshiya, 23
Hanamoto, Konosuke, 121
Hancock, J. A., 101
Hand, D. P., 132
Handa, Yasuhiro, 138
Handwerker, C. A., 56
Hankin, S. M., 280
Hannon, Margaret H., 172
Hapopian, J., 289
Happee, R., 228
Harada, Eiji, 111
Hardage, Donna M., 191, 295
Hardman, William, 15
Hare, David A., 117
Haridass, C., 182
Hariharan, V. K., 108
Harmer, Charles F. W., 325
Harmon, Mance E., 264
Harper, Graham M., 324
Harris, Don, 20
Harris, W. P., 134
Harris–Hooker, S., 71
Harris–Hooker, Sandra A., 201
Harrus, Ilana, 329
Hasegawa, Takashi, 288
Hasegawa, Takeshi, 268
Hashimoto, Sadamu, 242
Hawley, M. E., 302
Hay, N., 279
Hayashida, K. B., 143
Hayes, Carol E., 195
Hayes, M., 48, 303
Hayes, Richard E., 84
Heath, Panagiota, 314
Heberlie, Brian J., 251
Hecker, R., 161
Heere, Karen R., 10
Heffner, R., 38, 115
Heger, A. Sharif, 287
Heitbrink, W. A., 186
Henderson, D. O., 286
Hendy, N. J., 53
Hennig, Lee Ann, 314
Henry, Gregory W., 322, 323
Henry, Stephen M., 323
Hensley, D. K., 305
Herman, J. R., 193
Herman, Jay, 199
Hernandez–Gomez, C., 136, 301, 311
Heshmat, H., 19
Hess, Andrew, 15
Hess, S., 283, 310
Hicken, R. J., 58
Hickey, John R., 177
Hidalgo, Homero, 32
Hidalgo, Homero, Jr., 25
Hileman, Douglas R., 202
Hill, H. G. M., 329
Hill, Jill, 202
Hill, M. A., 132, 206
Hillard, G. Barry, 177
Hills, J. S., 101
Hinkley, Jeffrey A., 69
Hirai, Yoshiyuki, 64
Hiranaka, Yukio, 318, 319
Hirayama, Masatsugu, 245
Hirschfeld, D., 56
Hirst, G., 133
Hirst, G. J., 69, 132
Hirst, Graeme, 123
Hitchings, D., 45
Ho, Kevin H., 212
Ho, Luis C., 327, 335
Hoarty, D., 300
Hock, Yeoh Kian, 138
Hockridge, M. R., 282
Hodges, W. Todd, 10

Hoemmerich, Uwe, 119
Hoff, Craig, 112
Hoffman, Richard W., Jr., 179
Homaifar, A., 252, 255, 257
Homaifar, Abdolah, 254
Homaifar, Abdollah, 143, 253, 257, 266, 316
Home, Richard, 159
Homma, Naofumi, 243
Hommerich, U., 304
Hoofman, M. L. C., 227
Hooker, C. J., 134, 135, 290
Hopkins, Dale A., 146
Hoppe, D., 233
Hori, Fumio, 296
Hoshi, Ken–ichi, 246
Hoshino, Yasutaka, 104
Houlbrook, A. W., 234
Houts, Mike, 285
Hsiao, Chiamen, 146
Hsieh, Chen–Huei, 269
Hsu, A. Y., 167
Hu, Hurang, 142
Huang, Yonghua, 259
Huang, Yue–Lin, 76
Hubbell, Rob, 238
Huff, H., 97
Hughes, Derke R., 44
Hughes, T. J., 53
Hung, Chih–Cheng, 318
Hunt, Shawn D., 259
Hurt, William D., 211
Hutchby, J. A., 169
Hutchings, G., 241
Hutchinson, M. H. R., 134, 136, 301
Hyer, C. W., 140
Hynes, Michael K., 8

I

Ichiguchi, Katsuji, 292
Ichihara, K., 233
Ila, D., 305
Imai, Makoto, 245
Imhoff, M. L., 166
Inguva, R., 149, 150
Inguva, Ramarao, 154, 156, 157
Irish, Sandra M., 114
Irving, P., 144
Isawa, Ken, 236
Ishida, Fumihiko, 263
Ishihara, Atsushi, 49
Ishisaki, Y., 325
Ishiyama, Keitaro, 232
Ishizuka, Satoru, 49
Ishizuki, S., 233
Isobe, M., 292
Isobe, Shuji, 243
Isshiki, Kunihiko, 120
Ito, A., 73
Itoh, K., 291
Itoh, S.–I., 291
Itti, Laurent, 159
Iwasaki, Masakazu, 295
Iwase, A., 300
Iyengar, S. S., 198

J

Jablonska, Mariola, 328
Jackson, A., 153
Jackson, Andrew C., 206
Jackson, C. L., 67
Jackson, Eric, 97
Jackson, T., 167
Jacobson, D., 289
Jacobson, Ralph, 330
Jadaan, O. M., 70
Jain, R. K., 174
Jain, Raj K., 173
James, P. L., 330
James, R. B., 48
Jamshidi, M, 238
Jamshidi, M., 257
Jaunky, Navin, 141
Jean, Chih–Yih, 113
Jedlovec, G. J., 196
Jeffries, Damon K., 110
Jeng, Dong–Sheng, 200
Jenkins, P. P., 170
Jenkins, Philip, 179
Jenkins, Phillip P., 179
Jenkins, S., 144
Jennings, P., 68
Jenssen, Hans, 123
Jernajczyj, Wojciech, 221
Jia, Weiyi, 61, 287
Jimenez, Luis O., 239
Jinfang, Meng, 305
Johns–Kaysing, Loren, 234
Johnson, J. A., III, 137, 293
Johnson, Julie M., 213
Johnson, Mark A., 225
Johnson–Dunnings, H., 217
Johnston, John, 36
Joiner, Joanna, 157
Jones, A. C., 68
Jones, G., 59, 224
Jones, J. D. C., 132
Jones, Phyllis D., 114
Jorgenson, Philip C. E., 273
Joshi, Suresh M., 261
Joyce, Armond T., 154
Joyce, Gerald F., 200
Joyner, Michele L., 266
Juang, Jer–Nan, 77
Jumper, John M., 260

K

Kaelberer, Monte S., 331
Kaiser, M. L., 331
Kaleps, Ints, 8
Kalivas, J., 51
Kameda, Suguru, 92
Kamenetzky, Rachel R., 66
Kamiya, Hajime, 320
Kanari, Yasuaki, 243
Kanbara, Hirofumi, 274
Kaneko, O., 291
Kannan, N., 213
Kao, Chung–Ren, 113
Kapania, R. K., 16
Kapps, A., 209, 231
Kapur, V. K., 171
Karikari, E., 60
Karner, James M., 328
Katayama, Katsuki, 67
Katiyar, R. S., 305
Katnik, Gregory N., 31
Kato, Masafumi, 65
Kato, S., 292
Katsumata, Makoto, 251
Katti, V. R., 108
Katz, Richard, 141
Katz, R., 73, 106
Kaur, S. S., 218
Kawai, Kunihiro, 102
Kawai, W., 233
Kawamoto, Shin–ichi, 244
Kawamoto, T., 291
Kawamura, Jonathan, 109
Kawamura, Takaaki, 288, 306
Kawano, Koichi, 197
Kawasaki, Hisao, 57
Kawasaki, N., 233
Kaya, Tarik, 112
Kayaligil, Sinan, 269
Ke, Rong, 320
Kedzierski, M. A., 59
Keel, Lee H., 256, 259, 261
Keenan, R., 127, 128

Keller, Donald F., 7
Keller, G. R., 152
Keller, G. Randy, 190
Kelley, R. L., 325
Kelly, Thomas J., 35
Keppel, C. E., 119
Kern, Volker, 204
Keski–Kuha, R., 289
Kharuk, V. I., 167
Kibbler, A. E., 175
Kidd, A. K., 134
Kim, Hai–Young, 273
Kim, K.–M., 189
Kim, Y. T., 257
Kimiaghalam, Bahrain, 253, 257
Kimura, Mamoru, 103
Kimura, Noritoshi, 108
Kimura, Takayuki, 105
King, J. G., 148
King, Terry, 314
Kinouchi, N., 185
Kirby, K., 97
Kirk, A., 241
Kirzl, John E., 79
Kishida, N., 233
Kistner, Regina W., 164
Kitagata, Gen, 95
Kitayama, Nobuyasu, 192
Kletetschka, G., 192
Kleyner, I., 106
Klinedinst, D., 69
Klinke, Jochen, 198
Klopcic, J. Terrence, 211
Knapp, Beverly G., 18
Knox, F. S., 212
Ko, M. K. W., 185
Kobayashi, Eisuke, 121
Kobayashi, Jun–ichi, 102
Kobayashi, Susumu, 112
Koch, Christof, 159
Koch, Patrick N., 75
Kodounis, Antonios, 216
Kohler, Ronald E., 321
Komeda, Hiroyuki, 296
Konishi, Katsuyuki, 49
Konno, Hirotaka, 111
Kooi, J. W., 326
Korbieh, Edward, 255
Kory, Carol L., 271
Koshak, W. J., 289
Kosmidis, C., 131, 279, 280
Kostiuk, Larry W., 47
Kotani, Kenji, 106
Kottler, Herbert, 330
Kovacs, Katalin, 167
Koyama, Hitoshi, 312
Krainsky, Isay L., 284
Kramer, C., 175
Krasnowski, Bogdan R., 9
Krebs, W. K., 164
Kreimer, D., 312
Krishnamurthy, R., 3, 110
Krishnan, R., 249
Krothapalli, A., 110, 272
Krotkov, Nickolay, 199
Kruer, M. A., 173
Krushelnick, K., 118, 124, 125, 126, 297, 298, 299, 300
Kruzan, John, 314
Ku, Jentung, 112
Ku, Young, 51
Kuan, Dana, 158
Kuenemund, Christa, 216, 223
Kumagai, Shinji, 137
Kumamaru, Mamiko, 145
Kumar, Ashok, 265
Kumar, CR. Ashok, 252
Kumar, Renjith R., 22
Kumazawa, Takashi, 64
Kumbla, K. K., 238
Kumer, J. B., 185
Kummerow, C., 196
Kunchithapadam, V., 255
Kunieda, Hideyo, 327
Kunstmann, John F., 40
Kuntz, K. D., 334
Kuriyama, Masafumi, 111
Kurstjens, S. T. G. L., 80
Kurtz, Sarah R., 175
Kushara, Akihiro, 262
Kvaternik, Raymond G., 3
Kwok, W. M., 55
Kyriazi, N., 232

L

Lafate, K., 62, 98
Lagarde, D., 217
LaGarde, Didier, 219
Lagarde, Didier, 222
Lake, Mark S., 117
Lakew, B., 116
Lampkin, Gregory, 294
Landis, Geoffrey A., 173, 179, 180, 181
Lang, S., 196
Langari, Reza, 254
Langley, A. J., 130, 131, 134, 135, 279, 280
Langley, Andrew, 123
Langsaeter, Tor, 79
Lanning, Bruce R., 172
Larkin, D. J., 302, 311
Larko, D., 193
Larrieu, M. L., 82
Larssen, S., 187
Larsson, F., 46
Lassiter, John O., 36, 37
Lau, K.–M., 189
Lau, Wai M., 216
Lawless, Nancy, 212
Lawrence, W. T., 166
Lawton, B., 212
Lawton, R., 97
Laymen, Charles A., 156
Laymon, C., 149
Laymon, Charles, 157
Laymon, Charles A., 154, 157
Lazzeri, L., 44
Leahy, D. A., 326
LeBlaye, Patrick, 2
Lecot, A., 134
Ledingham, K. W. D., 125, 126, 131, 279, 280
LeDuc, Henry G., 109
Lee, Hae Yeon, 243
Lee, J. A., 59
Lee, Lian–Yan, 113
Lee, R. Q., 78
Lee, Sang Seok, 267
Lee, Sang W., 114
Lehtilae, A., 187
Leidholm, C. R., 171
Leonhardt, B. K., 21
Lesny, Gary G., 284
Lester, W. J., 290
Leu, Liang–Jeng, 146
Levy, M. R., 53
Lew, Jiann–Shiun, 143, 255, 261
Lewis, C. L. S., 127, 128
Lewis, Kemper, 73, 75
Lewis, Tim, 70
Li, Haiying, 42
Li, Xiang, 62
Li, Yong–Ming, 270
Liao, Wen–Hwei, 248
Liard, D. J., 283
Lienard, Sebastien, 36
Lin, K.–C., 47
Lin, Shiou–Gwo, 11
Lin, Sy–Chyi, 302
Lin, Yee–Shown, 200
Lin, Yiching, 146
Lin, Yung–Chih, 76
Lincoln, John W., 145
Linder, Jan, 219

Lindesay, James, 195
Lineberry, John T., 19
Linn, J., 98, 99
Linteris, G. T., 49
Litchford, Ron J., 19
Little, Rex W., 321
Liu, Dar Chyuan, 272
Liu, Huimin, 61, 287
Liu, Y. P., 149, 150
Liu, Yaping, 158
Livesey, 186
Liwu Wang,, 63
Lo, Hao–Yung, 248
Lo, Y., 99
Lockwood, M. K., 17
Lograsso, Thomas A., 55
Lomas, James, 23
Longman, Richard W., 77
Lopez–Garriga, J., 314
Lord, Kenneth R., II, 175
Loregnard, Kieron R., 302
Loretan, P., 203
Loughead, Tomas E., 225
Loutts, George B., 119
Love, Felisha D., 201
Lowe, Roland, 179
Lowe, Roland A., 102
Lowman, A., 289
Lowman, Andrew, 322
Lu, Chungsying, 113
Lu, J., 224
Lu, J. Y., 59
Lu, Po–Chien, 113
Lu, W. J ., 276
Lu, W. J., 62, 98, 302
Lu, Z., 209, 231
Lubelczky, Jeffrey T., 249
Luettgen, Gerald, 247
Lukaszewicz, V., 19
Lukyanov, A. V., 300
Lumia, Ron, 258
Luvall, J. C., 148
Lyle, Karen H., 13
Lyles, G. M., 26
Lyman, Peter, 330
Lyons, T. J., 14

M

Ma, C., 55
Ma, Deren, 228, 229
Macenka, S., 289
Machacek, A., 125, 299, 300
Maciel, R., 100
Mackinnon, A. J., 124
MacPhee, A. G., 127, 128
Madejski, G. M., 328
Madni, Asad M., 260
Maeda, Junji, 145
Maeda, Teruhiko, 94
Maestrello, Lucio, 21
Magee–Sauer, K., 328
Maguire, Joanne, 330
Maguire, William C., 331
Maharana, Prashanta K., 37
Maksymiuk, Grzegorz, 221
Malerud, Stein, 81
Malka, G., 124
Malka, V., 118, 124, 297, 298
Mallozzi, R. S., 335
Maloney, Stephen W., 50
Mandel, Eric, 324
Manfredi, G., 297
Manning, J. E., 228
Manu, A., 190
Marangos, J. P., 279
Marcus, Steven L., 199
Mariani, U., 44
Mariani, Ugo, 9
Marks, G. W., 178
Marquet, Thierry, 141
Marsh, Roland Reynard, 253
Marshall, D., 134, 135
Marshall, H., 326
Martin, Carl J., 25
Martin, Jim, 285
Martin, Kamalini, 37
Martin, S. H., 210
Martin, William N., 44
Martinez, Angela, 285
Martinez, Antonio, 62
Martinez, Maria, 147
Maruo, Kazuyuki, 107
Marvis, Dimitri N., 12
Marx, William J., 13
Masiello, Paul J., 212
Mason, P., 129
Mason, Patrick A., 211
Mason, W. H., 16
Mastin, E., 69
Masubuchi, Daisuke, 267
Mathers, J. H., 134
Matousek, P., 52, 53, 54, 55, 58, 136, 280, 281, 283
Matsuki, Kenzo, 98
Matsumoto, Yoshiyuki, 262
Matsunaga, G., 292
Matsuoka, K., 292
Matsuzawa, Tomohiro, 250
Matthew, D., 144
Matthew, David, 16
Mavriplis, Dimitri J., 267
Mavris, Dimitri, 75
Mavris, Dimitri N., 13
Mayorga, Maria A., 212
Mazanek, Daniel D., 22
Mazz, John P., 164
McCabe, S. P., 128
McCanny, T., 125, 126, 131, 279, 280, 299
McCarley, J. S., 164
McClain, Charles, 199
McConnell, R., 59
McCray, Christopher J., 301
McCullough, Shaun, 316
McGee, Jennie K., 36
McGhee, David S., 30
McGill, Preston, 32
McGruder, C. H., III, 333
McKenna, P., 131
McKinney, John, 264
McManamey, James R., 160
McNeal, Curtis, 70
McQuillan, R., 96
McWhinney, H., 306
McWhinney, Hylton G., 60
Mead, K. R., 186
Medelci, N., 170, 174
Medina, E., 257
Mei, Chuh, 141
Meldrum, A., 286
Melfi, S. H., 196
Melhado, C. D., 71
Melhado, Caroline D., 201
Mendenhall, Todd, 36
Mendham, K., 279
Mendonca, J. T., 294
Meneghini, R., 196
Menon, Madhu, 301
Mergenthaler, J. M., 185
Merrifield, R., 212
Messenger, S. R., 174, 175
Messenger, Scott R., 176
Metschan, S., 56
Metzl, R., 190, 303
Meulenberg, A., 181
Meulenberg, Andrew, 181
Meyer, V., 64
Meyer–ter–Vehn, J., 124
Michel, Martine, 82
Michette, G., 118
Mickens, Travluss, 43
Middleton, Benita, 217
Mignone, Domenico, 263

Miller, David, 109
Miller, G. D., 81
Miller, R. E., II, 211
Mims, Katherine, 20
Minamide, Hiroaki, 92
Mineck, Raymond E., 5
Minnetyan, Levon, 46, 242
Minnick, A., 171
Minow, Joseph I., 191, 295
Mintz, Eric A., 42, 62
Mishchenko, Michael I., 267
Misra, Mohan S., 40, 172
Misra, P., 182
Mistree, Farrokh, 73, 74, 75, 240, 241
Mitchell, K. D., 165
Mitra, D., 39
Mittal, M. L., 249
Mittermaier, E., 96
Miura, Osamu, 90
Miyabe, M., 277
Miyakawa, Shinya, 236
Miyake, Akiharu, 145
Miyazawa, J., 292
Mochena, T., 137
Moeti, I., 60
Moeti, L., 287
Moffat, James, 78
Moghazy, S., 287
Mohammed, I., 135
Molnia, Bruce F., 190
Montes, Leticia, 258
Moore, B., 128
Moore, Craig E., 286
Moore, Thomas C., Sr., 117
Moorhead, I. R., 241
Mora, D., 314
Morari, Manfred, 263
Morell, G., 48
Moreman, D., 318
Morgan, A. B., 67
Morgan, P. D., 81
Morgan, S., 48, 303, 304
Morgan, S. H., 276
Morikawa, Akihiro, 122
Morimoto, Akihiro, 105
Morita, Koji, 51
Morris, A., 48
Morris, Rene, 256
Morrison, J. B., 210
Mortley, D., 203
Mortley, Desmond G., 202
Moses, John H., 9
Motoyoshi, Katsuyuki, 104
Mott, B., 116
Mount, A. R., 68
Moutzouris, K., 290
Moya, John A., 204
Mu, R., 286
Mullan, Dermott J., 324
Mumma, M. J., 328
Muniz, Margarita, 202
Muraki, Kiyotaka, 274
Murata, M., 185
Murtugudde, Ragu, 188
Mushotzky, Richard F., 327
Muthusami, Jayakumar, 302
Muto, Kenji, 261
Myers, David E., 25
Mysore, Prasad, 8

N

Nagata, M., 292
Nair, G. Madhavan, 41
Najmudin, Z., 118, 124, 297
Najmudin, Z.a, 298
Nakagawa, Hideyuki, 275
Nakagawa, Tomoyuki, 263
Nakahira, M., 73
Nakajima, Akira, 115
Nakajima, Ayahiro, 245
Nakajima, Rina, 23
Nakajima, Tetsuo, 288
Nakamura, Kazuhiro, 214
Nakamura, Seizo, 94
Nakanishi, Taiga, 319
Nakao, Shin–ichi, 65
Nakashima, Y., 73
Nakaya, Shigemitsu, 214
Nakazato, Hiroumi, 192
Nakazawa, Hideki, 50
Narita, Tadashi, 64
Naser, Ahmad S., 43, 44
Naser, Ahmed A., 143
Nazario, W., 314
Nazarov, W., 126
Neades, David N., 211
Neelavathi, M., 96
Neely, D., 118, 124, 126, 127, 128, 133, 134, 135, 136, 297, 298, 301
Neely, David, 123
Neergaard, Linda F., 295
Negishi, Riichiro, 306
Negishi, Riichirou, 288
Nemoto, T., 233
Neo, Yoichiro, 103
Nesterov, Vladimir N., 305
Neudeck, Philip G., 311
Neugebauer, M., 332
Newell, W. R., 131
Nguyen, QuynhGiao N., 55
Nibs, Elvis, 155
Nicholas, T., 20
Nichols, T., 97
Nicol, J. J., 210
Nield, George C., 35
Nieves, R., 51
Nikiforov, S. M., 52
Nikitkin, Michael, 112
Nilsson, Thomy, 160
Ningmei, Yu, 234
Nishi, Hiroshi, 122
Nishikawa, K., 294
Nishimura, Tsunehiko, 262
Nishina, Tatsuo, 98, 318
Nito, Hiroaki, 320
Nobili, L., 222
Noble, David F., 84, 85
Noble, J. C., 333
Noble, John C., 333
Noda, Takafumi, 51
Noguchi, H., 185
Nomiyama, Hiroyuki, 320
Norman, Ignacio, 63
Norreys, P., 125
Norreys, P. A., 134, 299, 300
Norton, Todd, 322
Notley, M., 126, 133, 301
Notley, Margaret, 123
Notoya, Youji, 93
Notstrand, J., 90
Nottola, A., 132, 206
Nozawa, Toshiyuki, 235
Ntuen, C., 217
Nunes, A. C., Jr., 139
Nunes, Luis Romeu, 308
Nusing, R., 93
Nuth, Joesph A., III, 329
Nuth, Joseph A., III, 328
Nyberg, Sten, 162
Nyden, M., 67

O

O, 74
Oba, M., 277
Obergefell, Louise, 226, 228
Obergefell, Louise A., 229
Ochiai, Tsutomu, 295
Oestman, P., 290
Ogawa, J. S., 164
Ohashi, Yuji, 273
Ohkuni, K., 292
Ohtani, Keita, 308
Oka, Y., 291

Okabe, H., 182
Okamura, S., 292
Okuyama, Sumio, 318
Olson, J. M., 175
Olson, W. S., 196
ONeill, Mark J., 41
ONeill, P., 206, 282
ONeill, P. E., 167
Oner, Adalet, 269
Onikura, Hiromichi, 123
Ono, D., 39
OOhara, Wataru, 297
Opila, Elizabeth J., 55
Opstad, Per Kristian, 223
Oren, Tuncer I., 85
ORourke, R. M. N., 127, 128
Ortiz, Paul G. Roman, 238
Osakabe, M., 291, 292
Oshima, Takahiro, 278
Osvay, K., 136
Ottaviani, M., 297
Ottenstein, Laura, 112
Owens, Jerry K., 295
Owens, Lewis R., Jr., 6
Oxford, D., 241
Ozaki, Ryoichi, 296
Ozoroski, Lori P., 12

P

Pace, S., 99
Paciesas, W. S., 335
Pack, G. J., 180
Padilla, Denise D., 256
Pagan, Francisco, 151
Pages, Olivier, 256
Pai, Frank, 43
Pancratz, David J., 227
Pandey, R. K., 302
Panthaki, Malcolm, 238
Panunto, M. J., 175
Papanikolopoulos, N. P., 218
Pappalardo, G., 116
Paradis, Stephane, 84
Pardo, Philippe, 147
Parker, A. W., 53, 54, 55, 281, 282
Parker, Tony, 123
Parkinson, M., 134
Parks, Russell, 20
Parodos, Themis, 120
Parr, D., 129
Parr, D. M., 129
Parra, Amy, 249
Parsiani, Hamed, 238
Partridge, Michael, 287
Paskoff, G., 226
Pasley, J., 126, 300
Patel, Bharat, 241
Patnaik, Surya N., 146
Patrick, N., 224
Payne, M., 133
Payne, W. V., 168
Payton, Jeremy, 260
Pearl, John C., 331
Peck, Jeff, 25, 41
Pederson, Kevin, 285
Peli, Eli, 164
Pellettiere, J. A., 228
Pena, Edward, 255
Pendergraft, Odis C., Jr., 5
Pendleton, G. N., 335
Peng, Tai–Ching, 275
Penn, B., 276, 305
Penn, B. S., 152
Penn, Benjamin, 286
Penn, Benjamin B., 60
Penn, Benjamin G., 285, 303
Penn, Brian S., 260
Pepler, D., 133
Pepler, D. A., 133, 136, 301
Peplinski, Jesse, 75
Perez, A. E., 152
Perkey, Donald J., 183, 195
Perry, C. E., 212
Perry, Chris, 226
Perry, Jeffrey S., 163
Perry, Robert, 314
Perry, Troy, 182
Pert, G. J., 128, 279
Pesnell, W. D., 333
Pestehe, S. J., 128, 283
Peters, C., 132
Peterson, John A., 184
Peterson, Tim, 260
Petrone, Peter, 322
Petropoulos, L. J., 213
Petrovic, Zrilic G., 234
Pettersson, L., 89
Pfauntsch, S. J., 118
Pham, Vuong T., 63
Phillips, D., 55
Phillips, T. G., 326
Piatak, David J., 7
Pibil, William T., 164
Pick, Monique, 331
Pilmanis, A. A., 213
Pinai, Linwong, 246
Pingitore, N. E., 152
Pingitore, Nicholas E., Jr., 184
Pippin, H. G., 43
Pique, A., 116
Piszczor, Michael F., 41
Piya, Tanthawichian, 91
Plafker, George, 190
Plangetis, Gus F., 137
Plotkin, H., 116
Plumb, M., 282
Plumridge, J., 130
Poker, D. B., 305
Poletto, G., 332
Pollack, S. K., 49
Polsgrove, Daniel E., 117
Ponchak, George E., 77
Ponte, Rui M., 199
Porcu, Silvio, 221, 222, 223
Portalatin, M., 217
Posthumus, J. H., 130
Pour, K. M., 304
Powell, J. A., 311
Powell, Kirk St. A., 302
Powers, L. M., 70
Powis, I., 281
Prabhakaran, R., 45
Prasad, Nadipuram R., 94
Pratap, V., 39
Preece, R. D., 335
Prior, N. M., 135
Pritchard, Jocelyn I., 13
Privette, Jeffrey L., 166
Proctor, Fred H., 2
Przybylinski, Stanley M., 321
Ptak, Andrew F., 327, 335
Pu, Zhao–Xia, 197
Pukhov, A., 124
Pumarol, Manuel, 62
Purman, Richard I., 313
Pustovitov, Vladimir D., 291
Pyrhoenen, O., 100

Q

Qu, Min, 22
Quast, Peter, 38
Quinn, David A., 34, 329
Quintana, S., 257

R

Radil, K. C., 19
Rahman, Saidur, 244
Rajbhanadri, Narayan B., 155
Rajbhandari, N., 150
Rajbhandari, Narayan, 155

Rajbhandaril, Narayan, 158
Ramamurthi, K., 41
Ramirez–Angulo, J., 78, 97
Ramos–Izquierdo, L., 116
Ramsey, B. D., 324
Randolph, Lynwood, 313
Ranson, K. Jon, 167
Rao, Yan F., 51
Ravichandran, K., 276
Reason, C. J., 290
Redding, David, 322
Reddy, B. R., 153
Reddy, C., 184
Reddy, P., 39
Reed, Kim N., 23
Reehal, H. S., 69
Reid, Bob J., 285
Reid, K. L., 280
Reis, Deane G., 10
Ren, J., 238
Renaud, P., 170, 174
Rettig, T. W., 328
Reyes, Raul, 182
Reynolds, D. B., 212
Ribeiro, Nuno Pedro, 221
Rice, Catharine, 97
Richards, Rosalie A., 286
Rickman, D., 148
Rickman, Doug, 313
Rietmeijer, Frans J. M., 328
Riishojgaard, Lars Peter, 188
Rinde, T., 149
Ringel, S. A., 306
Rishe, Naphtali, 147
Rizer, Annette, 228
Rizer, Annette L., 229
Roberts, J. S., 310
Roberts, V., 310
Robertson, Brent, 36
Robertson, E. G., 282
Robinson, D. G., 210
Robinson, Dave, 322
Robinson, J. H., 143
Robinson, Richard D., 324
Robinson, Wayne, 199
Roddan, G., 210
Rodden, W. S. O., 132
Rodriguez, J. A., 152
Rodriguez, Ricardo, 249
Rodriguez, William J., 314
Rodriguez–Sanchez, Rosa, 159
Rodriquez, J. M., 185
Rogers, Dana B., 231
Rogers, Lawrence C., 229
Rogers, Paul, 112
Rohl, Peter J., 12
Romanacci, Paolo, 36
Romero, Melvin, 303
Romoli, M., 332
Rondon, Angelica, 249
Roney, Celeste A., 286
Ronney, P. D., 46
Rood, Richard B., 188
Rorie, Toinette, 265
Rose, S. J., 127, 301
Rose, Steven, 123
Rosekind, Mark R., 213
Rosentreter, J. J., 51
Rosner, Mordechai, 119
Ross, I., 311
Ross, I. N., 135, 136, 290
Roth, J. A., 173
Rotman, S. R., 161
Rousseau, J. P., 51
Ruark, M. D., 150
Rubadeux, K. L., 139
Rueda, Alfonso, 313
Rumerman, Judy A., 337
Rumminger, M. D., 49
Rusin, Robert, 166
Rutherford, Jacqueline, 62
Ryan, J. F., 109, 283, 310
Rybicki, G. C., 174
Rysdyk, R. T., 21

S

Sabelhaus, Phil, 36
Sachs, Daniel, 272
Sack, Fred D., 204
Sadaaki, Roberto, 244
Saha, Abi, 325
Saito, Shin, 67
Saito, Takahiro, 192
Saito, Takayuki, 112
Saito, Yuji, 66
Sajima, Takao, 123
Sakai, Masao, 262
Sakai, Yukio, 49
Sakamura, Jun–ichi, 274
Sakimoto, P., 313
Salvati, M., 118, 124, 297, 298
Sanchez, Merri J., 224
Sanden, R., 41
Sanders, F. H., 89
Sanders, Peter, 216
Sanderson, J. H., 131
Sanford, G. L., 71
Sanford, Gary L., 201
Sanghadasa, Mohan, 60, 285, 286
Santala, M., 299
Santala, M. I. K., 118, 124, 125, 126, 297, 298, 299, 300
Santee, M. L., 185
Santiago, Miguel, 61, 287
Santos, Javier, 42
Sanuki, Heiji, 293
Sarkisov, S., 305
Sarkisov, Sergey, 115
Saruta, Kazuki, 318
Sasaki, Kazuhiro, 193
Sasaki, Kouki, 244
Sasaki, Makoto, 92
Sasaki, Tamotsu, 236
Sathananthan, Sivapragasm, 256, 259
Sathanthan, S., 143
Sato, Atsushi, 90
Sato, J., 331
Sato, Junsei, 91
Sato, Masumi, 277
Sato, Naoyuki, 270
Sato, Shun, 266
Sato, T., 292
Sato, Yasuhiko, 291
Sato, Yoshiyuki, 103
Sauber, Jeanne, 190
Saucier, Richard, 269
Savage, M., 139
Sawyer, David G., 325
Scarl, Ethan A., 35
Schaefer, R. J., 56
Schaeffer, Jon C., 58
Schamschula, Marius, 154, 156, 157
Scheiman, D., 174
Scheiman, David, 179
Schetz, J. A., 16
Schiavi, A., 126
Schieder, R., 326
Schmidlin, F. J., 196
Schomer, Paul D., 272
Schrage, Daniel P., 12, 13, 240
Schuler, Peter, 66
Schulz, M., 333
Schulz, Mark J., 43, 44
Schurig, H. H., 173
Schutte, Klamer, 162
Schwartz, R. N., 304
Schweitzer, M., 226
Schwemmer, G., 116
Schwemmer, G. K., 196
Scott, R. L., 333
Scribner, D. A., 164
Seino, Takuya, 310
Sena, J. Tom, 285
Senwo, Z., 150, 152

Serlemitsos, Peter J., 327
Seywald, Hans, 22
Shadaydeh, Maha, 105
Shaffer, D., 152
Shah, D., 53
Shaikh, T. S., 238
Shaikh, W., 118, 132, 206
Shaker, John F., 40
Shakir, Safwat H., 152
Shannon, G. J., 132
Shapiro, Philip, 176
Sharif, J. A., 46
Sharkey, P., 281
Sharp, Lynda, 85
Shastry, S. V. K., 108
Shellenbarger, Zane A., 171
Shen, Yaxi, 143
Shepherd, D., 135
Shi, D., 276
Shi, D. T., 62, 302
Shi, D.T., 98
Shie, C.–L., 197
Shields, Elwood W., 12
Shima, Kazunari, 312
Shimamune, Yosuke, 309
Shimano, Satoshi, 278
Shimizu, Harumichi, 64
Shimoe, Okada, 244
Shimohure, Kensuke, 250
Shin, In–Seek, 285
Shindo, Wataru, 42
Shinmei, Katsuhisa, 235
Shizawa, Y., 233
Shoji, Daisei, 308
Sicard, B., 217
Sicher, D., 39
Siewert, T. A., 140
Silk, E. A., 168
Simms, P., 128
Simnett, G., 332
Simons, J. P., 282
Simons, M., 220
Simons, R. N., 78
Simonsen, K. J., 82
Simpson, J., 196, 197
Simpson, Timothy W., 74, 75
Sims, I. R., 281, 282, 330
Sims, Paul E., 179
Sinai, M. J., 164
Singh, V. K., 249
Singhal, R. P., 125, 126, 131, 279, 280
Skoug, R. M., 327
Slade, Kara N., 37
Slark, G. E., 127
Smialek, James L., 58
Smith, B., 203
Smith, C., 305
Smith, C. W., 327
Smith, D. C., 109
Smith, D. J., 131, 280
Smith, E., 196
Smith, Earl B., 254
Smith, Guy A., 288
Smith, I. W. M., 281, 282, 330
Smith, Michael D., 331
Smith, R., 59, 283
Smith, S. D., 231
Snowden, S. L., 334
So, Hon, 272
Sohma, Shunichi, 310
Solberg, Yoram, 119
Soman, Vishwas, 158
Soman, Vishwas V., 157
Sotoohi, Goli, 314
Spaans, Mink, 86
Spallicci, Allesendro D. A. M., 72
Speegle, C. O., 324
Spence, B. R., 178
Spencer, I., 125, 126, 299
Spencer, T. J., 311
Spinhirne, James, 166
Springate, E., 279
Springer, M.–J.–N., 210
Stahle, C. K., 325
Stajner, Ivanka, 188
Staker, R. J., 269
Stammer, Detlef, 199
Stanley, A., 54
Stanley, Diane, 36
Staples, C. R., 165
Starr, D. OC, 196
Starr, Stuart H., 88
Statler, Richard, 176
Stecher, Theodore, 326
Steen, W. M., 132
Steinfeld S., 158
Steinfield, S., 151
Stern, Jeff A., 109
Sterzelmeier, K., 93
Stevens, C. J., 109
Stevens, D. L., 132, 206
Stevens, William K., 87
Stinson, T., 135
Stockwell, Alan E., 13
Stone, Barbara, 217
Stone, Barbara M., 220
Strati, F., 128, 130
Strayer, Richard, 201
Strickland, D., 217
Stroud, Colin, 241
Struzik, Alain, 141
Stubbs, M. A., 135
Stuhmiller, James H., 212, 229
Stutzer, D., 166
Suarez, Max J., 195
Suess, Steven T., 332
Sugai, Ichirou, 275
Sugama, H., 292
Sugama, Hideo, 293
Suggs, Robert M., 191
Sugimura, Taku, 295
Sulistio, Pauvi, 235
Sullivan, Nancy G., 314
Summers, G., 169
Summers, G. P., 101, 174, 175
Summers, Geoffrey P., 176
Summers, S., 69
Sun, Fang, 246
Sun, Guoqing, 167
Sun, X. Z., 52
Sundfor, Hans Olav, 80
Sunkara, H. B., 276
Surrency, J., 150, 184
SuryanarayanaRao, K. N., 96
Suzuki, Akio, 237
Suzuki, Fumio, 111
Suzuki, Kouzo, 90
Suzuki, Tateyuki, 112
Suzuki, Tsunehisa, 205
Swanson, Gregory, 139
Szabo, A., 327
Szymkowiak, A. E., 325

T

Tabarrock, B., 208
Tabazadeh, A., 185
Tachibana, Kazuhiro, 98, 318
Tachon, P., 217
Tada, E., 73
Tada, Seiji, 248
Taday, P. F., 130, 131, 134, 135, 279, 280
Tadesse, W., 150, 156
Taga, Tooru, 63
Tai, Hsiang, 334
Tajika, Ichiro, 167
Tajima, T., 294
Takada, Kenichi, 278
Takagi, S., 292
Takahara, Hideki, 250
Takahashi, Daishiro, 243
Takahashi, Daisuke, 191
Takahashi, H., 73
Takai, Hideki, 246

Takatsuka, Toshinori, 309
Takechi, M., 292
Takeiri, Y., 291
Takeshi, Suzuki, 91
Takezawa, Masaaki, 116
Tallents, G., 128
Tallents, G. J., 127, 128, 129, 130, 132, 206, 283
Tanabe, Akira, 107
Tanaka, Atsushi, 318
Tanaka, Jun, 64
Tantaris, R. N., 322
Tantaris, Richard, 255
Tao, W.–K., 196, 197
Tashashi, Daisuke, 66
Tatarakis, M., 118, 124, 125, 297, 298, 299, 300
Taylor, P. T., 192
Taylor, R. A., 283, 310
Taylor, T., 286
Tebaldi, C., 297
Teehan, Russell F., 122
Teranishi, Kaname, 250
Terashima, Yuichi, 327, 335
Terauchi, Ryota, 313
Terse, Anita, 202
Testa, A., 99
Teulings, A. M. G. L., 230
Tezuka, Meguru, 295
Thaik, Myo, 304
Thampi, Sreekumar, 33
Their, Ricarda, 216, 223
Thielman, M., 326
Thomas E., 303
Thomas, C. B., 69
Thomas, Edward, Jr., 294
Thompson, Albert N., Jr., 286
Thompson, Anne M., 187
Thompson, R. S., 147
Thomson, J., 54
Thorner, John A., 95
Thornton, Thomas, 163
Thorsen, Ulf, 81
Thyagarajan, Sunil K., 43
Tielemans, W., 219
Tiggeler, H., 106
Tillery, Willie, 252
Tillman, Barry W., 18
Timmons, M. L., 101, 169
Timofeeva, Tatiana V., 276
Tinker, Michael L., 32, 37
Tobin, D., 196
Toi, K., 292
Tokanai, Hideki, 111
Tokar, R. L., 327
Tokmakian, Robin, 199
Tolbert, Mary O., 251
Tolk, Andreas, 81
Tominaga, Hiro–o, 50
Tominaga, Kenichiro, 104
Toner, W. T., 55
Torrisi, Fabio Danilo, 263
Townsend, Cheryl, 286
Townsend, John S., 41
Towrie, M., 53, 54, 55, 58, 68, 280
Towrie, Mike, 52
Treurniet, Willem, 84
Tripodi, P., 99
Trivedi, Mohan M., 241
Trotman, A., 42
Trotman, Audrey, 201
Tryggvason, Bjarni V., 72
Tsegaye, T., 150, 151, 152, 156, 184
Tsegaye, Teferi, 157, 158, 185
Tsintsadze, L. N., 294
Tsuga, Toshihito, 74
Tsuhara, Koichi, 92
Tsui, Kwok–Leung, 240
Tsumori, K., 291
Tsuru, Norio, 145
Tucker, C. J., 166
Tucker, Dennis S., 288
Tuhkanen, S., 187
Tung, Frank, 38
Tung, Y. S., 286, 302
Tunstel, E., 257
Turcu, E., 206
Turcu, I. C. E., 132
Turner, Matthew, 119
Tzallas, P., 131, 279

U

Uchida, M., 291
Ueda, A., 286
Ueki, Kazuya, 268
Underwood, J., 281
Uneyama, Kazuhiro, 271
Urban, Frank, 147
Usami, Kiyoaki, 288
Ushiki, Takeo, 107
Uyama, T., 292

V

Vadde, Srinivas, 241
Vainstein, F., 253
Valco, M. J., 19
Valentine, Mark E., 239
Valerio, Robert, 142
Valk, P. J. L., 220
Van Slyke, Jonathan J., 57
VanBeers, Pascal, 222
vanDelft, Jan, 84
vandenKroonenberg, A. J., 227
Vandeputte, Thomas W., 4
vanderBliek, Jan, 336
vanderHorst, M. J., 227
VanDerveer, Donald, 42
VanDyke, Melissa, 285
Vargas, Gabriel, 202
Vargas–Aburto, C., 174
Varoneckas, G., 224
Vas, Irwin E., 35
Vasilkov, Alexander, 199
Vasquez, Ramon, 249
Vaughn, Jason A., 66
Veazie, D., 287
Veazie, David R., 43
Velez–Reyes, Miguel, 157
Velicki, Darlene, 18
Vendura, G. J., Jr., 173
Venkatasubramanian, R., 101, 169
Venugopalan, S., 58
Vernon, Stanley, 171
Vickers, C., 124, 300
Videen, Gorden, 267
Vilela, M. F., 170, 174
Vink, Jan, 165
Vipond, A., 53
Vlcek, A., Jr., 52, 54, 58, 283
vonderBeeck, Michael, 247
Vorobiev, Pavel Mikhailovich, 35
Vullinghs, Huub F. M., 220

W

Wade, Montanez, 255
Wakaida, I., 277
Wakatani, Masahiro, 291
Walden, Maria A., 266
Walker, Gilbert, 120
Wallace, Kent, 294
Walraet, F., 283
Walsh, C., 207, 208
Walters, Brett A., 18
Walters, Michael R., 175
Walters, R., 169
Walters, R. J., 101, 174, 175, 180
Walters, Robert J., 176
Walton, Connie, 60
Wan, Chao–min, 207
Wang, Xiao Yen, 273
Wang, Chun–Chieh, 108

Wang, F. C., 306
Wang, Hui, 105
Wang, Ling, 207
Wang, Shaojie, 293
Wang, W. S., 303
Wang, Wen–Jieh, 108
Wang, Yabo, 237
Wang, Yanyun, 61
Wang, Z., 118
Wang, Zheng–rong, 207
Wark, J. S., 127, 299
Washington, D., 110
Washington, K., 306
Wasilewski, P. J., 192
Watanabe, H., 233
Watanabe, Hiroshi, 121
Watanabe, Hiroyuki, 214
Watanabe, Hisashi, 310
Watanabe, Masahiro, 247
Watanabe, T.–H., 292
Watkins, Wendell R., 218
Watson, Michael, 294
Watts, I., 125, 126, 298, 299, 300
Watts, I. F., 125
Wayda, Michael E., 321
Wayne, R. P., 53
Webster, J. R. P., 68
Wei, Ting–Cun, 67
Weinberg, I., 174, 180
Weiner, B. R., 48
Weiner, Brad R., 276
Welsch, H., 213
Welser, R. E., 307
West, Mark, 38
Westhall, J., 132, 206
Westrin, P., 96
Wharton, R. K., 212
Wheatley, Gary, 85
White, Bettie, 313
White, C. W., 286
White, Stacy J., 314
Whiteman, D. N., 116, 196
Whitley, P., 226
Whorton, Mark S., 284
Wider, John, 38
Wiener, Earl L., 9
Wientjes, Cornelis J. E., 220
Wijk, G., 144
Wilkins, R., 97, 302, 306
Wilkinson, J., 118
Wilkosz, A., 305
Wilks, R., 58
Willi, O., 124, 126
Williams, E. K., 305
Williams, I. D., 131
Williams, Kyron, 293
Williams, M. Susan, 6
Williams, T., 97
Williams, Tamara S., 323
Wilson, David L., 161
Wilson, John W., 334
Wilson, Mark, 322
Wilson, R. G., 304
Wilson, Robert M., 194, 195
Wilt, D. M., 170
Wilt, David M., 179
Wincheski, Buzz, 266
Winfree, William P., 266
Winkles, Joseph, 234
Winstone, T. B., 134
Wismans, J. S. H. M., 227, 230
Witte, Jacquelyn C., 187
Witus, G., 162
Wojtczuk, Steven, 120, 171
Wolf, Th., 93
Wolfe, David, 287
Wolfe, Jeremy M., 218
Wolfrum, E., 127, 128
Wolfrum, E. W., 128
Wood, P. C., 144
Woodyard, James R., 175
Workman, Gary L., 288
Worm, Arne, 84
Wright, G. W., 304
Wright, S., 217
Wright, S. M. A., 282
Wright, William B., 6
Wu, Chivey, 264
Wu, Fei, 276
Wu, J., 58
Wu, Joz, 11
Wu, M. H., 286
Wu, M.–S., 46
Wu, Ray–Shyan, 188
Wu, Ying–Jeng, 269
Wyborn, B. E., 136
Wyborn, Brian, 123

X

Xing, Guang–Qian, 114
Xu, F., 47
Xu, Y., 301
Xuan, Li, 307

Y

Yahagi, Kiyoshi, 318
Yajima, Tatsuhiko, 295
Yakura, S. Joe, 93
Yamada, H., 292
Yamada, Nozomi, 309
Yamaguchi, Takahiro, 107
Yamakawa, Hideki, 268
Yamauchi, Masaaki, 309
Yang, Jyh–Bin, 247
Yang, S., 196
Yang, Song, 189
Yaqoob, Tahir, 327
Yasaka, Tetsuo, 23
Yasuda, Noriaki, 308
Yasui, K., 292
Yater, Jane A., 179
Yates, Thomas, 156
Yatsuda, Hiromi, 274
Yau, Nie–Jia, 247
Yeager, William T., Jr., 3
Yeh, Hsing C., 145
Yeh, Kuo–Liang, 188
Yen, Tsong, 76
Yiu, Fong–Gee, 11
Yoda, Hidehiko, 289
Yokoyama, Masayuki, 291
Yokoyama, S., 185
Yoshida, Masato, 121
Yoshioka, Hiroki, 91
Yoshitomi, Kenichirou, 123
Yoshizawa, Masami, 288
You, Hisien–I, 113
You, Z., 97
Young, Thomas, 330
Yu, James H.–Y., 229
Yuan, X.–C., 127

Z

Zarbakhsh, A., 68
Zavada, J. M., 304
Zelenka, Richard E., 10
Zenker, T., 114
Zepf, M., 125, 126, 298, 299, 300
Zhang, J., 128
Zhang, Shoudu, 287
Zhang, X., 45
Zhang, Xiao–Ying, 270
Zhao, Feng–Ji, 263
Zhou, Feng, 302
Ziejewski, Mariusz, 226
Zmuidzinas, Jonas, 109
Zou, X., 152
Zrilic, Djuro, 78, 260
Zuhr, R., 286
Zycki, P. T., 328