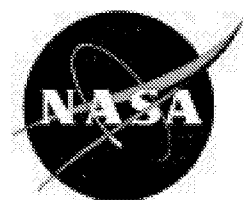


NASA/SP—1999—7037/SUPPL393
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AERONAUTICAL ENGINEERING

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Typical Report Citation and Abstract

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

Key

1. Document ID Number; Corporate Source
2. Title
3. Author(s) and Affiliation(s)
4. Publication Date
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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 393)

FEBRUARY 5, 1999

01 AERONAUTICS

19990009583 Logistics Management Inst., McLean, VA USA

The Aviation System Analysis Capability Noise Impact Model Final Report

Wingrove, Earl R., III, Logistics Management Inst., USA; Ege, Russell, Logistics Management Inst., USA; Burn, Melissa, Wyle Labs., Inc., USA; Carey, Jeffrey, Wyle Labs., Inc., USA; Bradley, Kevin, Wyle Labs., Inc., USA; Nov. 1998; 76p; In English
Contract(s)/Grant(s): NAS2-14361; RTOP 538-16-11-01

Report No.(s): NASA/CR-1998-208952; NAS 1.26:208952; Rept-NS704S1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

To meet its objective of assisting the U.S. aviation industry with the technological challenges of the future, NASA must identify research areas that have the greatest potential for improving the operation of the air transportation system. To accomplish this, NASA is building an Aviation System Analysis Capability (ASAC). The Noise Impact Model (NIM) has been developed as part of the ASAC. Its primary purpose is to enable users to examine the impact that quieter aircraft technologies and/or operations might have on community noise impact and air carrier operating efficiency at any of 16 large- and medium-sized U.S. airports. The analyst chooses an airport and case year for study, selects a runway use configuration and set of flight tracks for the scenario, and has the option of reducing the noise of the aircraft that operate at the airport by 3, 6, or 10 decibels. NIM computes the resultant noise impact and estimates any airline operations improvements. Community noise impact is characterized in three ways: the size of the noise contour footprint, the number of people living within the contours, and the number of homes located in the same contours. Distance and time savings are calculated by comparing the noise abatement flight path length to a less circuitous alternate routing. For a more efficient runway use configuration, the increase in capacity and reduction in delay are shown.

Author

Air Transportation; Airline Operations; Airports; Aircraft Noise; Noise Reduction

19990009584 NASA Langley Research Center, Hampton, VA USA

Aeroservoelastic and Structural Dynamics Research on Smart Structures Conducted at NASA Langley Research Center
McGowan, Anna-Maria Rivas, NASA Langley Research Center, USA; Wilkie, W. Keats, NASA Langley Research Center, USA; Moses, Robert W., NASA Langley Research Center, USA; Lake, Renee C., NASA Langley Research Center, USA; Florance, Jennifer Pinkerton, NASA Langley Research Center, USA; Wieseman, Carol D., NASA Langley Research Center, USA; Reaves, Mercedes C., NASA Langley Research Center, USA; Taleghani, Barmac K., NASA Langley Research Center, USA; Mirick, Paul H., NASA Langley Research Center, USA; Wilbur, Matthew L., NASA Langley Research Center, USA; 1998; 14p; In English; Smart Structures and Materials: Industrial and Commercial Applications, 1998, Unknown; Sponsored by International Society for Optical Engineering, USA

Report No.(s): Paper 3316-21; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An overview of smart structures research currently underway at the NASA Langley Research Center in the areas of aeroservoelasticity and structural dynamics is presented. Analytical and experimental results, plans, potential technology pay-offs, and challenges are discussed. The goal of this research is to develop the enabling technologies to actively and passively control aircraft and rotorcraft vibration and loads using smart devices. These enabling technologies and related research efforts include developing experimentally-validated finite element and aeroservoelastic modeling techniques; conducting bench experimental tests to assess feasibility and understand system trade-offs; and conducting large-scale wind-tunnel tests to demonstrate system performance. The key aeroservoelastic applications of this research include: active twist control of rotor blades using interdigitated electrode piezoelectric composites and active control of flutter, and gust and buffeting responses using discrete piezoelectric patches. In addition, NASA Langley is an active participant in the DARPA/ Air Force Research Laboratory/ NASA/ Northrop Grumman

Smart Wing program which is assessing aerodynamic performance benefits using smart materials. Keywords: aeroelasticity, smart structures, piezoelectric actuators, active fiber composites, rotorcraft, buffet load alleviation, individual blade control, aero-servoelasticity, shape memory alloys, damping augmentation, piezoelectric power consumption

Author

Research; Aeroservoelasticity; Dynamic Structural Analysis; Smart Structures; Mathematical Models; Data Acquisition

19990009747 NASA Langley Research Center, Hampton, VA USA

Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplement 391

Jan. 08, 1999; 52p; In English

Report No.(s): NASA/SP-1999-7037/SUPPL391; NAS 1.21:7037/SUPPL391; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

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

CASI

Bibliographies; Aerodynamics; Aeronautical Engineering; Indexes (Documentation)

19990009954 National Aerospace Lab., Tokyo, Japan

Experimental Studies of Supersonic Film Cooling with Shock Wave Interaction, 2

Ono, F., National Aerospace Lab., Japan; Kanda, T., National Aerospace Lab., Japan; Saito, T., National Aerospace Lab., Japan; Wakamatsu, Y., National Aerospace Lab., Japan; Dec. 1997; 22p; In Japanese

Report No.(s): PB99-108755; NAL-TR-1340; Copyright Waived; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Supersonic film cooling was tested in a Mach 2.35 wind tunnel to investigate the effect of external shock waves. The coolant was injected tangentially to the wall and became subsonic through the shock wave from the wake behind the separating plate. Mixing of the coolant with the primary fluid was not enhanced by the shock wave impingement in the vicinity of the wall surface, and the decrease of the film cooling effectiveness was mainly due to the deceleration of the coolant layer. The cooling effectiveness decreased downstream of the shock wave impingement. The maximum wall pressure was lower than the pressure calculated with the oblique shock wave equation. It was confirmed that momentum was transported from the primary flow to the core part of the coolant layer with mass transportation. Based on this result, the interaction between the subsonic film coolant and the supersonic primary flow caused by the shock wave impingement was simulated. With the simulated results, separation of the film coolant was investigated.

NTIS

Film Cooling; Slotted Wind Tunnels; Supersonic Flow; Engine Coolants; Supersonic Combustion Ramjet Engines; Shock Wave Interaction; Oblique Shock Waves; Supersonic Wind Tunnels

19990012864

Aeroacoustics and aerodynamics of high-speed Coanda devices, part 2: effects of modifications for flow control and noise reduction

Carpenter, P. W., Univ. of Warwick, UK; Smith, C.; Journal of Sound and Vibration; Dec 18, 1997; ISSN 0022-460X; Volume 208, no. 5, pp. 803-822; In English; Copyright; Avail: Issuing Activity

The paper describes two studies of the effects of flow control devices on the aerodynamics and aeroacoustics of a high-speed Coanda flow that is formed when a supersonic jet issues from a radial nozzle and adheres to a tulip-shaped body of revolution. Shadowgraphy and other flow-visualization techniques are used to reveal the various features of the complex flow fields. The acoustic characteristics are obtained from far- and near-field measurements with an array of microphones in an anechoic chamber. First the effects of incorporating a step between the annular exit slot and the Coanda surface are investigated. The step is incorporated to ensure that the breakaway pressure is raised to a level well above the maximum operating pressure. It substantially increases the complexity of the flow field and acoustic characteristics. In particular, it promotes the generation of two groups of discrete tones. A theoretical model based on a self-generated feedback loop is proposed to explain how these tones are generated.

The second study investigates the effects of replacing the annular exit slot with a saw-toothed one with the aim of eliminating the discrete tones and thereby substantially reducing the level of noise generated.

Author (EI)

Coanda Effect; High Speed; Noise Reduction; Acoustics; Aerodynamics; Supersonic Flow

19990012865

Aeroacoustics and aerodynamics of high-speed Coanda devices, part 1: conventional arrangement of exit nozzle and surface

Carpenter, P. W., Univ. of Warwick, UK; Green, P. N.; Journal of Sound and Vibration; Dec 18, 1997; ISSN 0022-460X; Volume 208, no. 5, pp. 777-801; In English; Copyright; Avail: Issuing Activity

The literature on high-speed Coanda flows and its applications is reviewed. The lack of basic information for design engineers is noted. The present paper is based on an investigation of the aeroacoustics and aerodynamics of the high-speed Coanda flow that is formed when a supersonic jet issues from a radial nozzle and adheres to a tulip-shaped body of revolution. Schlieren and other flow visualization techniques together with theoretical methods are used to reveal the various features of this complex flow field. The acoustic characteristics were obtained from measurements with an array of microphones in an anechoic chamber. The emphasis is placed on those features of the aerodynamics and aeroacoustics which may be of general interest.

Author (EI)

Coanda Effect; High Speed; Acoustics; Aerodynamics; Supersonic Flow

19990013291

Disturbances propagation in supersonic boundary layers

Lipatov, I. I.; Prikladnaya Matematika i Mekhanika; May-june, 1996; Volume 60, no. 3, pp. 457-464; In Russian; Copyright; Avail: Issuing Activity

The nonstationary processes of disturbances propagation in two-dimensional boundary layers are analyzed for the regime of strong interaction. A system of characteristics and subcharacteristics corresponding to the gasdynamic wave processes and the processes of convection and diffusion is determined. The systems of equations describing the processes of weak interaction of a flow in the laminar boundary layer with an external hypersonic flow near the surface cooled are analyzed. For the flow described by a self-model system of the boundary layer-equations, the velocity of disturbances propagation is found on the basis of a numerical solution as a dependence of temperature.

EI

Supersonic Boundary Layers; Hypersonic Flow; Hypersonics; Boundary Layers; Diffusion; Convective Heat Transfer

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19990009542 NASA Langley Research Center, Hampton, VA USA

Impingement of Boundary-Reflected Disturbances Originating at the Nose of a Body of Revolution in the Langley Research Center 16-Foot Transonic Tunnel

Re, Richard J., NASA Langley Research Center, USA; Capone, Francis J., NASA Langley Research Center, USA; Oct. 1998; 40p; In English

Contract(s)/Grant(s): RTOP 537-07-20-21

Report No.(s): NASA/TM-1998-208723; NAS 1.15:208723; L-17755; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An investigation has been conducted in the Langley 16-Foot Transonic Tunnel to determine boundary-reflected disturbance lengths at low supersonic Mach numbers in the octagonally shaped test section. A body of revolution that had a nose designed to produce a bow shock and flow field similar to that about the nose of a supersonic transport configuration was used. The impingement of reflected disturbances on the model was determined from static pressures measured on the surface of the model. Test variables included Mach number (0.90 to 1.25), model angle of attack (nominally -10, 0, and 10), and model roll angle.

Author

Supersonic Transports; Supersonic Speed; Static Pressure; Shock Waves; Mach Number; Bow Waves; Bodies of Revolution

19990010052 Alabama Univ., Dept. of Aerospace Engineering and Mechanics, Tuscaloosa, AL USA

Including Aeroelastic Effects in the Calculation of X-33 Loads and Control Characteristics

Zeiler, Thomas A., Alabama Univ., USA; Sep. 1998; 6p; In English; Also announced as 19990010001; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Up until now, loads analyses of the X-33 RLV have been done at Marshall Space Flight Center (MSFC) using aerodynamic loads derived from CFD and wind tunnel models of a rigid vehicle. Control forces and moments are determined using a rigid vehicle trajectory analysis and the detailed control load distributions for achieving the desired control forces and moments, again on the rigid vehicle, are determined by Lockheed Martin Skunk Works. However, static aeroelastic effects upon the load distributions are not known. The static aeroelastic effects will generally redistribute external loads thereby affecting both the internal structural loads as well as the forces and moments generated by aerodynamic control surfaces. Therefore, predicted structural sizes as well as maneuvering requirements can be altered by consideration of static aeroelastic effects. The objective of the present work is the development of models and solutions for including static aeroelasticity in the calculation of X-33 loads and in the determination of stability and control derivatives.

Derived from text

Aerodynamic Loads; Aeroelasticity; Stability Derivatives; Load Distribution (Forces); Mathematical Models

03

AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19990009282 NASA Langley Research Center, Hampton, VA USA

Generic Equations for Constructing Smooth Paths Along Circles and Tangent Lines With Application to Airport Ground Paths

Barker, L. Keith, NASA Langley Research Center, USA; Dec. 1998; 33p; In English; Original contains color illustration

Contract(s)/Grant(s): RTOP 538-04-13-02

Report No.(s): NASA/TP-1998-208960; L-17745; NAS 1.60:208960; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The primary purpose of this publication is to develop a mathematical model to describe smooth paths along any combination of circles and tangent lines. Two consecutive circles in a path are either tangent (externally or internally) or they appear on the same (lateral) or opposite (transverse) sides of a connecting tangent line. A path may start or end on either a segment or circle. The approach is to use mathematics common to robotics to design the path as a multilink manipulator. This approach allows a hierarchical view of the problem and keeps the notation manageable. A user simply specifies a few parameters to configure a path. Necessary and sufficient conditions automatically ensure the consistency of the inputs for a smooth path. Two example runway exit paths are given, and an angle to go assists in knowing when to switch from one path element to the next.

Author

Paths; Tangents; Circles (Geometry); Airports; Smoothing; Mathematical Models

19990009856 Federal Aviation Administration, Washington, DC USA

Airport Surface Operations Safety Action Plan, 1998: to Reduce Runway Incursions and Improve Operations

1998; 54p; In English

Report No.(s): PB99-112559; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This 1998 Action Plan represents a systemwide, multifaceted strategy to reduce incidents and accidents directly attributable to runway incursions and improve airport surface operations. It identifies goals, objectives, and actions that address management and procedural changes; improvements in airport navigation aids, signs and surface markings; technology-based efforts; and increased incursion awareness efforts. The plan is in direct support of the FAA Administrator's goal to reduce runway incursions by 15 percent of the 1997 level by the year 2000.

NTIS

Airports; Airfield Surface Movements; Accident Prevention; Safety

19990009861 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA

Report to the Chairman, Subcommittee on Transportation and Infrastructure, House of Representatives. Aviation Safety: Installation of Smoke Detection and Fire Suppression Systems in US Transport Aircraft

Dec. 1997; 30p; In English

Report No.(s): PB99-112757; GAO/RCED-98-54R; B-278016; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Federal Aviation Administration (FAA) is planning to issue new regulations to upgrade the fire safety standards for cargo or baggage compartments in certain passenger and cargo aircraft. These regulations would require that approximately 3,700 existing aircraft be retrofitted to include fire suppression and/or smoke detection systems in their cargo or baggage compartments and that all new aircraft entering service include such systems. We reviewed the actions under way at FAA and within the aviation industry to effect these changes within the 3-year time frame proposed by FAA. We addressed the following questions: What is the status of FAA's and the airline industry's efforts to equip aircraft cargo compartments with new smoke detection and fire suppression systems; and What factors may affect the timetable for equipping the entire fleet with this new equipment.

NTIS

Congressional Reports; Transport Aircraft; Smoke Detectors; Cargo Aircraft; Aircraft Safety; Smoke; Fire Prevention

1999000997 Army Aviation and Missile Command, Aeroflightdynamics Directorate, Moffett Field, CA USA

Short Haul Civil Tiltrotor Study in MIDAS: Auto versus Manual Nacelle Procedures for Commanded Go-Around

Atencio, Adolph, Jr., Army Aviation and Missile Command, USA; Banda, Carolyn, Sterling Software, Inc., USA; Nov. 1998; 162p; In English

Contract(s)/Grant(s): RTOP 538-07-15; DA Proj. 6211A-A47A-AF2075

Report No.(s): NASA/TM-1998-208753; NAS 1.15:208753; A-9900314; USAAMCOM-TR-99-A-003; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Tiltrotor aircraft combine the speed and range of a turboprop performance with the ability to take off and land in a vertical mode like a helicopter. These aircraft will transport passengers from city center to city center and from satellite airports to major hub airports to make connections to long range travel. The Short Haul Civil Tiltrotor (SH(CT)) being studied by NASA is a concept 40 passenger civil tiltrotor (CTR) transport. The Man-machine Integration Design and Analysis System (MIDAS) was used to evaluate human performance in terms of crew procedures and pilot workload for a simulated 40 passenger Civil Tiltrotor Transport on a steep approach to a vertiport. The scenario for the simulation was a normal approach to the vertiport that is interrupted by a commanded go-around at the landing decision point. The simulation contrasted an automated discrete nacelle mode control with a fully manual nacelle control mode for the go-around. The MIDAS simulation showed that the pilot task loading during approach and for the commanded go-around is high and that pilot workload is near capacity throughout. The go-around in manual nacelle mode was most demanding, resulting in additional time requirements to complete necessary tasks.

Author

Short Haul Aircraft; Man Machine Systems; Automatic Control; Nacelles; Manuals; Aircraft Design; Manual Control

04

AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19990009119 NASA Goddard Space Flight Center, Greenbelt, MD USA

Spaceborne GPS: Current Status and Future Visions

Bauer, Frank H., NASA Goddard Space Flight Center, USA; Hartman, Kate, NASA Goddard Space Flight Center, USA; Lightsey, E. Glenn, NASA Goddard Space Flight Center, USA; 1998; 16p; In English; Defense and Civil Space Programs, 30 Oct. 1998, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Global Positioning System (GPS), developed by the Department of Defense is quickly revolutionizing the architecture of future spacecraft and spacecraft systems. Significant savings in spacecraft life cycle cost, in power, and in mass can be realized by exploiting GPS technology in spaceborne vehicles. These savings are realized because GPS is a systems sensor--it combines the ability to sense space vehicle trajectory, attitude, time, and relative ranging between vehicles into one package. As a result, a reduced spacecraft sensor complement can be employed and significant reductions in space vehicle operations cost can be realized through enhanced on-board autonomy. This paper provides an overview of the current status of spaceborne GPS, a description of spaceborne GPS receivers available now and in the near future, a description of the 1997-2000 GPS flight experiments, and the spaceborne GPS team's vision for the future.

Author

Global Positioning System; Spacecraft Instruments; Radio Receivers; Autonomous Navigation; Spacecraft Guidance; Space Navigation

19990009215 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA
National Airspace System: FAA Has Implemented Some Free Flight Initiatives, but Challenges Remain
Sep. 1998; 19p; In English; Report to Congressional Requesters.

Report No.(s): AD-A354694; GAO/RCED-98-246; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report discusses the results of our review of (1) the status of the Federal Aviation Administration's (FAA) efforts to implement free flight, including a planned operational demonstration formerly known as Flight 2000 and now called the Free Flight Operational Enhancement Program, and (2) the views of the aviation community and FAA on the challenges that must be met to implement free flight in a cost-effective manner. The predicted growth in air traffic and the aging of air traffic control equipment led the Federal Aviation Administration (FAA) to undertake a multibillion-dollar modernization effort in 1981 to improve the safety, capacity, and efficiency of the nation's air traffic control system. Since that time, this program has experienced substantial cost overruns, lengthy schedule delays, and significant performance shortfalls. To get the modernization effort back on track and thereby address the limitations of the present system and satisfy users' growing demands, FAA-in consultation with the aviation community-is developing a phased approach to modernization, including a new way of managing air traffic known as "free flight." Under the modernization program, FAA plans to introduce a host of new technologies and procedures that will enable free flight-allowing the agency to move gradually from its present use of highly structured rules and procedures for air traffic operations to a more flexible system in which decisions for conducting flight operations will be based increasingly on collaboration between FAA and users. For example, these technologies and associated procedures will give pilots and controllers more precise information about the location of aircraft and allow them to exchange information more efficiently.

DTIC

Air Traffic; Air Traffic Control; Augmentation; Control Equipment; Controllers

19990009280 Civil Aeromedical Inst., Oklahoma City, OK USA

An Acoustic Analysis of ATC Communication Final Report

Prinzo, O. V., Civil Aeromedical Inst., USA; Lieberman, P., Brown Univ., USA; Pickett, E., Brown Univ., USA; Jul. 1998; 27p; In English

Contract(s)/Grant(s): FAA-95-G-034

Report No.(s): AD-A355102; DOT/FAA/AM-98/20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report consists of an acoustic analysis of air traffic control (ATC) communications. Air traffic control specialists (ATCS) from a TRACON facility participated in the simulation study. Each ATCS worked light and heavy traffic density scenarios for 2 feeders and 1 final sector. All communications were audio recorded and transcribed verbatim by a retired ATCS. Workload was determined by the number of aircraft under positive control when the ATCS initiated a transmission. Utterances were selected to achieve maximal workload contrast. For each participant, the 5 lowest workload utterances from the Light version of the scenario (simulating that participant's normal work station) and the 5 highest workload utterances from the Heavy version of the scenario (simulating a work station unfamiliar to the participant) were identified and digitized. For all participants, speaking rate (syllables/second), pause frequency (number of pauses/number of words), and pause duration (duration of pauses/number of words) were generated from the selected utterances using the BLISS speech analysis system (Lieberman and Blumstein, 1988). The results indicate that ATCSs tended to pause more frequently and for greater duration under a light workload condition. The hesitations found in their speech may reflect a shift between a more cognitive "thinking" response mode in light traffic situations where ATCSs know that they have more time to respond and a more automatic mode, which allows them to respond to the increased pace induced by higher traffic loads. In conclusion, it appears that hesitation in speech may be a potential indicator of workload. Despite its highly speaker-dependent nature, hesitation pauses may be a useful indicator of an ATCS's responding in a cognitive, rather than in an automatic mode.

DTIC

Acoustic Measurement; Air Traffic Control; Air Traffic Controllers (Personnel); Aircraft Control; Loads (Forces)

19990009402 Topo Photo, Inc., Columbus, OH USA

Development of Aerial Photogrammetric Navigation by GPS Final Report

Merchant, Dean C., Topo Photo, Inc., USA; Oct. 24, 1997; 26p; In English

Report No.(s): PB99-109787; FHWA/OH-98/001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this research was to implement a similar photo-nav system for ODOT, tailored to the larger scale characteristics of the ODOT photo missions. Drawing on these developments, the ODOT photogrammetric system, which includes a geodetic quality airborne GPS(Global positioning System) receiver, was augmented with a laptop computer and supporting devices to provide the photo-navigator with full view and control over the various system components. Software developments facilitated the office flight-planning phase, the field operations, and subsequent download processing of data. At the conclusion of the program,

the photo-nav equipment was installation in the ODOT Partenavia aircraft and demonstrated. The final report includes the objectives of the program and descriptions of hardware, software and results.

NTIS

Photogrammetry; Navigators; Global Positioning System; Air Navigation; Aerial Photography

19990009439 Range Commanders Council, White Sands Missile Range, NM USA

Guidelines Document: Global Positioning System (GPS) as a Real-Time Flight Safety Data Source

Jun. 1998; 56p; In English

Report No.(s): AD-A355134; RCC-322-98; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This guidelines document was written specifically to assist flight safety and other range support personnel in implementing GPS as a real time safety data source. However, it also provides information to the range manager who is involved in transitioning a range to GPS and to range users who are considering incorporating GPS as a tracking source on their test vehicles. This document includes a brief discussion of the overall flight safety test management process and the requirement placed on any metric data source when that source is to be used for real time safety decision making.

DTIC

Air Navigation; Global Positioning System; Flight Safety; Safety Management

19990009440 Civil Aeromedical Inst., Oklahoma City, OK USA

Recovery of the FAA Air Traffic Control Specialist Workforce, 1981-1992 Final Report

Broach, Dana, Editor, Civil Aeromedical Inst., USA; Aug. 1998; 62p; In English

Report No.(s): AD-A355135; DOT/FAA/AM-98/23; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Federal Aviation Administration was confronted in 1981 with the challenge of rebuilding its core, technical, and highly-trained air traffic control specialist (ATCS) workforce following the PATCO strike. From late 1981 through mid-1992, the FAA rebuilt this critical workforce through a large-scale testing, screening and training program. By mid-1992, recovery of the controller workforce was complete, and it was no longer necessary for the FAA to conduct a large-scale hiring program. The six papers presented in this report represent the first major retrospective analysis of the complete data set describing the recovery of the FAA's en route and terminal ATCS workforce following the 1981 controller strike. The first paper describes the personnel processes, focusing on recruitment and hiring programs for the en route and terminal options. The second paper presents a detailed description of the aptitude test battery used to evaluate over 400,000 applicants between 1981 and 1992. The third paper offers a definitive statistical portrait of the FAA Academy Screening programs as predictors of field training outcomes. On-the-job training (OJT) programs in en route and terminal facilities are described in the fourth paper. These four papers, taken together, provide a definitive description of the processes used to recruit, test, screen, and train persons for the ATCS occupation between 1981 and 1992. The fifth paper draws on FAA organizational survey data to describe controller perceptions of the organizational climate in which the workforce recovery occurred. The sixth paper analyzes current controller workforce demographics and technological trends in air traffic control to identify potential areas of future research.

DTIC

Work; Education; Air Traffic Control; Personnel Development; Controllers

19990009945 Ohio State Univ., Columbus, OH USA

Continuous Aircraft Positioning Using GPS Aided by INS Final Report

Jekeli, C.; Jan. 23, 1998; 50p; In English

Report No.(s): PB99-106726; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents the results of a study performed at the Department of Civil Environmental Engineering and Geodetic Science with application to ODOT's Aerial Engineering tasks. Specifically, the study was concerned with the integration of the Global Positioning System and an inertial navigation system (INS) for precise, continuous positioning of ODOT's aerial photogrammetric airplane. The study was based on testing a medium-to-high accuracy inertial navigation system (Litton's LN93) with GPS on board an aircraft. The objective was to demonstrate that such an integration can maintain the GPS accuracy of 2-3 cm over short intervals (few seconds) and to determine the capability using optimal estimation algorithms of maintaining accurate positions over somewhat longer periods. The motivation behind this study is the fact that GPS positioning may be interrupted because of a variety of reasons, from electronic interference (causing cycle slips) to shadowing of the satellite signals (by aircraft wings and tail).

NTIS

Global Positioning System; Photogrammetry; Inertial Navigation; Position Sensing; Airborne Equipment

19990010030 Auburn Univ., Dept. of Aerospace Engineering, AL USA

Evaluation of GPS Coverage for the X-33 Michael-6 Trajectory

Lundberg, John B., Auburn Univ., USA; Sep. 1998; 6p; In English; Also announced as 19990010001; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The onboard navigational system for the X-33 test flights will be based on the use of measurements collected from the Embedded Global Positioning System (GPS)/INS system. Some of the factors which will affect the quality of the GPS contribution to the navigational solution will be the number of pseudorange measurements collected at any instant in time, the distribution of the GPS satellites within the field of view, and the inherent noise level of the GPS receiver. The distribution of GPS satellites within the field of view of the receiver's antenna will depend on the receiver's position, the time of day, pointing direction of the antenna, and the effective cone angle of the antenna. The number of pseudorange measurements collected will depend upon these factors as well as the time required to lock onto a GPS satellite signal once the GPS satellite comes into the field of view of the antenna and the number of available receiver channels. The objective of this study is to evaluate the GPS coverage resulting from the proposed antenna pointing directions, the proposed antenna cone angles, and the effects due to the time of day for the X-33 Michael-6 trajectory from launch at Edwards AFB, California, to the start of the Terminal Area Energy Management (TAEM) phase on approach to Michael AAF, Utah.

Author

Global Positioning System; Spacecraft Trajectories; Field of View

05

AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19990009270 Naval Air Warfare Center, Weapons Div., Point Mugo, CA USA

Distributed Simulation Testing for Weapons System Performance of the F/A-18 and AIM-120 AMRAAM

Watson, Tom, Naval Air Warfare Center, USA; Jan. 1998; 17p; In English

Report No.(s): AD-A355385; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Naval Air Warfare Center Weapons Division has established a long range, real-time link between the F/A-18 Weapons System Support Facility (WSSF) at China Lake, CA and the AIM-120 Hardware in the Loop (HWIL) laboratory at Point Mugu, CA. The link was established in response to a fleet demand for information on the total weapons system performance of the Hornet and AIM-120 sub-systems in an electronic jamming environment, since AIM-120 performance is very dependent on the quality of the guidance data link provided by the host aircraft. In an effort to minimize costly flight testing, the link concept was developed to obtain actual (vice simulated) aircraft radar performance and data link updates in order to more accurately assess overall performance of the aircraft/missile system.

DTIC

Air to Air Missiles; California; Data Links; Flight Tests; Jamming; Radar Data

19990009346 Science Applications International Corp., Huntsville, AL USA

X-33 Flight Visualization

Laue, Jay H., Science Applications International Corp., USA; 1998; 7p; In English; Space Technology and Applications International Forum (STAIF), 31 Jan. 4 Feb. 1999, Albuquerque, NM, USA

Contract(s)/Grant(s): NAS8-40197; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The X-33 flight visualization effort has resulted in the integration of high-resolution terrain data with vehicle position and attitude data for planned flights of the X-33 vehicle from its launch site at Edwards AFB, California, to landings at Michael Army Air Field, Utah, and Maelstrom AFB, Montana. Video and Web Site representations of these flight visualizations were produced. In addition, a totally new module was developed to control viewpoints in real-time using a joystick input. Efforts have been initiated, and are presently being continued, for real-time flight coverage visualizations using the data streams from the X-33 vehicle flights. The flight visualizations that have resulted thus far give convincing support to the expectation that the flights of the X-33 will be exciting and significant space flight milestones... flights of this nation's one-half scale predecessor to its first single-stage-to-orbit, fully-reusable launch vehicle system.

Author

X-33 Reusable Launch Vehicle; Real Time Operation; Optical Tracking

19990009407 Naval Postgraduate School, Monterey, CA USA

An Optimization-Based Decision Support Model for the Navy H-60 Helicopter Preventive Maintenance Program

Albright, Michael H.; Sep. 1998; 57p; In English

Report No.(s): AD-A355527; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

For Naval aircraft, the largest portion of Operating and Support (O&S) costs is consumed by maintenance. The effort to reduce O&S costs is part of a Naval Air Systems Command initiative termed Affordable Readiness. Innovative programs are being implemented under Affordable Readiness to maintain safety, sustain readiness, and reduce costs. One program, Integrated Maintenance Concept (IMC), is being developed for the Navy H-60 helicopter. IMC calls for depot-level artisans to be collocated at each squadron facility rather than at a central facility. Integrating appropriate organizational level maintenance tasks with germane subsets of the depot level tasks is the essence of the H-60 IMC. Reduced aircraft maintenance costs and out-of-service time are the major benefits of IMC. As part of the transition to IMC, current organizational, intermediate and depot maintenance requirements are being reviewed for applicability and effectiveness. The result of this review will be a new listing of justified preventive maintenance tasks. The tasks will then be grouped into admissible maintenance evolutions that attempt to minimize total aircraft out-of-service time. This thesis explores the potential synergism inherent to certain preventive maintenance task groupings that can lead to an overall reduction in aircraft out-of-service time. A prototypic optimization-based decision support model is developed. The solution presented is in terms of total cost in hours to perform all required tasks over a given time horizon. Additionally, the optimal task groupings are identified. Together, these results are insightful for developing a preventive maintenance program.

DTIC

Optimization; Aircraft Maintenance; Helicopters; Mathematical Models; Computerized Simulation; Prevention; Planing

19990009611 Army Research Lab., Army Vehicle Technology Center, Hampton, VA USA

Innovative Composite Fuselage Design for Improved Crashworthiness

Jackson, Karen E., Army Research Lab., USA; Fasanella, Edwin L., Army Research Lab., USA; 1998; 9p; In English; 54th, 20-22 May 1998, Washington, DC, USA; Sponsored by American Helicopter Society, Inc., USA; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An innovative composite fuselage design concept was developed which will meet structural and flight loads requirements and satisfy design goals for improved crashworthiness. The fuselage is fabricated using a composite sandwich construction and consists of a relatively rigid upper section, or passenger cabin, including a stiff structural floor and a frangible lower section which encloses the crash energy management structure. This report describes the advantages of the fuselage concept, the fabrication process for building a 1/5 scale model of the fuselage concept, and the experimental procedure used to conduct an internal pressure test of the section. In addition, the STructural Analysis of General Shells (STAGS) finite element code was used to analyze design modifications and to simulate the structural response of the fuselage section to internal pressure testing.

Author

Design Analysis; Fuselages; Fabrication; Structural Analysis; Sandwich Structures; Aerodynamic Loads

19990009940 Rutgers - The State Univ., Mechanical and Aerospace Engineering, Piscataway, NJ USA

Stochastic Methods for Aircraft Design *Final Report*

Pelz, Richard B., Rutgers - The State Univ., USA; Ogot, Madara, Rutgers - The State Univ., USA; 1998; 10p; In English

Contract(s)/Grant(s): NAG1-1559; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The global stochastic optimization method, simulated annealing (SA), was adapted and applied to various problems in aircraft design. The research was aimed at overcoming the problem of finding an optimal design in a space with multiple minima and roughness ubiquitous to numerically generated nonlinear objective functions. SA was modified to reduce the number of objective function evaluations for an optimal design, historically the main criticism of stochastic methods. SA was applied to many CFD/MDO problems including: low sonic-boom bodies, minimum drag on supersonic fore-bodies, minimum drag on supersonic aeroelastic fore-bodies, minimum drag on HSCT aeroelastic wings, FLOPS preliminary design code, another preliminary aircraft design study with vortex lattice aerodynamics, HSR complete aircraft aerodynamics. In every case, SA provided a simple, robust and reliable optimization method which found optimal designs in order 100 objective function evaluations. Perhaps most importantly, from this academic/industrial project, technology has been successfully transferred; this method is the method of choice for optimization problems at Northrop Grumman.

Author

Aerodynamic Characteristics; Aerodynamics; Aeroelasticity; Aircraft Design; Flexible Wings; Sonic Booms; Supersonic Drag

19990012778

Surface integrity and fatigue life of turned gamma titanium aluminide

Mantle, A. L., Univ. of Birmingham, UK; Aspinwall, D. K.; Journal of Materials Processing Technology; Dec 15, 1997; ISSN 0924-0136; Volume 72, no. 3, pp. 413-420; In English; Copyright; Avail: Issuing Activity

This paper outlines the effect of single-point turning on the surface integrity and fatigue life of a gamma XD(trademark) titanium aluminide (Ti-45Al-2Nb-2Mn-0.8% TiB(sub 2)) produced by Howmet, USA. Intermetallic materials of this type are currently being evaluated by leading aerospace companies world-wide for use in aeroengine applications (e.g. compressor blades), due to their good high-temperature properties and low density (approximately = 50% of Ni-based superalloys). Workpiece surface integrity defects were found after machining, including deformed lamellae/surface drag, material pull-out/cracking (less than 20 micron depth) and increased microhardness. Such problems were encountered in all specimens even when machining under fine-finishing conditions. The S-N fatigue curves, produced from rotating bending tests at room temperature, were 'flat' and contained a large amount of spread. The difference between turned and polished specimens was minimal, both having an endurance limit of approximately 350 MPa.

Author (EI)

Fatigue Life; Titanium Aluminides; Titanium Alloys; Fatigue (Materials); Intermetallics; High Temperature; Density (Mass/Volume)

19990013976 NASA Marshall Space Flight Center, Huntsville, AL USA

X-34 Program Status

London, John R., III, NASA Marshall Space Flight Center, USA; Lyles, Garry M., NASA Marshall Space Flight Center, USA; 1998; 5p; In English; 49th; International Astronautical Congress, 28 Sep. - 2 Oct. 1998, Melbourne, Australia
Report No.(s): IAF-98-V.4.04; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The National Aeronautics and Space Administration (NASA) initiated the current X-34 program in 1996 as part of the U.S. Space Agency's effort to dramatically reduce the cost of access to space. The X-34 is the First in a series of 'Pathfinder' vehicles designed to conduct flight testing of key launch vehicle technologies at low cost. The X-34 program has moved rapidly from the drawing board to hardware buildup with the first flight scheduled for 1999. The development of the X-34 has been accomplished by a unique blend of industry and government organizations and personnel working closely together. The program will provide rocket-powered winged vehicles that can fly sub-orbital missions in support of advanced reusable launch vehicle (RLV) technology development. In addition, the X-34 vehicles will represent a hypersonic testbed for advanced experiments in the aeronautical sciences.

Author

X-34 Reusable Launch Vehicle; Reusable Launch Vehicles; Reusable Spacecraft; Rocket Vehicles; Launch Vehicles; Hypersonics; Flight Tests; Cost Reduction; Aerodynamics

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.

19990009344 NASA Lewis Research Center, Cleveland, OH USA

Improved Modeling of Finite-Rate Turbulent Combustion Processes in Research Combustors

VanOverbeke, Thomas J., NASA Lewis Research Center, USA; Nov. 1998; 290p; In English

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

Report No.(s): NASA/TM-1998-208823; E-11430; NAS 1.15:208823; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

The objective of this thesis is to further develop and test a stochastic model of turbulent combustion in recirculating flows. There is a requirement to increase the accuracy of multi-dimensional combustion predictions. As turbulence affects reaction rates, this interaction must be more accurately evaluated. In this work a more physically correct way of handling the interaction of turbulence on combustion is further developed and tested. As turbulence involves randomness, stochastic modeling is used. Averaged values such as temperature and species concentration are found by integrating the probability density function (pdf) over the range of the scalar. The model in this work does not assume the pdf type, but solves for the evolution of the pdf using the Monte Carlo solution technique. The model is further developed by including a more robust reaction solver, by using accurate thermodynamics and by more accurate transport elements. The stochastic method is used with Semi-Implicit Method for Pressure-Linked Equa-

tions. The SIMPLE method is used to solve for velocity, pressure, turbulent kinetic energy and dissipation. The pdf solver solves for temperature and species concentration. Thus, the method is partially familiar to combustor engineers. The method is compared to benchmark experimental data and baseline calculations. The baseline method was tested on isothermal flows, evaporating sprays and combusting sprays. Pdf and baseline predictions were performed for three diffusion flames and one premixed flame. The pdf method predicted lower combustion rates than the baseline method in agreement with the data, except for the premixed flame. The baseline and stochastic predictions bounded the experimental data for the premixed flame. The use of a continuous mixing model or relax to mean mixing model had little effect on the prediction of average temperature. Two grids were used in a hydrogen diffusion flame simulation. Grid density did not effect the predictions except for peak temperature and tangential velocity. The hybrid pdf method did take longer and required more memory, but has a theoretical basis to extend to many reaction steps which cannot be said of current turbulent combustion models.

Author

Combustion Physics; Turbulence Models; Mathematical Models; Direct Numerical Simulation; Energy Dissipation; Monte Carlo Method; Premixed Flames; Reaction Kinetics; Thermodynamics; Turbulent Combustion

19990009739 National Aerospace Lab., Tokyo, Japan

Mach 6 Testing of a Scramjet Engine Model

Kanda, T., National Aerospace Lab., Japan; Saito, T., National Aerospace Lab., Japan; Kudo, K., National Aerospace Lab., Japan; Komuro, T., National Aerospace Lab., Japan; Ono, F., National Aerospace Lab., Japan; Feb. 1998; 30p; In English Report No.(s): PB99-108771; NAL-TR-1345T; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Testing of a sub-scale scramjet research engine model was carried out in the Mach 6 Ramjet Engine Test Facility of the National Aerospace Laboratory, Kakuda Research Center. by attaching a short strut on the top wall, intensive combustion with high combustion efficiency was attained, and the engine-produced thrust cancelled the drag. The flame was held in the low-velocity region around the step, even after the ignitors had been turned off. When the fuel flow rate was small, there was a different combustion mode with weak combustion and little thrust. Tangential injection of fuel inhibited intensive combustion.

NTIS

Supersonic Combustion Ramjet Engines; Engine Tests; Hypersonic Speed; Fuel Combustion; Fuel Flow; Aerospace Planes; Combustion Efficiency

08

AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

19990009395 Swedish Defence Research Establishment, Div. of Guidance and Control, Materials and Underwater Sensors, Stockholm, Sweden

Fiberoptic Guided Missiles: A Missile Seeker Model and Methods for Fusing Seeker Data in a System with Multiple Missiles

Brolund, Daniel, Swedish Defence Research Establishment, Sweden; Dec. 1997; ISSN 1104-9154; 60p; In English Report No.(s): PB99-108672; FOA-R-97-00664-314-SE; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this thesis, 3D modeling of passive seeker estimates has been investigated. The effects of fusing the seeker estimates from two such seekers in a system of fiberoptic guide missiles have been examined. The intention has been to see if there are any benefits from having two seekers pointed at the same area, and what those benefits are compared to letting the missiles search different areas. An important matter has been to model the passive seeker estimates in 3D using ground topology information to limit the estimates along the line-of-sight of the seeker. The rotational and translational uncertainties of the missile has also been added to the model. The 3D estimates have been fused statically (independently in each frame in time), and by fusion of target tracks established in each sensor by itself. The results of simulations give that seeker data fusion is beneficial. It is argued that the benefits are more significant when a target is occluded in one of the seekers. The costs of the improvements are that less than half the search rate can be obtained and that it takes at least twice the time-of-flight in search mode.

NASA

Fiber Optics; Missiles; Data Systems; Missile Configurations; Estimates; Missile Control

1999009396 Swedish Defence Research Establishment, Div. of Guidance and Control, Materials and Underwater Sensors, Stockholm, Sweden

Fibreoptic Guided Missiles: Optimization of Flight Paths

Raicevic, Peter, Swedish Defence Research Establishment, Sweden; Dec. 1997; ISSN 1104-9154; 74p; In English
Report No.(s): PB99-108680; FOA-R-97-00663-314-SE; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report addresses the problem of finding the optimal paths between the launch site and the target area for a system of fiber optic guided missiles. The missiles will try to avoid flying over areas with high risk. A network model of the problem together with algorithms to solve it is developed. First we look at how to solve the problem with a dynamic programming approach. The dynamic programming algorithm that is used finds the k node-disjoint paths with a minimum total cost. Also, we look at an algorithm concerning how to restrict the maximum number of nodes, and therefore also the length, in a path. Secondly, we investigate briefly how a neural network can be implemented to solve the problem. In this method, we iterate a solution that converges toward the optimal one. A test is run on the first dynamic programming algorithm and presented in the appendix.

NTIS

Fiber Optics; Missiles; Flight Paths; Flight Optimization; Launching Sites; Targets; Missile Control

1999010390

Acoustic altimeter control of a free vehicle for near-bottom turbulence measurements

Montgomery, E. T., Woods Hole Oceanographic Inst., USA; Schmitt, R. W.; Deep-Sea Research, Part 1: Oceanographic Research Papers; Jun, 1997; ISSN 0967-0637; Volume 44, no. 6, pp. 1077-1084; In English; Copyright; Avail: Issuing Activity

A 200 kHz acoustic altimeter was incorporated into the freely-falling High Resolution Profiler (Schmitt et al., 1988; Journal of Atmospheric and Oceanic Technology, 5, 484-500) for the control of weight release at dive-end for near-bottom approaches. The altimeter gave consistent returns within 100 m of the bottom. This has allowed controlled approaches to within 10 m of the bottom for the measurement of turbulence levels. Since near-bottom turbulence levels can be many orders of magnitude above those in the interior ocean, this capability permits study of the strongest mixing regions in the deep ocean.

Author (EI)

Flow Measurement; Turbulent Flow; Altimeters; Oceanography; Audio Equipment; Turbulence

09

RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

1999010315

Performance of a respirable multi-inlet cyclone sampler

Gautam, Mridul, West Virginia Univ., USA; Sreenath, Avula; Journal of Aerosol Science; Oct, 1997; ISSN 0021-8502; Volume 28, no. 7, pp. 1265-1281; In English; Copyright; Avail: Issuing Activity

The performance of the 10 mm Dorr-Oliver cyclone is known to suffer from bias associated with the dependence of its aspiration efficiency on the inlet orientation. A new multi-inlet cyclone sampler was developed to minimize such orientation bias. The sampling flow rate through the new sampler was optimized to match its performance with the newly established ISO-ACGIH-CEN respirable dust sampling convention. Sampling efficiency curves for the multi-inlet cyclone sampler are presented and the cyclone was found to be in good agreement with the ISO-ACGIH-CEN curve in both wind tunnel (at a free-stream velocity of 1.52 m s^(sup -1)) and calm-air chamber tests. At an optimized sampling flow rate of 2.5 l min^(sup \$MIN 1), the sampler has a bias in the mass sampled as low as 0.05%. The new sampler was also designed to be compatible with the existing filter cassette, sampling pumps and the cyclone holder. The samplers were challenged in a wind tunnel using polydispersed coal dust generated in a custom-built fluidized bed. An Aerodynamic Particle Sizer (APS) was used to measure the particle concentration and size distributions collected by the isokinetic sampler and the cyclone sampler. The test matrix consisted of a range of sampling flow rates, orientations from the free stream and free-stream velocities representative of workplace conditions.

Author (EI)

Particle Size Distribution; Sampling; Wind Tunnels; Coal; Dust; Fluidized Bed Processors

19990010318

Factors affecting particle resuspension from grass swards

Giess, P., Univ. of Wolverhampton, UK; Goddard, A. J. H.; Shaw, G.; Journal of Aerosol Science; Oct, 1997; ISSN 0021-8502; Volume 28, no. 7, pp. 1331-1349; In English; Copyright; Avail: Issuing Activity

Measurements of resuspension of 1, 10 and 20 micron particles from grass swards exposed to three wind speeds within a wind tunnel are reported. Particles used were monodisperse porous silica of about unit density, and were labelled with a stable tracer to ensure that deposited and resuspended amounts could be established by neutron activation analysis using the Imperial College Reactor. Grass swards were allowed to grow to two heights of 10 and 25 cm. Resuspension rates (λ) which may be derived in terms of the fraction of the initial deposit that has occurred by a particular time were determined for both sward heights. In another experiment the contaminated grass swards were exposed to a mean free stream wind velocity of 3 m s⁻¹. In some experiments this wind speed was periodically enhanced by sudden gusts of wind generated artificially by opening and closing a pneumatically operated plate fitted over the tunnel exhaust system. The results of these experiments have indicated that surface and environmental conditions can play a significant role in determining particle resuspension from natural surfaces.

Author (EI)

Particle Size Distribution; Wind Tunnels; Silicon Dioxide; Porous Materials; Neutron Activation Analysis

19990011589

Concrete and airport pavements

Barling, J. M., BAA plc Engineering and Construction; Proceedings of the Institution of Civil Engineers, Transport; Nov, 1997; ISSN 0965-092X; Volume 123, no. 4, pp. 226-233; In English; Copyright; Avail: Issuing Activity

This paper traces the development of airport rigid pavement design and construction both in the UK and in the USA, where much of the early theoretical analysis and full scale testing took place. The phenomenal increase in the weight of military and civilian aircraft has led to a more analytical approach to the design of structural pavement layers, with less reliance on empirical solutions, in order to achieve economic designs. With the advent of modern personal computers, and the almost exponential growth in the power of mainframe computers, complex and sophisticated modelling of realistic pavement systems is now possible. Ongoing research into materials technology has sought to enhance the properties of conventional concrete mixes to achieve higher performance at lower whole life cost. Innovation in construction techniques will also allow airport owners to build high quality pavements at lower capital cost. Further full scale loading tests in the USA promise to further advance our understanding of performance in service and bridge the gap between theory and practice.

Author (EI)

Concretes; Pavements; Airports; Runways; Structural Design; Computerized Simulation; Computer Aided Design

19990011590

Dynamic measurements of the Second Severn Crossing

Macdonald, J. H. G., Univ. of Bristol, UK; Dagless, E. L.; Thomas, B. T.; Taylor, C. A.; Proceedings of the Institution of Civil Engineers, Transport; Nov, 1997; ISSN 0965-092X; Volume 123, no. 4, pp. 241-248; In English; Copyright; Avail: Issuing Activity

During construction and for the first year operation of the Second Severn Crossing, the dynamic response of the cable-stayed section of the structure was monitored. This gave valuable insight into the dynamic behavior of cable-stayed bridges in different wind conditions at various stages of construction. The opportunity was also taken to develop and test a remote computer vision displacement measurement system. The actual behavior was compared with predictions from wind tunnel tests and from a finite element model. Following problems with cable oscillations during construction, cable damping parameters were measured and an effective secondary cable system was installed to prevent the vibrations occurring.

Author (EI)

Computer Vision; Displacement Measurement; Bridges (Structures); Structural Analysis; Dynamic Response; Wind Effects; Wind Tunnels

10 ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

19990009161 NASA Marshall Space Flight Center, Huntsville, AL USA

Subsystem Analysis/Optimization for the X-34 Main Propulsion System

McDonald, J. P., Sverdrup Technology, Inc., USA; Hedayat, A., Sverdrup Technology, Inc., USA; Brown, T. M., Sverdrup Technology, Inc., USA; Knight, K. C., Sverdrup Technology, Inc., USA; Champion, R. H., Jr., NASA Marshall Space Flight Center, USA; 1998; 14p; In English; 7th; Multidisciplinary Analysis and Optimization, 2-4 Sep. 1998, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS8-40836

Report No.(s): AIAA Paper 98-4827; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Orbital Sciences Corporation X-34 vehicle demonstrates technologies and operations key to future reusable launch vehicles. The general flight performance goal of this unmanned rocket plane is Mach 8 flight at an altitude of 250,000 feet. The Main Propulsion System (MPS) supplies liquid propellants to the main engine, which provides the primary thrust for attaining mission goals. Major MPS design and operational goals are aircraft-like ground operations, quick turnaround between missions, and low initial/operational costs. Analyses related to optimal MPS subsystem design are reviewed in this paper. A pressurization system trade weighs maintenance/reliability concerns against those for safety in a comparison of designs using pressure regulators versus orifices to control pressurant flow. A propellant dump/feed system analysis weighs the issues of maximum allowable vehicle landing weight, trajectory, and MPS complexity to arrive at a final configuration for propellant dump/feed systems.

Author

Systems Analysis; X-34 Reusable Launch Vehicle; Technology Assessment; Operating Costs; Flight Characteristics

19990011383

ETS-VI on-orbit system identification experiments

Yamaguchi, Isao, Natl. Aerospace Lab., Japan; Kida, Takashi; Komatsu, Keiji; Sano, Masaaki; Sekiguchi, Takeshi; Ishikawa, Shin-ichi; Ichikawa, Shin-ichiro; Yamada, Katsuhiko; Chida, Yuichi; Adachi, Shuichi; JSME International Journal, Series C; Dec, 1997; ISSN 1340-8062; Volume 40, no. 4, pp. 623-629; In English; Copyright; Avail: Issuing Activity

System identification and attitude control experiments have been performed as part of a series of bus experiments on the Engineering Test Satellite-VI, which was launched by an H-II rocket in August 1994. The aims of the experiments were to establish a pre-launch system dynamics modeling method, to evaluate typical on-orbit modal parameter identification methods and to develop robust and precise attitude controller design technology for future large flexible spacecraft and large space structures. In the on-orbit identification experiments, the central body of the satellite was excited by gas jet thrusters and the measured attitude and paddle accelerometer signals were downlinked by telemetry. In this paper, the identified parameters are compared with those of the pre-launch modeling and the accuracy of the pre-launch model is evaluated.

Author (EI)

Parameter Identification; System Identification; Orbits; Launching; Jet Engines

11 CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19990009170 Research Triangle Inst., Research Triangle Park, NC USA

Toxicological Profile for JP-5 and JP-8

Aug. 1998; 206p; In English

Report No.(s): PB99-102550; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This public health statement tells you about the jet fuels JP-5 and JP-8 and the effects of exposure. JP-5 and JP-8 stand for jet propellant-5 and jet propellant-8. JP-5 is the US Navy's primary jet fuel, and JP-8 is one of the jet fuels used by the US Air

Force. Other common names for JP-5, JP-8, and kerosene are these: fuel oil no. 1; straight-run kerosene; kerosine; range oil; Deo-base (the trade name of a clear, white, deodorized kerosene); and coal oil.

NTIS

JP-5 Jet Fuel; JP-8 Jet Fuel; Fuel Oils; Toxicity

19990009543 Ohio Aerospace Inst., MMC Life Prediction Cooperative, Cleveland, OH USA

Validation of Framework Code Approach to a Life Prediction System for Fiber Reinforced Composites *Final Report*

Gravett, Phillip, Pratt and Whitney Aircraft, USA; Sep. 1997; 28p; In English

Contract(s)/Grant(s): NAG3-1768; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The grant was conducted by the MMC Life Prediction Cooperative, an industry/government collaborative team, Ohio Aerospace Institute (OAI) acted as the prime contractor on behalf of the Cooperative for this grant effort. See Figure I for the organization and responsibilities of team members. The technical effort was conducted during the period August 7, 1995 to June 30, 1996 in cooperation with Erwin Zaretsky, the LERC Program Monitor. Phil Gravett of Pratt & Whitney was the principal technical investigator. Table I documents all meeting-related coordination memos during this period. The effort under this grant was closely coordinated with an existing USAF sponsored program focused on putting into practice a life prediction system for turbine engine components made of metal matrix composites (MMC). The overall architecture of the NMC life prediction system was defined in the USAF sponsored program (prior to this grant). The efforts of this grant were focussed on implementing and tailoring of the life prediction system, the framework code within it and the damage modules within it to meet the specific requirements of the Cooperative. The tailoring of the life prediction system provides the basis for pervasive and continued use of this capability by the industry/government cooperative. The outputs of this grant are: 1. Definition of the framework code to analysis modules interfaces, 2. Definition of the interface between the materials database and the finite element model, and 3. Definition of the integration of the framework code into an FEM design tool.

Author

Prediction Analysis Techniques; Turbine Engines; Metal Matrix Composites; Finite Element Method; Fiber Composites; Engine Parts

19990009562 NASA Lewis Research Center, Cleveland, OH USA

Space Shuttle Pinhole Formation Mechanism Studies

Jacobson, Nathan S., NASA Lewis Research Center, USA; Nov. 1998; 42p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 260-10-0G

Report No.(s): NASA/TM-1998-208659; NAS 1.15:208659; E-11351; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Pinholes have been observed to form on the wing leading edge of the space shuttle after about 10-15 flights. In this report we expand upon previous observations by Christensen (1) that these pinholes often form along cracks and are associated with a locally zinc-rich area. The zinc appears to come from weathering and peeling paint on the launch structure. Three types of experimental examinations are performed to understand this issue further: (A) Detailed microstructural examination of actual shuttle pinholes (B) Mass spectrometric studies of coupons containing, actual shuttle pinholes and (C) Laboratory furnace studies of ZnO/SiC reactions and ZnO/SiC protected carbon/carbon reaction. On basis of these observations we present a detailed mechanism of pinhole formation due to formation of a corrosive ZnO-Na-2-O-SiO₂ ternary glass, which flows into existing cracks and enlarges them.

Author

Space Shuttles; Pinholes; Leading Edges; Wings; Carbon-Carbon Composites; Microstructure; Weathering

19990013397

Aerodynamic processing of quartz sands

Brovtsyn, A. K., Obninskij Inst. Atomnoj Energetiki, Russia; Chersheva, G. S.; *Steklo i Keramika*; June, 1996, no. 6, pp. 28-29; In Russian; Copyright; Avail: Issuing Activity

The principally novel setup for the aerodynamic processing of quartz sands and similar friable materials is designed and developed. The study were accomplished on the base of technological processes simulation with the physical models using the similarity theory for the treatment of experimental data obtained. The setup of aerodynamic processing should allow to produce the high-quality found and glass sands.

EI

Quartz; Sands; Silicon Dioxide; Aerodynamics; Models; Simulation

12 ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19990009206 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

ACN Handheld System Design Study Team Report

Legare, David; Blake, Thomas; Sterline, Richard; Gleason, Michael; Erskine, Edmund; Oct. 07, 1998; 92p; In English

Contract(s)/Grant(s): F19628-95-C-0002

Report No.(s): AD-A354843; ESC-TR-95-131; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report examines handheld wireless communication services for the tactical theater that can be provided by a high altitude airborne communication node (ACN) such as the Global Hawk unmanned air vehicle (UAV). An integrated system approach supporting four categories of service is described. The four handheld services included are: a circuit-oriented service for voice and other streaming traffic, a data-oriented service for packets, a tactical broadcast service, and a paging service. Technical issues addressed include: frequency band selection, electromagnetic compatibility, link performance, antenna designs, multiple access, implementation, and security. A system architecture which is asymmetric with regard to its uplink and downlink and which incorporates on-board processing is recommended. The applicability of commercial and government off-the-shelf technologies (COTS and GOTS) is investigated. No single off-the-shelf system was found to satisfy all desired characteristics.

DTIC

Airborne Equipment; Aircraft Communication; Antenna Design; Architecture (Computers); Asymmetry; Broadcasting

19990009499 Research and Technology Organization, RTO Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
Airframe Inspection Reliability Under Field/Depot Conditions *Degre de Fiabilite des Visites d'Inspection des Cellules en Depot et en Conditions Operationnelles*

Nov. 1998; 202p; In English, 13-14 May 1998, Brussels, Belgium; Also announced as 19990009500 through 19990009518

Report No.(s): RTO-MP-10; AC/323(AVT)TP/2; ISBN 92-837-1002-9; Copyright Waived; Avail: CASI; A10, Hardcopy; A03, Microfiche

Papers presented at a Workshop on Airframe Inspection Reliability under Field/Depot Conditions organised by the Applied Vehicle Technology Panel (AVT) of RTO, in Brussels, Belgium, 13-14 May 1998 are presented. The Workshop had the general objective of promoting general discussion on the merits and practicality of generating NDI Probability of Detection (POD) from in-service data and on the use of reliability data in the life-cycle management process. The papers are presented under the following headings: (1) Perspectives on: the role of NDI, factors influencing eddy current POD in the field environment, and NDT reliability; (2) Estimation from small samples and in-service experience; Approaches to POD generation; Analytical issues related to generation and use of POD data; and Practical experience and case studies.

Author

Airframes; Inspection; Nondestructive Tests; Fatigue (Materials); Aircraft Reliability; Service Life; Failure Analysis; Aircraft Maintenance; Structural Analysis

19990009500 Aeronautical Systems Div., Wright-Patterson AFB, OH USA

Role of Nondestructive Inspections in Airworthiness Assurance

Lincoln, John W., Aeronautical Systems Div., USA; Airframe Inspection Reliability under Field/Depot Conditions; Nov. 1998; 14p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Since the seventies, when USA Air Force and the Federal Aviation Administration adopted damage tolerance, much attention has been focused on the reliability of nondestructive inspections of metallic structures. Although there has been considerable effort expended on analyses and tests for many years, there are still serious concerns about the ability to adequately quantify this reliability. This is true for both the widely used deterministic approach as well as the probabilistic approach. The probabilistic approach, which is currently gaining new interest is particularly difficult because the complete probability of detection (POD) function must be determined. Much of the concern with inspection reliability is associated with the lack of understanding of the difference between the laboratory environment and the field environment. Another concern is the level of competence of the inspector needed to reflect the detection probability developed for the instrument. It is the purpose of this paper to illustrate the importance of understanding the reliability of the inspection process to continued airworthiness. This will be accomplished primarily through probabil-

istic methods. The paper will also discuss the use of teardown inspections to enhance the quantification of the inspection reliability. Further, it will discuss some of the current efforts to enhance reliability of the inspection process.

Author

Nondestructive Tests; Inspection; Aircraft Reliability; Aircraft Maintenance; Structural Analysis; Statistical Analysis

19990009501 Boeing Phantom Works, Long Beach, CA USA

Factors Influencing Eddy Current PoD in the Field Environment

Hagemaijer, Don, Boeing Phantom Works, USA; Airframe Inspection Reliability Under Field/Depot Conditions; Nov. 1998; 12p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The probability of detection (PoD) is defined as the probability that, using a specific inspection procedure, a trained inspector will detect a flaw of a certain specified size ($a(\text{det})$). Presented are those factors which influence the eddy current PoD in the field environment, i.e., on-aircraft inspections. Generally, these factors tend to lower NDI performance below that expected on the basis of capability as demonstrated in a laboratory environment. Hence, strict attention must be placed on minimizing the influence the following factors have on the inspection reliability: Human factors and qualified personnel, Access to the inspection area, Inspector working to a specific validated written procedure, Equipment variability, Measurement repeatability, Detectable crack size, Signal-to-noise ratio, and Reference standards. All of these factors must be considered and accounted for to have a reliable written inspection. The most frequent cause for unreliable NDI performance is that of improper NDE engineering. There is a "process", to arrive at reliable inspections. This process consists of the following steps: Perform damage tolerance analysis of the area; Marked-up engineering drawing showing crack location/orientation and crack growth curves; NDT engineers determines the materials involved and the thickness of the structure; Potential NDT methods are selected based on access and $a(\text{det})$; Simulated structure is designed and fabricated; EDM notches of various sizes are fabricated in the reference standard; Determine preliminary procedure and $a(\text{det})$; Finalize procedure and verify on operational aircraft; Procedure reviewed by operator manufacture Working Group and Regulator prior to release; and Release and revise as necessary. The most important point is determining the minimum detectable crack size and establishing the inspection threshold "A" which provides two or more inspections before the crack grows to $a(\text{inst})$. The inspection threshold "A" shall provide a signal-to-noise ratio of 3 to 1 or better.

Author

Nondestructive Tests; Eddy Currents; Inspection; Cracks; Detection; Aircraft Maintenance; Aircraft Structures

19990009502 Defence Evaluation Research Agency, Structural Materials Centre, Farnborough, UK

NDT Reliability Estimation From Small Samples and In-Service Experience

Bruce, David A., Defence Evaluation Research Agency, UK; Nov. 1998; 22p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Optimisation of an inspection strategy to provide acceptable safety at minimal cost requires a knowledge of the reliability of the inspection procedures which could be used. A methodology for assessing inspection reliability, characterising the inspection process by a 95% confidence level probability of detection (POD) curve estimated from artificial trials, has become the standard approach. This method works satisfactorily for straightforward inspection situations where the POD curve can be estimated from a large database, but application of similar methods to airframe inspection suffer from the prohibitive cost of obtaining the reliability curve from realistic trials. Where there is limited data available to determine the reliability, the inbuilt conservatism of the standard method leads to wholly unrealistic estimates for the POD curve which in turn give rise to unacceptably short inspection intervals and excessive maintenance costs. It may be possible to deduce inspection reliability from in service inspection data, although the diversity of inspection situations suggests that there will still be a very limited amount of information available from which to estimate the reliability for a particular inspection task. In this paper the effect of the inbuilt conservatism inherent in the standard method of POD assessment will be demonstrated. Alternative approaches to the prediction of NDT performance will be compared to establish the minimum requirements for inspection data in order to achieve specified safety levels. The possibility of using techniques based on Bayesian inference to provide an optimal prediction of reliability which can be refined as further information is acquired will be described. The effects will be demonstrated using simulated data based on real inspection reliability trials.

Author

Nondestructive Tests; Structural Analysis; Airframes; Inspection; Statistical Analysis; Bayes Theorem; Quality Control

19990009503 Royal Air Force, Non-Destructive Testing Squadron, Barry, UK

Royal Air Force In-Service Approach to Airframe Inspection Reliability Under Field/Depot Conditions

Beverley, S. J., Royal Air Force, UK; Nov. 1998; 8p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The reliability of an NDT technique is directly attributable to 3 factors: the chosen methodology; the quality of technique that the NDT technician is applying; and most importantly, the technicians' capability. The RAF infrastructure optimises each of these 3 elements to ensure that any inspection can be reliably carried out by any NDT technician. NDT techniques are based on practical research and are validated by selected personnel, who have numerous years of operational experience, using all NDT methods. Equally adept, highly motivated technicians then apply the techniques. Hence, confidence in the quality and repeatability of any NDT technique within the RAF is extremely high. The paper will describe the organisation and functions of the RAF NDT Squadron. In-Service equipment and NDT Squadron capability will be reviewed, followed by a look at evaluation and procurement of new equipment, as a function of tasks and technological advancement. The merits of assessing the probability of detection (POD) within the NDT Squadron, using a sterile environment for data capture will then be discussed. The paper will move on to discuss how technique validation is the key to maintaining NDT reliability, and that metallurgical data on the minimum fault size to be detected is essential when selecting the correct methodology. A number of case studies will be presented to highlight some of the more challenging techniques that have been developed and how the various sections interact to provide an effective NDT solution.

Author
Nondestructive Tests; Quality Control; Structural Analysis; Aircraft Maintenance; Airframes

19990009504 National Aerospace Lab., Amsterdam, Netherlands

Airframe Inspection Reliability Using Field Inspection Data

Heida, J. H., National Aerospace Lab., Netherlands; Grooteman, F. P., National Aerospace Lab., Netherlands; Nov. 1998; 10p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The possibilities within the Royal Netherlands Air Force (RNLAF) maintenance system to establish reliability data relevant for the in-service nondestructive inspection of F-16 airframe structure are described. The principal inspection techniques herewith are manual and automatic eddy current inspection for the detection of fatigue cracking. Use is made of field inspection data registered in the Core Automated Maintenance System (CAMS) for specific airframe inspection points within the F-16 Aircraft Structural Integrity Program (ASIP). The available data include the registration of the number of cracks and the length of the largest crack found during the phased inspections. Further, use is made of crack growth data obtained from the aircraft manufacturer. An evaluation of the field inspection data and the crack growth data allows the estimation of the sensitivity and reliability of inspection for the structural details concerned. The results of this evaluation can be used to revise the current values of the inspection intervals for the ASIP inspection points.

Author

Airframes; Structural Failure; Eddy Currents; Inspection; F-16 Aircraft; Nondestructive Tests; Fatigue (Materials); Cracks

19990009505 Air Logistics Center, Tinker AFB, OK USA

Performance Experience and Reliability of Retirement For Cause (RFC) Inspection Systems

Keller, Sara, Air Logistics Center, USA; Berens, A. L., Dayton Univ. Research Inst., USA; Garcia, Robert, Air Logistics Center, USA; Pairazaman, Carlos, Veridian, USA; Buynak, Charles F., Wright Lab., USA; Nov. 1998; 4p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The US Air Force Inspection Based Life Management of engine components requires an extensive Nondestructive Inspection (NDI) system Reliability Assessment. When this inspection technology is implemented in a production mode of operation, trade-off between better Probability of Detection - POD (lower thresholds) and throughput requirements become a way of life. Compromises between inspection requirements and "real Life" take place. The US Air Force experience developing, testing, and implementing Automated inspection systems, NDE technology, and Reliability testing are discussed.

Author

Nondestructive Tests; Engine Parts; Inspection; Aircraft Maintenance; Service Life; Statistical Analysis; Retirement For Cause

19990009506 Boeing Commercial Airplane Co., Seattle, WA USA

Development of Reliable NDI Procedures for Airframe Inspection

LaRiviere, Stephen G., Boeing Commercial Airplane Co., USA; Thompson, Jeff, Boeing Commercial Airplane Co., USA; Nov. 1998; 6p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Nondestructive inspection (NDI) plays a key role in maintaining the continued airworthiness of the airplane fleet, with its ability to detect small defects with minimal disassembly. Although the responsibility for developing the inspection procedure rests with the NDI Technology engineer, collaboration with other technical communities is necessary. Structures Engineering and Customer Service representatives identify inspection requirements and provide the NDI engineers with information from fatigue tests

and analysis, along with in-service issues. This collaboration has produced more than 1,000 reliable inspection procedures over the last 20 years.

Author

Nondestructive Tests; Inspection; Aircraft Maintenance; Airframes; Fatigue (Materials); Failure Analysis; Fatigue Tests

19990009507 Institute for Aerospace Research, Ottawa, Ontario Canada

Probability of Detection of Corrosion in Aircraft Structures

Komorowski, J. P., Institute for Aerospace Research, Canada; Forsyth, D. S., Institute for Aerospace Research, Canada; Simpson, D. L., Institute for Aerospace Research, Canada; Gould, R. W., Institute for Aerospace Research, Canada; Nov. 1998; 8p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

High cost and safety concerns related to aircraft corrosion indicate the need for changes to the current "find-it-fix-it" philosophy for corrosion management. Developments in nondestructive inspection techniques will lead to multidimensional corrosion metrics to support the corrosion damage assessment of structures. Data fusion techniques are proposed to aid in the interpretation of the multiple nondestructive inspections typically required for corrosion damage quantification. Corrosion reliability in terms of probability of detection (POD) is proposed as a requirement for safety related corrosion detection. Quantification of the POD for field corrosion inspections is limited by the subjective manner in which detected corrosion is characterised. Corrosion metrics need to be identified to provide consistency to characterisation of detected corrosion, to provide input to corrosion analytical assessments and to provide the basis for POD evaluations.

Author

Aircraft Structures; Nondestructive Tests; Inspection; Aircraft Maintenance; Structural Analysis; Corrosion; Damage Assessment

19990009511 British Aerospace Aircraft Group, Military Aircraft and Aerostructures, Warton, UK

A Systematic Approach to the Selection of Economic Inspection Methods and Intervals

Spence, S. H., British Aerospace Aircraft Group, UK; Nov. 1998; 8p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Fatigue related inspections are required when the safe life of a structure is less than the target service life (as a result of shortcomings in design, changes in usage, etc.) or where structural integrity support by inspection has been identified by a damage tolerance analysis. The increase in life extension programmes arising due to constricting defence budgets is leading to an increasing dependence on inspections. Under these circumstances the structural integrity of a fleet or individual aircraft is safeguarded by inspection for fatigue cracks. The majority of fatigue cracks in airframe structures occur at fastener holes. This work, therefore, specifically considers the inspection and repair of fastener holes. The inspectable crack size, inspection interval and cost are interdependent. The smaller the crack inspected for, the longer will be the period of growth to reach a maximum acceptable size. However, the associated preparation, inspection and down time costs will be greater. Further, for a given inspection technique, the probability of detection will be lower for a smaller crack and the chances of a false call will be higher. This paper discusses the factors which must be considered when selecting inspection techniques and determining the associated inspection periods. By optimising the inspection process, life-cycle cost benefits can be realised without compromising structural integrity. A schematic approach is detailed in which a balance may be struck between inspection effectiveness, required inspection interval and the associated costs. This will enable the end users to determine the most economic maintenance programme provided that the effectiveness of potential inspection techniques can be sufficiently quantified.

Author

Airframes; Structural Failure; Holes (Mechanics); Cracks; Fatigue Life; Nondestructive Tests; Aircraft Maintenance; Inspection; Failure Analysis

19990009512 Cranfield Univ., School of Industrial and Manufacturing Sciences, Bedford, UK

The Effect of Aircraft Maintenance on Human Factors

Lock, M. W. B., Cranfield Univ., UK; Nov. 1998; 6p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Many factors affect the performance of the human operator during the inspection and maintenance of aircraft. This paper highlights the basic problem of attempting to quantify these human factors. To ensure reliable task performance it is suggested that one should reduce these effects by ensuring operator comfort, both physiologically and psychologically rather than attempt to estimate probabilities.

Author

Aircraft Structures; Nondestructive Tests; Inspection; Aircraft Maintenance; Quality Control

19990009513 National Aerospace Lab., Airframe Div., Tokyo, Japan

Practical Evaluation of Crack Detection Capability for Visual Inspection in Japan

Asada, H., National Aerospace Lab., Japan; Sotozaki, T., National Aerospace Lab., Japan; Endoh, S., Ministry of Transportation, Japan; Tomita, T., Ministry of Transportation, Japan; Nov. 1998; 20p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The role of visual inspection is important for maintaining and improving aircraft structural integrity. The Civil Aviation Bureau of Japan organized the investigation team for visual inspection capability consisting of three major operators, four major manufacturers and the National Aerospace Laboratory. This paper describes the collected field data of cracks detected by visual inspection during maintenance of aircraft operated by Japanese airlines, the analyzed results and the significant information for safety and reliability of aircraft structures evaluated by the damage tolerance design. Detected cracks are collected from primary aluminum alloy structures of in-service transport aircraft. The number of detected cracks is more than 1000 collected over a period of three years.

Author

Aircraft Structures; Nondestructive Tests; Inspection; Aircraft Maintenance; Quality Control; Cracks; Visual Observation

19990009514 Boeing Co., Saint Louis, MO USA

Field Inspection Results and Damage of F-4F Horizontal Stabilizer Internal Structure

Flood, Jack T., Boeing Co., USA; Pfau, Reinald E., Boeing Co., USA; Grauvogl, Ernst, Daimler-Benz Aerospace A.G., Germany; Regler, Friedrich, Daimler-Benz Aerospace A.G., Germany; Nov. 1998; 8p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The McDonnell Douglas F-4F Phantom will remain in the German Luftwaffe inventory well beyond the year 2000. With the extensive usage in airforces all over the world, structural inspection programs based on fatigue tests and equally important, usage experiences shared with other countries provide a good knowledge of structurally critical areas of the airframe. However, depot inspections of the horizontal stabilizers discovered fatigue cracks in a rib that required fleet wide inspection through removal skin fasteners using boroscope and eddy current technique, performed by different "field inspection teams" from the German Luftwaffe and industry. Mathematical modeling of the local stress distribution with the damages zone together with periodic inspection provided the background for continuous A/C operation with damaged ribs and scheduled the sequence for replacements of cracked items. A database for the reliability, evaluation was gained by performing additional inspections on an original build-up structure with cracked ribs under in-field conditions.

Author

Airframes; Nondestructive Tests; Inspection; Aircraft Maintenance; Fatigue Tests; Stabilizers (Fluid Dynamics); Cracks

19990009515 Institute for Aerospace Research, Ottawa, Ontario Canada

Double Pass Retroreflection Versus Visual Inspection of Impact Damage in Composites

Forsyth, D. S., Institute for Aerospace Research, Canada; Gould, R. W., Institute for Aerospace Research, Canada; Komorowski, J. P., Institute for Aerospace Research, Canada; Nov. 1998; 6p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Double Pass Retroreflection is the basis of the D Sight(TM) Aircraft Inspection System, (DAIS). The DAIS 500 equipment is built specifically for the rapid inspection of large composite surfaces for impact damage. In one sensor placement 0.27 M2 can be assessed for the presence of impact damage. Impact indentations of 0.025 mm depth are observed with high rates of detection in D Sight(TM) inspections of certain composite structures. Current structures are designed with generally accepted BVID (barely visible impact damage) limits of between 1 to 2.5 mm deep dents. Benefits which could be derived from the implementation of DAIS to current and future composite structures inspections are briefly discussed. For damage tolerance design purposes, probability of detection (POD) data for DAIS equipment is required. This report presents inspection results from a set of inspectors with different levels of training, with two sets of specimens, one derived from a vertical stabiliser surface area on the CF-18, and one derived from hat stiffened composite panels built at the Institute for Aerospace Research (IAR). It is shown that inspectors, almost independent of the training time, can reliably identify impact indents an order of magnitude better than currently accepted BVID limits, with almost zero false calls. This sensitivity and reliability, when combined with low cost and speed of DAIS inspections, demonstrate that the DAIS 500 is an excellent tool for rapid, wide area inspection of composite structures for BVID.

Author

Airframes; Nondestructive Tests; Inspection; Aircraft Maintenance; Composite Structures; Impact Damage; Visual Observation

19990009516 Warner Robins Air Logistics Center, Materials Analysis Team, Robins AFB, GA USA

C-141 Spanwise Splice Advanced NDI Method (Probability of Detection Experiment Results)

Mullis, Roy T., Warner Robins Air Logistics Center, USA; Nov. 1998; 12p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Second-layer cracking of the lower inner-wing spanwise splice-joints was identified as the life-limiting structural feature of the C-141 aircraft. This cracking problem dictated the need for a new inspection process. The WR-ALC Materials Analysis Team (TIEDM) was tasked to develop a nondestructive inspection (NDI) procedure with a proven capability to detect 0.125 inch cracks in the splice-joint 2nd layer. TIEDM determined the best alternative inspection method, with potential to meet the 2 layer inspection requirement, was an automated ultrasonic scanning technique. TIEDM contracted with SAIC/Ultra Image International for splice-joint inspection process development, SAIC subsequently designed a prototype ultrasonic scanning inspection system that met the C-141 requirements, A Probability-of-Detection (PoD) Experiment was designed and conducted to formally quantify the inspection reliability of the prototype process. The PoD study simulated on-aircraft inspection conditions as close as possible by utilizing actual C-141 components for test specimens. A total of 16 test specimens were subjected to artificial cyclic loading to produce a statistically desirable fatigue crack population. The cracked specimens were subsequently characterized and documented, then assembled per established Air Force maintenance requirements. Fourteen inspectors with various training and experience backgrounds participated in the PoD experiment at WR-ALC. The experiment results show the new procedure has a 90% crack detection threshold of 0.073 inch. This data will allow the C-141 structural managers to confidently implement the new NDI procedure and establish future inspection intervals and requirements. In addition to providing reliability data, the PoD experiment also provided an information base on the procedural and human variables which most effect procedure results. This information will be used to make procedure enhancements to further improve the system reliability.

Author

Aircraft Structures; Nondestructive Tests; Inspection; Aircraft Maintenance; Quality Control; Cracks; C-141 Aircraft; Fatigue (Materials); Wings

19990009517 Izmir Inst. of Tech., Dept. of Mechanical Engineering, Izmir, Turkey

A New Approach for Reliable Inspection in Radiography of Turbine Blades

Aygun, Hacer, Izmir Inst. of Tech., Turkey; Selcuk, Ekrem, Middle East Technical Univ., Turkey; Nov. 1998; 10p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Some extra ordinary patterns have been observed on the radiographs for Ni-base gas turbine blades, which cannot be correlated to any kind of flaws (or other density differences) in the material and which commonly are called "mottling". In this study, reasons of the mottling have been investigated by radiosopic and radiographic methods. The major mottling indications are caused by Laue diffraction of the tungsten target material characteristic K(alpha) and K(beta) radiations from the thin edge of the specimens, <200 solidification direction and FCC diffraction plane. to prevent mottling on the radiographs, a new double-slit system and a new NDT-slit system have been developed by the authors. The results show that new developed NDT-system is the best technique for preventing mottling indications on the radiographs of the directionally solidified Ni-base gas turbine blades.

Author

Nondestructive Tests; Inspection; Aircraft Maintenance; Radiography; Turbine Blades; Nickel Alloys; Solidification; Tungsten

19990009518 Daimler-Benz Aerospace A.G., Dept. EVP, Bremen, Germany

Borehole Inspection With Rotating EC-Probes: A New Procedure With Improved Reliability

Schiller, D., Daimler-Benz Aerospace A.G., Germany; Speckmann, H., Daimler-Benz Aerospace A.G., Germany; Nov. 1998; 12p; In English; Also announced as 19990009499; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This report describes the development of a standard procedure for nondestructive inspection of cylindrical bores with rotating Eddy Current probes. It can replace approximately 90% of the special inspection procedures included in the Nondestructive Testing Manual (NTM). It is independent of the type of aircraft and can be used on all aircraft structures which meet the requirements of the structure specification defined in this procedure. One requirement to be met by the standard procedure was the verification of a probability of detection (POD) of 90% at a 95% confidence level for a fatigue crack with a maximum length greater than or equal 1 mm. This was verified by means of a qualification program. The basic development of the standard procedure was carried out on a European level in the framework of the BRITE/EURAM Program (BE5145) initiated by the European Community. The objective of this program was to increase the safety of aircraft by improving reliability, quality, and cost effectiveness of the inspection of safety-critical structures.

Author

Nondestructive Tests; Inspection; Aircraft Maintenance; Boreholes; Cylindrical Bodies; Eddy Currents; Fatigue (Materials)

19990009572 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
The Feasibility of Vibration Diagnostics Measurements in a Gas Turbine Engine

Korjack, T. A.; Sep. 1998; 35p; In English

Report No.(s): AD-A355546; ARL-TR-1800; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A variety of analytical and experimental techniques has been explored to determine the efficacy and viability of application for diagnostics of a tank gas turbine engine. Engine performance criteria, along with mechanical maintenance programs, have been identified to be used in the turbine engine diagnostics program. Fast-Fourier analysis, Hilbert transforms, wavelets, and Kurtosis techniques were explored as the governing tools in determining engine functionalities. A proof-in-principle test was performed via spectrum analysis that clearly illustrated that a signal-rich environment, as provided by the measurements performed in this specific study, is required for engine performance analysis and diagnostics.

DTIC

Vibration; Rotors; Feasibility Analysis; Vibration Measurement; Gas Turbine Engines

19990009853

Temperature compensating an integrated pressure sensor

Paillard, B., The Univ. of Sherbrooke, Canada; Sensors (Peterborough, NH); Jan, 1998; ISSN 0746-9462; Volume 15, no. 1; In English; Copyright; Avail: Issuing Activity

A new technique for measuring the die temperature of an integrated pressure sensor is based on a double Wheatstone bridge and a software multistage correction algorithm. Integrated pressure sensors consist of millimeter-sized aneroid capsules etched out of silicon. A semiconductor fabrication process is used to implant a network of piezoresistors into the surface of the silicon diaphragm, making the resistors an integral part of the diaphragm. This network is configured as a full Wheatstone bridge. The digital compensation method presented here can be applied to gauge, differential, and absolute sensors. The technique can be used to correct the linearity of both the tube and the sensor. This improved performance can be realized at a modest cost. The hardware requirements for this technique are minimal, consisting of two CS5516 A/D converters, four precision low temperature coefficient resistors, and a reference barometer that communicates with the computer via a serial link. The calibration is several orders of magnitude more precise than conventional methods based on temperature-sensitive resistor networks.

Author (revised by EI)

Pressure Sensors; Temperature Measurement; Error Analysis; Altimeters

19990010136

Temperature programmed desorption-mass spectrometer with supersonic molecular beam inlet system

Danon, Albert, Nuclear Research Cent., Israel; Avraham, Ifat; Koresh, Jacob E.; Review of Scientific Instruments; Dec, 1997; ISSN 0034-6748; Volume 68, no. 12, pp. 4359-4363; In English; Copyright; Avail: Issuing Activity

A new temperature programmed desorption-mass spectrometer (TPD-MS) that contains a supersonic molecular beam which bridges between the atmospheric pressure sample chamber and the quadrupole mass spectrometer is described. This method enables quantitative adsorption measurements of adsorbing gas and vapors. As an application, the system has been used to study the role of physical adsorption of air mixture (O_2 , N_2 , and H_2O) at room temperature on carbon molecular sieve fibers (CMSF). System performance has been checked with the decomposition of $CuSO_4 \cdot 5H_2O$, $CaC_2O_4 \cdot H_2O$, well established standard test molecules, and by direct injections of variable amounts of different substances such as gasses and liquids. All spectra have been carried out using He at above atmospheric pressure as a carrier gas. Overall, high sensitivity has been achieved.

EI

Carbon Fibers; Mass Spectrometers; Molecular Beams; Supersonic Inlets; Desorption; Temperature Control; Mass Spectroscopy; Adsorption

19990010440

2-D analytical approach of the stator-rotor contact problem including rotor bending effects for high torque piezomotor design

Le Moal, P., Lab. de Mecanique Applique R. Chaleat Associe au CNRS, France; Minotti, P.; European Journal of Mechanics, A/Solids; 1997; ISSN 0997-7538; Volume 16, no. 6, pp. 1067-1103; In English; Copyright; Avail: Issuing Activity

The modelling of travelling wave type piezoelectric motors involves a large variety of mechanical and physical phenomena and therefore leads to numerous approaches and models. The latter, mainly based on phenomenological and numerical (based on Finite Element Method) analyses, are not suitable for current objectives oriented toward the development of efficient C.A.D. tools. As a result, we have attempted to investigate analytical approaches, in order to theoretically model the mechanical energy conver-

sion at the stator/rotor interface. This paper deals with the analytical modelling of such rotative motors. After a short description of the operating principles specific to the piezomotors, the mechanical and tribological assumptions made for the driving mechanism of the rotor, are briefly described. We then show that the kinematic and dynamic modelling of the stator, combined with the static representation of the stator/rotor interface, gives an efficient way in order to perform the calculation of loading characteristics communicated to the driving shaft. Moreover, the specifications of a new software named C.A.S.I.M.M.I.R.E., which has been recently developed on the basis of our earlier mechanical modelling, are described. It is shown finally that the theoretical simulations performed on SHINSEI Japanese motors are closed to the experimental data and that the results reported in this paper will lead to the structural optimization of future travelling wave ultrasonic motors.

Author (EI)

Energy Conversion; Traveling Waves; Piezoelectricity; Electric Motors; Stators; Rotors; Winding; Computerized Simulation

19990010768

Rational algorithm for bend rigidity calculation of the step rotors

Baranovskij, V. M.; Mil'chenko, A. I.; *Khimicheskoe I Neftyanoe Mashinostroenie*; May, 1996, no. 5, pp. 16-19; In Russian; Copyright; Avail: Issuing Activity

Four typical schemes of fixing the step rotors are considered. The rational algorithm for calculation is proposed on the base of theoretical analysis. The formulae for calculation of step shafts displacement are given. The method versatility is noted, since it takes into account all types of the loads into rotor. It is shown that effect of shear deformation on shafts displacements increases as rotor length decreases and may achieve 20-30% displacements under bending for the short rotors.

EI

Rotors; Shafts (Machine Elements); Displacement; Loads (Forces); Shear Stress

19990010773

Absorption thermotransformers with expanded zone of degassing

Minkus, B. A.; Morozyuk, T. V.; *Khimicheskoe I Neftyanoe Mashinostroenie*; May, 1996, no. 5, pp. 40-42; In Russian; Copyright; Avail: Issuing Activity

Absorption thermotransformer is calculated for standard operation conditions. Analysis of the obtained parameters shows that expansion of degassing zone of the thermomechanical compressor, as one of method for rise of energetic effectiveness of the absorption thermotransformers, can be achieved via realization of step absorption. The thermotransformer schemes and working cycle in a diagram of concentration-enthalpy for water ammonia solution are given.

EI

Refrigerating Machinery; Compressors; Thermodynamics; Ammonia

19990010953

Prediction of rotordynamic forces in a labyrinth seal based on three-dimensional turbulent flow computation

Ishii, Eiji, Hitachi, Ltd., Japan; Kato, Chisachi; Kikuchi, Katsuaki; Ueyama, Yoshiharu; *JSME International Journal, Series C*; Dec, 1997; ISSN 1340-8062; Volume 40, no. 4, pp. 743-748; In English; Copyright; Avail: Issuing Activity

A numerical method based on a finite volume approach has been developed to predict the rotordynamic forces on an eccentric labyrinth seal. The SIMPLER algorithm and a low-Reynolds-number k-epsilon turbulence model are used to compute the complex turbulent flow field within the seal. To verify the validity of the developed method, the turbulent flow in the labyrinth seal was calculated and the resulting fluid forces was estimated. The predicted fluid forces are in good agreement with the reported measured values. It is also shown that the flow field near each labyrinth tooth must be accurately predicted to evaluate the rotordynamic forces. Labyrinth tooth throttling has more effect on the tangential force component than on the radial one. The developed code was proven to be an effective tool for predicting rotordynamic forces.

Author (EI)

Computational Fluid Dynamics; Labyrinth Seals; Rotor Dynamics; Three Dimensional Flow; Turbulent Flow; Seals (Stoppers); Rotors; Loads (Forces); Flow Measurement

19990011137

On the vibration and control of a flexible rotor mounted on fluid film bearings

Abduljabbar, Z., King Saud Univ., Saudi Arabia; ElMadany, M. M.; Al-Bahkali, E.; *Computers and Structures*; Dec, 1997; ISSN 0045-7949; Volume 65, no. 6, pp. 849-856; In English; Copyright; Avail: Issuing Activity

In this paper, an active vibration controller for controlling the dynamics of a flexible rotor running in flexibly-mounted journal bearings is addressed. The control effort consists of two components. The first is a state feedback controller designed to stabilize

the system and to achieve desirable transient response. The second is a feed-forward controller, based on the state of the excitation model, designed to counteract the effect of the external excitations on the system. The results have shown that a significant improvement in the system response is achieved by a stationary compensation of the selected set of excitation frequencies.

Author (EI)

Fluid Films; Vibration Damping; Rotors; Bearings; Vibration; Mathematical Models

19990011156

Correlation equations for friction factors and convective coefficients in tubes containing bundles of internal, longitudinal fins

Campo, A., Idaho State Univ., USA; Chang, J.; Heat and Mass Transfer/Waerme- und Stoffuebertragung; Dec, 1997; ISSN 0042-9929; Volume 33, no. 3, pp. 225-232; In English; Copyright; Avail: Issuing Activity

Finned tubes are commonly employed in tubular heat exchangers to augment the heat transfer rates between two dissimilar fluid streams. The goal of this study is two-fold: a) to determine the laminar, fully developed velocity and temperature fields for long, internal, longitudinal finned tubes; and b) to construct empirical correlation equations applicable for the asymptotic friction factor and the asymptotic Nusselt numbers as a function of the number of fins and the relative fin height in the bundle. Neither the fluid dynamics nor the heat transfer literature provides information for the second goal, which can be extremely useful to thermal engineers for the implementation of Computer-Aided Design (CAD) of internal, longitudinal finned tubes in heat exchange devices. Moreover, for the validity of the correlation equations, a seldom adopted criterion for the critical Reynolds number has also been introduced as an indispensable guideline to warrant laminar regimes.

Author (EI)

Friction Factor; Fins; Heat Transfer; Convective Heat Transfer; Heat Transfer Coefficients; Friction; Laminar Flow

19990011157

Convective heat transfer and pressure loss in rectangular ducts with drop-shaped pin fins

Chen, Z., Univ. of Paderborn, Germany; Li, Q.; Meier, D.; Warnecke, H. -J.; Heat and Mass Transfer/Waerme- und Stoffuebertragung; Dec, 1997; ISSN 0042-9929; Volume 33, no. 3, pp. 219-224; In English; Copyright; Avail: Issuing Activity

It has been experimentally researched that convective heat transfer and pressure loss characteristics in rectangular channels with staggered arrays of drop-shaped pin fins in crossflow of air. The effects of arrangements of pin fins on heat transfer and resistance are discussed and the row-by-row variations of the mean Nusselt numbers are presented. By means of the heat/mass transfer analogy and the naphthalene sublimation technique, the heat transfer coefficients on pin fins and on endwall (base plate) of the channel have been achieved respectively. The total mean heat transfer coefficients of pin fin channels are calculated and the resistance coefficients are also investigated. The experimental results show that heat transfer of a channel with drop-shaped pin fins is higher than that with circular pin fins while the resistance of the former is much lower than that of the latter in the Reynolds number range from 900 to 9000.

Author (EI)

Convective Heat Transfer; Channel Flow; Fins; Heat Transfer; Mass Transfer

19990011391

Wing-type vortex generators (WVGs) heat transfer enhancement mechanisms and potential for heat transfer surfaces and heat exchangers

Fiebig, Martin, Ruhr-Universitaet, Germany; Heat and Technology; 1997; ISSN 0392-8764; Volume 15, no. 1, pp. 31-41; In English; Copyright; Avail: Issuing Activity

Wing-type vortex generators (WVGs) have got intensive research attention during the last 15 years at our institute. A part of this research is presented. WVGs are slender wings or winglets which form an angle of attack with the main flow direction, and are manipulations of a heat transfer surface. They can easily be manufactured by attachment, embossing, or punching. WVGs induce all three passive convective heat transfer enhancement mechanisms, (1) developing boundary layers, (2) swirl, and (3) flow destabilization. These mechanisms are detailed in conjunction with one WVG, the rectangular winglet vortex generator. The heat transfer enhancement potential and associated flow losses are shown quantitatively for the periodically attached rectangular winglet for varying angle of attack and Reynolds number. Heat transfer enhancement of several 100% is possible. An application of delta winglet vortex generators to fin-tube heat exchangers is presented. The potential of WVGs for finned flat tubes is especially high. The multitude of possible geometric variations provide a large reservoir for improvements which has only been scratched.

Author (EI)

Heat Exchangers; Heat Transfer; Vortex Generators; Convective Heat Transfer; Boundary Layers; Reynolds Number; Fins

19990011394

Pressure drop during condensation and vaporization of refrigerants inside enhanced tubes

Cavallini, A., Universita di Padova, Italy; Del Col, D.; Doretti, L.; Longo, G. A.; Rossetto, L.; Heat and Technology; 1997; ISSN 0392-8764; Volume 15, no. 1, pp. 3-10; In English; Copyright; Avail: Issuing Activity

The most interesting enhanced tubes for inside condensation and vaporization are low-fin and micro-fin tubes because they present a marked improvement in heat transfer with small penalty in pressure losses: the aim of this work is to investigate pressure drops inside horizontal finned tubes. Two traditional models for adiabatic pressure losses inside smooth tubes (Friedel and Sardesai et al.) were modified for condensation and vaporization inside enhanced tubes by a specific correction which accounts for the effects of micro-fins. These modified models were compared against the available experimental data which includes condensation and boiling of traditional refrigerants (R12, R22, R32, R502), new refrigerants (R134a) and also zeotropic and nearly-azeotropic refrigerant mixtures (R407A, R407C, R404A, R410A) in a wide range of tube geometries and operative conditions.

19990011605

Rapid reswitching of induction machine from current source inverter on the supply net

Rusek, Jan; COMPEL - The International Journal for Computation and Mathematics in Electrical and Electronic Engineering; 1997; ISSN 0332-1649; Volume 16, no. 4, pp. 275-283; In English; Copyright; Avail: Issuing Activity

The contribution deals with the dynamics of induction machine during reswitching process from the main feeder on the stand-by one. The main feeder may be a current source inverter in which case the machine, before switching off, may be operated with lower frequency than the frequency of the stand-by supply net. It causes that the electromotive force on the opened machine terminals is no longer a measure of the magnitude of the rotor currents. The analysis was carried out with recognition for the magnetic saturation of the main flux.

Author (EI)

Electromotive Forces; Induction Motors; Electric Power Supplies; Electric Control; Electric Current; Rotors; Winding; Magnetic Fields

19990012275

Robust stator-flux-oriented induction motor drive with hybrid sliding mode speed controller

Lin, Faa-Jeng, Chung Yuan Christian Univ., Taiwan, Province of China; Liu, Gee-Shen; Liu, Da-Chuan; Journal of Control Systems and Technology; Sep, 1997; ISSN 1002-2812; Volume 5, no. 3, pp. 211-219; In English; Copyright; Avail: Issuing Activity

A robust stator-flux-oriented induction motor (IM) drive using on-line rotor time-constant estimation with a hybrid sliding mode speed controller is introduced in this paper. The estimation of the rotor time-constant is made on the basis of the model reference adaptive system (MRAS) using an energy function; and the estimated rotor time-constant is used in the current decoupled controller, which is designed to decouple the torque and flux in the stator flux field-oriented control. Moreover, a hybrid sliding-mode speed controller, comprised of an integral-proportional (IP) speed controller and a sliding-mode controller with an integral-operation sliding surface, is designed to increase the robustness of the speed control loop. When a sliding mode occurs on the sliding surface, the control system acts as a robust state feedback system.

Author (EI)

Induction Motors; Time Constant; Stators; Rotors; Robustness (Mathematics); Adaptive Control

19990012867

Multiple harmonic balance method for the internal resonant vibration of a non-linear Jeffcott rotor

Kim, Y. B., Chonnam Natl. Univ., Republic of Korea; Choi, S. -K.; Journal of Sound and Vibration; Dec 18, 1997; ISSN 0022-460X; Volume 208, no. 5, pp. 745-761; In English; Copyright; Avail: Issuing Activity

A multiple harmonic balance method is presented in this paper for obtaining the internal resonant steady state vibration of a Jeffcott rotor with a piecewise-linear non-linearity at the bearing support. The method utilizes the hypertime concept, which isolates each frequency component of a response into pseudo-time domains. Explicit Jacobians are derived to obtain stable convergence solutions in the iteration process. The frequency components of the non-linear restoring force part are analytically expressed from those of the displacement part, using the Galerkin technique to guarantee a convergent solution. As the method utilizes general and systematic computational procedures, it can be applied to analyze the multi-tone or combination-tone responses for higher-dimensional non-linear systems such as multi-disk rotors or automotive drivelines with multiple excitational inputs. To demonstrate the accuracy and effectiveness of the proposed method, various simulation results are studied and the results of multiple HBM are compared with those from numerical integration.

Author (EI)

Harmonic Analysis; Resonant Vibration; Vibration Mode; Rotors; Resonance; Supports; Bearings

19990012872

Evaluation of rotor imbalance in flexibly mounted machines

Lees, A. W., Univ. of Wales Swansea, UK; Friswell, M. I.; Journal of Sound and Vibration; Dec 18, 1997; ISSN 0022-460X; Volume 208, no. 5, pp. 671-683; In English; Copyright; Avail: Issuing Activity

A method is presented to determine the state of imbalance of a rotating machine by using the measured pedestal vibration. The only requirements of the procedure are a good numerical model for the rotor and an approximate model for the bearing behavior. No assumptions are made concerning the operational mode shape of the rotor and the influence of the supporting structure is included in a consistent manner. For simplicity the analysis is presented in a single plane orthogonal to the rotor axis, but no difficulty is foreseen in extending the method to two planes. Examples are given for a two-bearing system.

Author (EI)

*Mechanical Engineering; Rotation; Rotors; Vibration Mode; Vibration Measurement
Rotors; Chemical Reactors; Velocity Measurement; Mixing; Laser Doppler Velocimeters*

19990012923

Evaluating mixing in stirred reactors by 3-D visualization: Partial segregation for dual-feed semi-batch operation

Mann, R., Univ. of Manchester Inst. of Science and Technology, UK; Togatorop, A.; Senior, P. R.; Graham, P.; Edwards, R. B.; Chemical Engineering Research & Design, Transactions of the Institute of Chemical Engineers, Part A; Nov, 1997; ISSN 0263-8762; Volume 75, A8, pp. 755-762; In English; Copyright; Avail: Issuing Activity

Stirred vessel reactors, when operated semi-batchwise, will exhibit departures from perfect mixing if the reactions being carried out are faster than the rates of mixing induced by stirring. This gives rise to partial segregation between the primary reagents, which will have consequences for selectivity from complex sets of chemical reactions. The extent and intensity of this partial segregation can be visualized in 3-D by single point acid/alkali additions in conjunction with colored pH indicators. The role of impeller type and design in determine this reactive partial mixing remains obscure. Results for a standard angled blade impeller and an A320 are presented using this approach. The greater convection induced by the Lightning' impeller produces a less marked, though still significant segregation, when simultaneous 'front' elevation and 'underneath' plan images from a glass semi-tech scale vessel are compared. Surprisingly, there is extreme segregation in the tangential direction, which is difficult to deduce from front view images alone. The 3-D visualizations are supported by CFD simulations using PHOENICS which are presented in see-through solid-body graphics. These theoretical image reconstructions confirm that the degree of partial segregation is more intense for the angled-blade as compared to the A320 impeller. However, the use of an assumption of perfect micromixing in each CFD volume element possibly exaggerates the predicted absolute levels of segregation between acid and alkali.

Author (EI)

Applications Programs (Computers); Chemical Reactors; Mixing; Flow Visualization; Computational Fluid Dynamics; Rotors

19990012924

Liquid crystal thermographic technique for the measurement of mixing characteristics in stirred vessels

Lee, K. C., King's Coll. London, UK; Yianneskis, M.; Chemical Engineering Research & Design, Transactions of the Institute of Chemical Engineers, Part A; Nov, 1997; ISSN 0263-8762; Volume 75, A8, pp. 746-754; In English; Copyright; Avail: Issuing Activity

A liquid crystal thermographic technique has been developed and employed to determine the transient mixing characteristics in a stirred vessel of 100 mm diameter. The technique makes use of temperature as a passive scalar and shows promise for the rapid and accurate determination of mixing time and temperature distributions in stirred vessels. Characteristic results obtained in the 100 mm vessel stirred by one and two Rushton impellers are presented and compared with previously reported measurements obtained with other techniques.

Author (EI)

Liquid Crystals; Chemical Reactors; Thermography; Mixing; Temperature Distribution; Rotors

19990012925

Quantification of the performance of agitators in stirred vessels: Definition and use of an agitation index

Mavros, P., Aristotle Univ., Greece; Baudou, C.; Chemical Engineering Research & Design, Transactions of the Institute of Chemical Engineers, Part A; Nov, 1997; ISSN 0263-8762; Volume 75, A8, pp. 737-745; In English; Copyright; Avail: Issuing Activity

An agitation index, based on velocity measurements obtained from laser Doppler velocimetry or other similar techniques, is proposed as an objective measure of the effectiveness of a particular agitator in inducing flow in a stirred vessel. This index is calculated by first generating a cell structure based on the measurement grid, and then assigning each velocity to the entire corresponding cell; the volume-weighted sum of velocities yields then the agitation index, which represents the volume-average veloc-

ity as a percentage of the impeller tip velocity. The usefulness of this objective measure of the quality of agitation in a stirred vessel is illustrated by applying it first to the case where three different agitators have to be graded in terms of effectiveness in inducing flow, and then to the case of determining the clearance of two agitators located on the same shaft corresponding to the optimum liquid circulation.

Author (EI)

19990013143

Discharge in long air gaps at presence of insulated bodies

Koryavin, A. R., VEI, Russia; Volkova, O. V.; *Elektrichestvo*; Nov, 1996, no. 11, pp. 19-24; In Russian; Copyright; Avail: Issuing Activity

The paper gives results of the investigation in long air gap with insulated body of different dimensions in it. The objective laws governing the development of discharge formation in the systems with insulated body are revealed. A simple dependence connected the relation between the dimension model, its height suspension and gap spacing necessary for tests on spread of attachments has been found.

EI

Electric Discharges; Insulators; Simulation; Helicopters

19990013147

Calculation of current-conducting rotor shell parameters of an induction motor

Annenkov, A. N., VGTU, Russia; Shiyanov, A. I.; *Elektrichestvo*; Nov, 1996, no. 11, pp. 50-53; In Russian; Copyright; Avail: Issuing Activity

The problem of an allowance for the influence of a current distribution in a rotor shell on the basis field of an induction motor is solved. On the basis of an analytical method correlations for calculating parameters of rotor shell sections, corresponding to the magnetic circuit discrete model, are obtained. Rotor shell parameters are determined with allowance for eddy current spreading under two-dimensional distribution of a magnetic field in limits of an elementary section contour.

EI

Induction Motors; Rotors; Winding; Electrical Resistivity; Solids; Numerical Analysis

Author (EI)

Heat Exchangers; Heat Flux; Fins; Heat Transfer; Pipes (Tubes)

19990013369

The calculation of ribbed shells in conditions of physically nonlinear deformation

Gayanov, F. F., Sankt-Peterburgskij Inzhenerno-Stroitel'nyj Inst., Russia; Yakunchikhin, V. G.; *Problemy Prochnosti*; Apr, 1996, no. 4, pp. 91-97; In Russian; Copyright; Avail: Issuing Activity

On a basis of the successive loading method and using special discontinuous functions, the stress-strained state of ribbed shells is investigated under physically-nonlinear deformation conditions. The solution of the differential equations is built as the combinations of regular and special discontinuous functions. This allows to represent the nonregular character of stressed state and to consider the physical nonlinearity of material.

EI

Mechanical Properties; Shells (Structural Forms); Fins; Heat Transfer; Loads (Forces)

19990013458

Vibration of elastic disk with a rim of blades at complex rotation

Gulyaev, V. I., Ukrainskij Transportnyj Univ., Ukraine; Domaretskij, R. V.; *Problemy Prochnosti*; June, 1996, no. 6, pp. 71-81; In Russian; Copyright; Avail: Issuing Activity

A problem of precision vibrations of the elastic rotor, whose rotation axis makes a plane turn, is considered. The rotor consists of elastic disk fitted onto rigid shaft and rim of blades connected to external edge of the disk. by the solution of considered task it is ascertained that the complicate rotation of system being studied may be a source of excitation of the resonance precision vibrations.

EI

Mechanical Properties; Reliability; Turbomachinery; Rotors

19990013755

Experimental study of inflow effects on natural air cooling of plate fins

Wei, Jie, Tokyo Inst. of Technology, Japan; Hijikata, Kunio; Inoue, Takayoshi; *Experimental Heat Transfer*; Jul-sep, 1997; ISSN 0891-6152; Volume 10, no. 3, pp. 165-179; In English; Copyright; Avail: Issuing Activity

An extensive set of experiments was conducted to examine inflow effects of constricted convection on natural air cooling of plate fins. Several configurations were tested in the experiments: fins in an infinite cooling air; fins shrouded by a vertical side plate; fins shrouded by a horizontal lower plate; and fins enclosed by both lower and side plates. For closely spaced fins with high aspect ratios, a side shroud shows virtually less effect on the array heat dissipation. A lower shroud, however, effects a considerable reduction in the heat dissipation when the shrouded clearance becomes smaller than a critical space. Significantly, enclosing the fins with both lower and side shrouds results in a serious deterioration in the heat dissipation, the deterioration is closely dependent on the side shrouded clearance as well. From the results, an optimum enclosing configuration appears to exist corresponding to the maximum volume heat dissipation rate.

Author (EI)

Air Cooling; Cooling Fins; Convective Heat Transfer; Fins; Heat Transfer; Cooling; Aspect Ratio

13

GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19990009102 Desert Research Inst., Reno, NV USA

Characterization of Aircraft Produced Soot and Contrails Near the Tropopause, 1 Jun. 1994 - 31 Dec. 1997

Hallett, John, Desert Research Inst., USA; Gudson, James G., Desert Research Inst., USA; 1997; 22p; In English
Contract(s)/Grant(s): NAG2-923; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Participation in the SUCCESS project primarily involved development and deployment of specific instruments for characterizing jet aircraft exhaust emissions as particulates and their subsequent evolution as contrail particles, either liquid or solid, as cirrus. Observations can be conveniently considered in two categories - close or distant from the aircraft. Thus close to the aircraft the exhaust is mixing through the engine turbulence with a much drier and colder environment and developing water/ ice supersaturation along the trail depending on circumstances (near field), whereas distant from the aircraft (far field) the exhaust has cooled essentially to ambient temperature, the turbulence has decayed and any particle growth or evaporation is controlled by the prevailing ambient conditions. Intermediate between these two regions the main aircraft vortices form (one on each side of the aircraft) which tend to inhibit mixing under some conditions, a region extending from a few aircraft lengths to sometimes a hundred times this distance. Our approach to the problem lay in experience gained in characterizing the smoke from hydrocarbon combustion in terms of its cloud forming properties and its potential influence on the radiation properties of the smoke and subsequent cloud from the viewpoint of reduction (absorption and scattering) of solar radiation flux leading to significant global cooling (Hudson et al 1991; Hallett and Hudson 1991). Engine exhaust contains a much smaller proportion of the fuel carbon than is sometimes present in ordinary combustion (less than 0.01% compared with 10%) and influences condensation in quite different ways, to be characterized by the Cloud Condensation Nucleus, CCN - supersaturation spectrum. The transition to ice is to be related to the dilution of solution droplets to freeze by homogeneous nucleation at temperatures somewhat below -40C (Pueschel et al 1998). The subsequent growth of ice particles depends critically on temperature, supersaturation and to some extent pressure, as is demonstrated in an NSF funded project being carried out in parallel with the work reported here. As will be discussed below, nucleation processes themselves and also exhaust impurities also influence the growth of ice particles and may control some aspects of growth of ice in contrails. Instrumentation was designed to give insight into these questions and to be flown on the NASA DC- 8 as a platform. In addition a modest program was undertaken to investigate the properties of laboratory produced smoke produced under controlled conditions from the viewpoint of forming both CCN and CN. The composition of the smoke could be inferred from a thermal characterization technique; larger particles were captured by formvar replicator for detailed analysis; ice particles were captured and evaporated in flight on a new instrument, the cloudscope, to give their mass, density and impurity content.

Author

Hydrocarbon Combustion; Jet Aircraft; Drying Apparatus; Supersaturation; Soot; Solar Radiation

19990009122 NASA Goddard Space Flight Center, Greenbelt, MD USA

NASA Ocean Altimeter Pathfinder Project, Report 1, Data Processing Handbook

Koblinsky, C. J., NASA Goddard Space Flight Center, USA; Beckley, Brian D., Raytheon STX Corp., USA; Ray, Richard D., Raytheon STX Corp., USA; Wang, Yan-Ming, Raytheon STX Corp., USA; Tsaoussi, Lucia, Raytheon STX Corp., USA; Brenner, Anita, Raytheon STX Corp., USA; Williamson, Ron, Raytheon STX Corp., USA; Apr. 01, 1998; 53p; In English; Original contains color illustrations

Report No.(s): NASA/TM-1998-208605; NAS 1.15:208605; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The NOAA/NASA Pathfinder program was created by the Earth Observing System (EOS) Program Office to determine how satellite-based data sets can be processed and used to study global change. The data sets are designed to be long time-series data processed with stable calibration and community consensus algorithms to better assist the research community. The Ocean Altimeter Pathfinder Project involves the reprocessing of all altimeter observations with a consistent set of improved algorithms, based on the results from TOPEX/POSEIDON (T/P), into easy-to-use data sets for the oceanographic community for climate research. This report describes the processing schemes used to produce a consistent data set and two of the products derived from these data. Other reports have been produced that: a) describe the validation of these data sets against tide gauge measurements and b) evaluate the statistical properties of the data that are relevant to climate change. The use of satellite altimetry for earth observations was proposed in the early 1960s. The first successful space based radar altimeter experiment was flown on SkyLab in 1974. The first successful satellite radar altimeter was flown aboard the Geos-3 spacecraft between 1975 and 1978. While a useful data set was collected from this mission for geophysical studies, the noise in the radar measured and incomplete global coverage precluded it from inclusion in the Ocean Altimeter Pathfinder program. This program initiated its analysis with the Seasat mission, which was the first satellite radar altimeter flown for oceanography.

Author

Altimeters; Climate Change; Earth Observing System (EOS); GEOS 3 Satellite; Measuring Instruments; Oceanography; Poseidon Satellite; Radio Altimeters; Satellite Altimetry; Satellite-Borne Radar; Seasat Satellites

19990009214 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA

Automated Surface Observing System. ASOS User's Guide

Mar. 1998; 89p; In English

Report No.(s): AD-A354716; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The ASOS User's Guide provides a fundamental description and explanation of ASOS and its impact upon users of the Aviation Routine Weather Report (METAR) and other ASOS data. This guide is therefore designed to speak to a variety of interests inside and outside the federal meteorological community. The guide is written for those with more than a rudimentary understanding of the manual surface observation program. Using the manual observation as context, the ASOS User's Guide describes the basic ASOS functions of data ingest, data processing and data distribution. Descriptions are provided, element by element, of the sensors and algorithms that ASOS employs. The guide also discusses the unique strengths and limitations of each ASOS data element. Among the basic strengths of the ASOS observation is its capability to measure critical aviation weather parameters, such as sky condition and visibility, at specific locations where they are needed most-the touchdown zone(s). ASOS data are updated once each minute and transmitted directly to forecasters, air traffic controllers and pilots. ASOS is capable of performing all the basic observing functions and operating in either attended or unattended mode, enabling observing personnel to focus on other demanding duties. ASOS data is accessible through a variety of media never before available from a surface observing site. Local, on-site video screen displays are available on the Operator Interface Device (OID) and the Video Display Unit (VDU). Additional video monitor hook-ups can be made available to airlines and other external users at the airport. Authorized remote users can acquire a wide variety of ASOS data through the a remote user dial-in port. Computer-generated voice message are provided by ASOS for local FAA radio broadcast to pilots and are made available for general aviation use through a dial-in telephone number for each location.

DTIC

Air Traffic Controllers (Personnel); Airline Operations; Airports; Algorithms; Broadcasting; Civil Aviation; Commercial Aircraft

19990010759 New Mexico Univ., Dept. of Earth and Planetary Sciences, Albuquerque, NM USA

CM-like Interplanetary Dust Particles in Lower Stratosphere During 1989 October and 1991 June/July

Rietmeijer, Frans J. M., New Mexico Univ., USA; Meteoritics and Planetary Sciences; 1996; Volume 31, pp. 278-288; In English
Contract(s)/Grant(s): NAGw-3626; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The stratospheric interplanetary dust particles L2005T12 and L2011O3 are linked to CM chondrite matrix. Particle L2005T12 is dominated by tabular grains of partially dehydrated greenalite-rich serpentine. Its amorphous matrix contains abun-

dant smectite nanocrystals and annular Fe,Ni,S units. A uniquely stratified (partial) maghemite rim occurs only on S-rich parts of the matrix. Formation of this rim and Mg depletions in the matrix occurred during atmospheric entry heating of this particle. Particle L2011O3 has large iron sulfide and magnesiowustite grains in an amorphous low-Al, ferromagnesian silica matrix. Hydrous crystallisation of this matrix produced ultrafine-grained smectites and disseminated iron sulfides. Atmospheric entry heating of both particles is indicated by the partial iron oxide rim, vesicular sulfides, and the scatter of matrix compositions due to loss of Mg. While many uncertainties remain, the high incidence of chondritic rough particles, which include an unknown amount of CM-like particles, in the lower stratosphere during 1984, 1989, and 1991 suggests annual variations in their abundances. The timing of lower stratospheric dust samplings is critical to collect these particles.

Author

Interplanetary Dust; Particle Mass; Stratosphere; Crystallization; Aerodynamic Heating

19990011651

Performance analysis of new wind turbine blade profiles

Chiatti, Giancarlo, III Università degli Studi di Roma, Italy; De Pratti, Giovanni Maria; Ruscitti, Raffaele; Wind Engineering; 1997; ISSN 0309-524X; Volume 21, no. 5, pp. 295-306; In English; Copyright; Avail: Issuing Activity

The blade profiles of horizontal axis wind turbines (HAWT) are mostly derived from aeronautical applications. However, in recent years some unconventional profiles have been developed especially for the variable speed HAWT. These profiles were particularly aimed at getting a high aerodynamic efficiency, less sensitivity to roughness, 'smooth' stall characteristics and an implicit boundary layer control, thus increasing the reliability and the availability of the aerogenerators, and the operative range. The above mentioned profiles are well suited for the offshore Mediterranean sites characterized by a more uniform air-flow and a lower turbulence level. These new profiles may be also particularly profitable for the very aggressive sea environment, for their lower sensitivity to surface damage. A significant reduction of the high offshore maintenance costs may be then obtained. For the prediction of the turbine rotor blade performances, in the design and off-design conditions, a great amount of experimental data are needed. For the new profiles only the values of the overall coefficients calculated by numerical codes are often available, as the wind tunnel experimental data acquisition is long and expensive. In order to get sufficiently accurate data for a preliminary turbine design, experimental tests on a water table, based on Lamb's Analogy, may be of great advantage. In this paper the aerodynamic performances of some recent profiles, FFA-W1-152, MEL-002 and Du-W1-251, measured on the water test bench are reported and compared.

Author (EI)

Reliability Analysis; Turbine Blades; Wind Turbines; Turbomachine Blades; Aerodynamics; Turbulence; Reliability

19990011654

Structural and economic optimization of OWEC support structure: Contribution to the Joule III project opti-OWECS
Ferguson, Murray, Kvaerner, Earl & Wright Consulting Engineers, UK; Wind Engineering; 1997; ISSN 0309-524X; Volume 21, no. 5, pp. 339-350; In English; Copyright; Avail: Issuing Activity

The support structure for an Offshore Wind Energy Converter (OWEC) is a vital component in the development of an Offshore Wind Farm. The purpose of the work described has been the design development of a structure to support an 80 m diameter 3 MW wind turbine under the imposed aerodynamic and hydrodynamic forces. Concept evaluations are described for a range of support structure options including both lifted and piled configurations. Further development of two options - a lattice-tower to stand in approximately 25 m water depth in relatively demanding environmental conditions, and a mono-tower in 15 m water depth in a more moderate environment, are presented. Innovative construction and installation techniques are described which obviate the need for the delicate offshore operation of lifting the rotor and nacelle and so totally remove the requirement for a heavy lift vessel - the most costly component of the offshore installation operation.

Author (EI)

Windpower Utilization; Windpowered Generators; Electric Generators; Waterwave Energy Conversion; Wind Turbines; Aerodynamics

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LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19990009099 Institute of Space Medico-Engineering, Beijing, China

An Analysis of Dynamic ECG of 36 Pilots

Lin, Hu, Institute of Space Medico-Engineering, China; Zhang, Fusheng, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Feb. 1997; ISSN 1002-0837; Volume 10, No. 1, pp. 65-67; In Chinese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Twenty four hour dynamic electrocardiogram (DCG) of 36 healthy male fighter pilots, aged 25-35 years were recorded and analyzed, then the data were compared with DCG of 55 normal subjects. The results showed that supraventricular arrhythmias were more than ventricular ones; both supraventricular and ventricular arrhythmias of pilots were more than that of the control; The appearing rate of ST segment depression of pilots was higher.

Author

Electrocardiography; Aircraft Pilots; Heart Function

19990009307 Institute of Space Medico-Engineering, Beijing, China

Tolerance Limit of Human Head-Neck Region to High Speed Windblast

Zhang, Yunran, Institute of Space Medico-Engineering, China; Wu, Guirong, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Feb. 1997; ISSN 1002-0837; Volume 10, No. 1, pp. 6-10; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

To provide parameters for designers of open type escape systems in an aircraft, aerodynamic and biomechanical characteristics of human head-neck region was studied and analyzed. The results show that tolerance limit of human head-neck region are 2.452 kN, 1.358 kN and 0.169 kN to aerodynamic drag, aerodynamic lift, and aerodynamic side force respectively during high speed windblast. Meanwhile the curve of tolerance limit to high speed windblast is given. Regardless of crewman posture during ejection, human head-neck region is free from windblast injury unless the aerodynamic force exerted on the head-neck region is within the above-mentioned value.

Author

Tolerances (Mechanics); Wind Effects; Biodynamics; Escape Systems; Flight Safety; Impact Damage; Physiology

19990009316 Institute of Space Medico-Engineering, Beijing, China

Tolerance Limit of Human Upper Extremity with Arm Restraint Plate on Eject Seat to Simulated Aerodynamic Loads

Wu, Guirong, Institute of Space Medico-Engineering, China; Zhang, Yunran, Institute of Space Medico-Engineering, China; Liu, Bingkun, Institute of Space Medico-Engineering, China; Zhu, Qingan, Institute of Space Medico-Engineering, China; Lu, Haijun, Institute of Space Medico-Engineering, China; Ouyang, Jun, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Feb. 1997; ISSN 1002-0837; Volume 10, No. 1, pp. 39-43; In Chinese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

To obtain tolerance limits of the human upper extremity with an arm restraint plate on an ejection seat to windblast, impact was applied to the upper extremity of 13 human corpses and 7 living monkeys by a spring driven impact device. Relationships between impact load, moment of elbow joints and arm injuries with the arm restraint plate were studied. The relationship between the biomechanical characteristic curve of the human elbow joint and clinical injuries was obtained. The results indicated that the tolerance limit of the human upper arm is higher than the forearm. The safety limit of the human anterior arm to simulated aerodynamic load is 1.26 kN.

Author

Human Tolerances; Impact Loads; Blast Loads; Arm (Anatomy); Ejection Seats

19990009319 Naval Postgraduate School, Monterey, CA USA

Design of a Microelectronic Controller with a MIL-STD-1553 Bus Interface for the Tactile Situation Awareness System

Luke, Brian L.; Sep. 1998; 180p; In English

Report No.(s): AD-A354463; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Spatial Disorientation (SD) is a triservice aviation problem that costs the Department of Defense more than \$300 million annually in destroyed aircraft and is the primary cause of pilot related mishaps in the Navy and the Air Force. As one solution to the SD problem, the Naval Aerospace Medical Research Laboratory has developed the Tactile Situation Awareness System (TSAS). The primary objective of TSAS is to enhance pilot performance and reduce SD related aircrew/aircraft losses by provid-

ing continuous non-visual information using the normally underutilized sensory channel of touch. Using vibrotactile stimulators, TSAS applies information taken from the aircraft's instruments to the pilot's torso. The current implementation of TSAS is a research system that is not compatible with the crowded cockpit of modern aircraft. This thesis presents a design of a microelectronic controller for TSAS compatible with tactical environments. This new system, called the Tactor Interface Microcontroller System (TIMS), incorporates the functionality of the research TSAS into a palm sized microcontroller system and enables TSAS to communicate directly to the computerized sensory and weapons systems in combat aircraft such as the Navy F/A-18. TIMS brings the TSAS prototype out of the research stage and puts this exciting technology into the hands of the warfighter.

DTIC

Aerospace Medicine; Cockpits; Computer Techniques; Control Systems Design; Costs; Defense Program; Disorientation

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MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

19990009126 NASA Dryden Flight Research Center, Edwards, CA USA

Application of Design Methodologies for Feedback Compensation Associated with Linear Systems *Final Report*

Smith, Monty J., NASA Dryden Flight Research Center, USA; 1996; 35p; In English

Contract(s)/Grant(s): NGT4-52400; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The work that follows is concerned with the application of design methodologies for feedback compensation associated with linear systems. In general, the intent is to provide a well behaved closed loop system in terms of stability and robustness (internal signals remain bounded with a certain amount of uncertainty) and simultaneously achieve an acceptable level of performance. The approach here has been to convert the closed loop system and control synthesis problem into the interpolation setting. The interpolation formulation then serves as our mathematical representation of the design process. Lifting techniques have been used to solve the corresponding interpolation and control synthesis problems. Several applications using this multiobjective design methodology have been included to show the effectiveness of these techniques. In particular, the mixed H 2-H performance criteria with algorithm has been used on several examples including an F-18 HARV (High Angle of Attack Research Vehicle) for sensitivity performance.

Author

Angle of Attack; F-18 Aircraft; Feedback Control; Linear Systems; Research Vehicles

19990009268 Air Force Research Lab., Wright-Patterson AFB, OH USA

From Vaporware to Software The Relational Avionics Planning Tool for Operational Requirements (RAPTOR)

Szymanski, Raymond, Air Force Research Lab., USA; Jan. 1998; 19p; In English

Report No.(s): AD-A355427; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

At the 1997 Joint Avionics Weapons Systems conference.

DTIC

Avionics; Conferences

19990010010 Tennessee Univ., Dept. of Computer Science and Electrical Engineering, Chattanooga, TN USA

Virtual Environment User Interfaces to Support RLV and Space Station Simulations in the ANVIL Virtual Reality Lab

Dumas, Joseph D., II, Tennessee Univ., USA; Sep. 1998; 5p; In English; Also announced as 19990010001; No Copyright; Avail:

CASI; A01, Hardcopy; A04, Microfiche

Several virtual reality I/O peripherals were successfully configured and integrated as part of the author's 1997 Summer Faculty Fellowship work. These devices, which were not supported by the developers of VR software packages, use new software drivers and configuration files developed by the author to allow them to be used with simulations developed using those software packages. The successful integration of these devices has added significant capability to the ANVIL lab at MSFC. In addition, the author was able to complete the integration of a networked virtual reality simulation of the Space Shuttle Remote Manipulator System docking Space Station modules which was begun as part of his 1996 Fellowship. The successful integration of this simulation demonstrates the feasibility of using VR technology for ground-based training as well as on-orbit operations.

Author

Virtual Reality; Human-Computer Interface; Flight Simulation; Space Environment Simulation; Systems Integration; Applications Programs (Computers)

19990011740

Finite element simulation of non-linear transient response due to rotor-stator contact

Chen, S. L.; Geradin, M.; Engineering Computations (Swansea, Wales); 1997; ISSN 0264-4401; Volume 14, no. 6-7, pp. 591-603; In English; Copyright; Avail: Issuing Activity

The non-linear dynamics due to rotor-stator contact is simulated using the finite element method. Develops and describes a general contact finite element. by implementing this element into a powerful multibody dynamics software, different rotor global motions are analyzed. Special attention is also given to determine the effects of rotation speed and friction on the rotor orbit during contact.

Author (EI)

Finite Element Method; Transient Response; Rotors; Stators; Computerized Simulation; Computer Programs

**16
PHYSICS**

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

19990009566 NASA Lewis Research Center, Cleveland, OH USA

Benefits of Swept and Leaned Stators for Fan Noise Reduction

Woodward, Richard P., NASA Lewis Research Center, USA; Elliott, David M., NASA Lewis Research Center, USA; Hughes, Christopher E., NASA Lewis Research Center, USA; Berton, Jeffrey J., NASA Lewis Research Center, USA; Nov. 1998; 36p; In English; 37th; Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 538-03-11-00

Report No.(s): NASA/TM-1998-208661; NAS 1.15:208661; AIAA Paper 99-0479; E-11382; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An advanced high bypass ratio fan model was tested in the NASA Lewis Research Center 9 x 15-Foot Low Speed Wind Tunnel. The primary focus of this test was to quantify the acoustic benefits and aerodynamic performance of sweep and lean in stator vane design. Three stator sets were used for this test series. A conventional radial stator was tested at two rotor-stator axial spacings. Additional stator sets incorporating sweep + lean, and sweep only were also tested. The hub axial location for the swept + lean, and sweep only stators corresponded to the location of the radial stator at the upstream rotor-stator spacing, while the tip axial location of these modified stators corresponded to the radial stator axial position at the downstream position. The acoustic results show significant reductions in both rotor-stator interaction noise and broadband noise beyond what could be achieved through increased axial spacing of the conventional, radial stator. Theoretical application of these results to acoustically quantify a fictitious 2-engine aircraft and flight path suggested that about 3 Effective Perceived Noise (EPN) dB could be achieved through incorporation of these modified stators. This reduction would represent a significant portion of the 6 EPNdB noise goal of the current NASA Advanced Subsonic Technology (AST) initiative relative to that of 1992 technology levels. A secondary result of this fan test was to demonstrate the ability of an acoustic barrier wall to block aft-radiated fan noise in the wind tunnel, thus revealing the acoustic structure of the residual inlet-radiated noise. This technology should prove valuable toward better understanding inlet liner design, or wherever it is desirable to eliminate aft-radiated noise from the fan acoustic signature.

Author

Acoustic Properties; Aerodynamic Characteristics; Aerodynamic Noise; Noise Reduction; Stators; Vanes; Wind Tunnel Tests; Stator Blades; Engine Noise; Jet Aircraft Noise; Sweep Effect; Effective Perceived Noise Levels; Fans

19990009873 NASA Langley Research Center, Hampton, VA USA

Preliminary Work for Modeling the Propellers of an Aircraft as a Noise Source in an Acoustic Boundary Element Analysis

Vlahopoulos, Nickolas, Michigan Univ., USA; Lyle, Karen H., Army Vehicle Technology Center, USA; Burley, Casey L., NASA Langley Research Center, USA; Noise Control Engineering; May 1998; Volume 46, No. 3, pp. 132-136; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An algorithm for generating appropriate velocity boundary conditions for an acoustic boundary element analysis from the kinematics of an operating propeller is presented. It constitutes the initial phase of Integrating sophisticated rotorcraft models into a conventional boundary element analysis. Currently, the pressure field is computed by a linear approximation. An initial valida-

tion of the developed process was performed by comparing numerical results to test data for the external acoustic pressure on the surface of a tilt-rotor aircraft for one flight condition.

Author

Propellers; Acoustic Measurement; Noise Generators; Algorithms; Boundary Conditions

19990011282

Rotor dynamics of polygonal mirror scanner motor supported by air bearings in digital electrophotography

Kawamoto, Hiroyuki, Fuji Xerox Co., Ltd., Japan; *Journal of Imaging Science and Technology*; Nov-dec, 1997; ISSN 1062-3701; Volume 41, no. 6, pp. 565-569; In English; Copyright; Avail: Issuing Activity

A mathematical analysis has been performed on rotor dynamics of a high-speed polygonal mirror scanner motor in digital electrophotography. The rotor is assumed rigid and vertically supported by air bearings with an effective length that is not negligible compared to the rotor length. The model is a four-degree-of-freedom system that includes the gyroscopic effect and nonorthogonal force of the air bearing. The model also includes the effects of longitudinal bearing length and radially unstable magnetic stiffness of a driving motor and/or a magnetic bearing. A simulation program was coded to calculate complex eigenvalues, static and dynamic stability, critical speeds, unbalance responses, and external excitation responses. The results indicated that although the effects of bearing length and magnetic unstable stiffness were ignored in the past, these simplifications result in substantial error for the evaluation of rotor dynamics. The model is utilized to realize high-performance scanner motors.

Author (EI)

Electro-Optical Photography; Gas Bearings; Rotor Dynamics; Imaging Techniques; Mirrors; Rotors; Winding; Magnetic Bearings; Degrees of Freedom

17

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

19990010615

Multifleet routing and multistop flight scheduling for schedule perturbation

Yan, S., Natl. Central Univ., Taiwan, Province of China; Tu, Y. -p.; *European Journal of Operational Research*; Nov 16, 1997; ISSN 0377-2217; Volume 103, no. 1, pp. 155-169; In English; Copyright; Avail: Issuing Activity

Efficient and effective incidental scheduling techniques for schedule perturbation are essential to an airline carrier's operations. This research aims at developing a framework to assist carriers in fleet routing and flight scheduling for schedule perturbations in the operations of multifleet and multistop flights. The framework is based on a basic multifleet schedule perturbation model constructed as a timespace network from which strategic models are developed to research incidental scheduling. These network models are formulated as multiple commodity network flow problems. Lagrangian relaxation with subgradient methods accompanied by the network simplex method, a Lagrangian heuristic and a modified subgradient method are developed to solve the problems. A case study regarding the international operations of a major Taiwan airline carrier is presented.

Author (EI)

Air Transportation; Scheduling; Efficiency; Air Traffic Control; Mathematical Models

19

GENERAL

19990009189 Central Intelligence Agency, Washington, DC USA

The CIA and the U-2 Program, 1954-1974

Pedlow, Gregory W., Central Intelligence Agency, USA; Welzenbach, Donald E., Central Intelligence Agency, USA; Jan. 1998; 269p; In English

Report No.(s): AD-A355539; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This History Staff Monograph offers a comprehensive and authoritative history of the CIA's manned overhead reconnaissance program, which from 1954 to 1974 developed and operated two extraordinary aircraft, the U-2 and the A-12 OXCART. It describes not only the program's technological and bureaucratic aspects, but also its political and international context. The manned reconnaissance program, along with other overhead systems that emerged from it, changed the CIA's work and structure

in ways that were both revolutionary and permanent. The formation of the Directorate of Science and Technology in the 1960s, principally to develop and direct reconnaissance programs, is the most obvious legacy of the events recounted in this study.

DTIC

U-2 Aircraft; Reconnaissance

19990010001 NASA Marshall Space Flight Center, Huntsville, AL USA

Research Reports: 1997 NASA/ASEE Summer Faculty Fellowship Program *Final Report*

Karr, G. R., Editor, Alabama Univ., USA; Dowdy, J., Editor, NASA Marshall Space Flight Center, USA; Freeman, L. M., Editor, Alabama Univ., USA; Sep. 1998; 446p; In English; 33rd, 2 Jun. - 8 Aug. 1997, Huntsville, AL, USA; Sponsored by American Society for Engineering Education, USA; Also announced as 19990010002 through 19990010052

Contract(s)/Grant(s): NGT8-52836

Report No.(s): NASA/CR-1998-208803; M-897; NAS 1.26:208803; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

For the 33rd consecutive year, a NASA/ASEE Summer Faculty Fellowship Program was conducted at the Marshall Space Flight Center (MSFC). The program was conducted by the University of Alabama in Huntsville and MSFC during the period June 2, 1997 through August 8, 1997. Operated under the auspices of the American Society for Engineering Education, the MSFC program was sponsored by the Higher Education Branch, Education Division, NASA Headquarters, Washington, D.C. The basic objectives of the program, which are in the 34th year of operation nationally, are: (1) to further the professional knowledge of qualified engineering and science faculty members; (2) to stimulate an exchange of ideas between participants and NASA; (3) to enrich and refresh the research and teaching activities of the participants' institutions; and (4) to contribute to the research objectives of the NASA centers. The Faculty Fellows spent 10 weeks at MSFC engaged in a research project compatible with their interests and background and worked in collaboration with a NASA/MSFC colleague. This document is a compilation of Fellows' reports on their research during the summer of 1997. The University of Alabama in Huntsville presents the Co-Directors' report on the administrative operations of the program. Further information can be obtained by contacting any of the editors.

Author

Education; NASA Programs; University Program; Aeronautical Engineering; Aerospace Technology Transfer

Subject Term Index

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