Engine Thermal Structural Analysis Using Ansys

Bibliography of Lewis Research Center Technical Publications Announced in 1977
ISSW30 - Volume 1
Life Prediction Analysis of a Subscale Rocket Engine Combustor Using a Fluid-thermal-structural Model
Engine Structural Analysis Software
RTC2011
Research and Technology 1991
Research Highlights of the Global Modeling and Simulation Branch for 1986-1987
Research Into Improving the Durability of the Hot Section in the Aircraft Turbine Engine
Safe Affordable Fission Engine-(Safe-) 100a Heat Exchanger Thermal and Structural Analysis
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Technology for Large Space Systems
Space Shuttle Main Engine Structural Analysis and Data Reduction/Evaluation. Volume 2
Thermal/structural Tailoring of Engine Blades (T/SEAEBL). Theoretical Manual
Proceedings of Regional Tribology Conference 2011
Computer Program Abstracts
Turbine Engine Hot Section Technology, 1985
Engine Structures
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Thermal Stress Analysis of Composite Beams, Plates and Shells
Space Shuttle Main Engine Structural Analysis and Data Reduction/Evaluation. Volume 2
NASA Scientific and Technical Publications
High Pressure Oxidizer Turbo-Pump Turbine End Bearing Analysis
Assessment of Crack Growth in a Space Shuttle Main Engine First-Stage, High-Pressure Fuel Turbopump Blade
Structural Failure Analysis and Prediction Methods for Aerospace Vehicles and Structures
Structural and Thermal Optimization of a Thrust Vectoring Nozzle Test Rig for Hybrid Rocket Engine
Aeronautical Engineering
Application of Integrated Fluid-thermal-structural Analysis Methods
Thermal and Structural Analysis of a Hollow Core Space Shuttle Main Engine (SSME) Turbine Blade

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Hearings Before a Subcommittee of the Committee on Appropriations, House of Representatives, One Hundred First Congress, Second Session
Diesel Engine Engineering 2
Wave-Rotor-Enhanced Gas Turbine Engine Demonstrator
NASA Thesaurus
High Pressure Oxidizer Turbo-Pump Turbine End Bearing Analysis
Technology for Large Space Systems
Implementation Plan for the NASA Center of Excellence for Structures and Materials

SALAZAR MICAH

Bibliography of Lewis Research Center Technical Publications Announced in 1977

Malaysian Tribology Society

A two-dimensional finite element fracture mechanics analysis of a space shuttle main engine (SSME) turbine blade firtree was performed using the MARC finite element code. The analysis was conducted under combined effects of thermal and mechanical loads at steady-state conditions. Data from a typical engine stand cycle of the SSME were used to run a heat transfer analysis and, subsequently, a thermal structural fracture mechanics analysis. Temperature and stress contours for the firtree under these operating conditions were generated. High stresses were found at the firtree lobes where crack initiation was triggered. A life assessment of the firtree was done by assuming an initial and a final crack size. Abdul-Aziz, Ali Unspecified Center NAS3-25266; RTOP 553-13-00...

ISSW30 - Volume 1

Bentham Science Publishers

Thrust vector control is an important aspect of rocket engine operation. Current trends and prospective propulsion architectures place an increasing need for higher performance and cost-effective thrust vectoring systems. A promising method to address these requirements is a secondary injection thrust vector control system. This operates on the principal of differential injection of secondary fluids into the primary nozzle to affect a change in the vector of the thrust. A study was conducted on a hybrid rocket engine which was married to this kind of secondary injection thrust vector control system. The aim of this study was to obtain data about the combined thermal-structural and fluidic interactions of the propellant with the structure of the rocket engine. The aim of this project was twofold primary to optimize a secondary injection thrust vector control nozzle and secondary to develop a HGITVC system. A CFD study of the nozzle was conducted this was implemented in conjunction with a thermal-structural analysis of the engine. The results obtained from this directed the optimization of both the primary and the secondary nozzles. A detailed valve selection process was carried out for implementation of HGITVC. The nozzle optimization for the HGITVC utilized the Rao

method of characteristics. The analysis for hot gas injection based on the valve limit was carried out. The hot gas injection studies were carried out for three non-dimensional axial locations of 1.5, 2 and 2.5.*****Thrust vector control is an important aspect of rocket engine operation. Current trends and prospective propulsion architectures place an increasing need for higher performance and cost-effective thrust vectoring systems. A promising method to address these requirements is a secondary injection thrust vector control system. This operates on the principal of differential injection of secondary fluids into the primary nozzle to affect a change in the vector of the thrust. A study was conducted o

Life Prediction Analysis of a Subscale Rocket Engine Combustor Using a Fluid-thermal-structural Model

Thermal and Structural Analysis of a Hollow Core Space Shuttle Main Engine (SSME) Turbine BladeSafe Affordable Fission Engine-(Safe-) 100a Heat Exchanger Thermal and Structural Analysis

Thermal Stress Analysis of Composite Beams, Plates and Shells: Computational Modelling and Applications presents classic and advanced thermal stress topics in a cutting-edge review of this critical area, tackling subjects that have little coverage in existing resources. It includes discussions of complex problems, such as multi-layered cases using modern advanced computational and vibrational methods. Authors Carrera and Fazzolari begin with a review of the fundamentals of thermoelasticity and thermal stress analysis relating to advanced structures and the basic mechanics of beams, plates, and shells, making the book a self-contained reference. More challenging topics are then addressed, including anisotropic thermal stress structures, static and dynamic responses of coupled and uncoupled thermoelastic problems, thermal buckling, and post-buckling behavior of thermally loaded structures, and thermal effects on panel flutter phenomena, amongst others. Provides an overview of critical thermal stress theory and its relation to beams, plates, and shells, from classical concepts to the latest advanced theories Appeals to those studying thermoelasticity, thermoelastics, stress analysis, multilayered structures, computational methods, buckling, static response, and dynamic response Includes the authors' unified formulation (UF) theory, along with cutting-edge topics that receive little coverage in other references Covers metallic and composite structures, including a complete analysis and sample problems of layered structures, considering both mesh and meshless methods Presents a valuable resource for those working on thermal stress problems in mechanical, civil, and aerospace engineering settings

Engine Structural Analysis Software Andrei Makartchouk

This compilation of abstracts describes and indexes over 780 technical reports resulting from the scientific and engineering work performed and managed by the Lewis Research Center in 1977. All the publications were announced in the 1977 issues of STAR (Scientific and Technical Aerospace Reports) and/or IAA (International Aerospace

Abstracts). Documents cited include research reports, journal articles, conference presentations, patents and patent applications, and theses.
RTC2011 Createspace Independent Publishing Platform
The TRANCITS (TRansfer ANalysis Code to Interface Thermal/Structural problems) code can be used to interface temperature data between thermal and structural analytical models. The use of this transfer module allows the heat transfer analyst to select the thermal mesh density and thermal analysis code best suited to solve the thermal problem, and it gives the same freedoms to the stress analyst without the efficiency penalties associated with common meshes and the accuracy penalties associated with the manual transfer of thermal data.
Research and Technology 1991 Springer
Thermal and Structural Analysis of a Hollow Core Space Shuttle Main Engine (SSME) Turbine BladeSafe Affordable Fission Engine-(Safe-) 100a Heat Exchanger Thermal and Structural AnalysisCreatespace Independent Publishing Platform
Research Highlights of the Global Modeling and Simulation Branch for 1986-1987 Academic Press
The high-pressure oxidizer turbopump (HPOTP) consists of two centrifugal pumps, on a common shaft, that are directly driven by a hot-gas turbine. Pump shaft axial thrust is balanced in that the double-entry main inducer/impeller is inherently balanced and the thrusts of the preburner pump and turbine are nearly equal but opposite. Residual shaft thrust is controlled by a self-compensating, non-rubbing, balance piston. Shaft hang-up must be avoided if the balance piston is to perform properly. One potential cause of shaft hang-up is contact between the Phase 2 bearing support and axial spring cartridge of the HPOTP main pump housing. The status of the bearing support/axial spring cartridge interface is investigated under current loading conditions. An ANSYS version 4.3, three-dimensional, finite element model was generated on Lockheed's VAX 11/785 computer. A nonlinear thermal analysis was then executed on the Marshall Space Flight Center Engineering Analysis Data System (EADS). These thermal results were then applied along with the interference fit and bolt preloads to the model as load conditions for a static analysis to determine the gap status of the bearing support/axial spring cartridge interface. For possible further analysis of the local regions of HPOTP main pump housing assembly, detailed ANSYS submodels were generated using I-DEAS Geomod and Supertab (Appendix A). Sisk, Gregory A. Unspecified Center...
Research Into Improving the Durability of the Hot Section in the Aircraft Turbine Engine Independently Published
This book is a compilation of papers presented at the Regional Tribology Conference 2011 (RTC2011) - Langkawi, Malaysia on 22 ~ 24 November 2011.
Safe Affordable Fission Engine-(Safe-) 100a Heat Exchanger Thermal and Structural Analysis Createspace Independent Publishing Platform
Revised and extended, this new edition provides

the foundation for diesel engines design, based on traditional methods in thermodynamics, dynamics, structural analysis, chemistry, heat transfer, and applied analysis of system operation. It also offers additional material and examples for the calculation of combustion process, thermal efficiency, heat release, NOx emissions, and diesel turbocharging. Diesel Engine Engineering-2nd Edition demonstrates details of diesel engine performance with graphs and schematic diagrams, illustrates the characteristics and modes of diesel engine operation, describes the analytical models for calculation of thermodynamics parameters, in-cylinder cycles and emissions, discusses how various design factors affect engine performance, efficiency, emissions, the system reliability, offering correct techniques to improve performance, stability, and endurance.

Monthly Catalog of United States Government Publications

The 1982 statistics on the use of family planning and infertility services presented in this report are preliminary results from Cycle III of the National Survey of Family Growth (NSFG), conducted by the National Center for Health Statistics. Data were collected through personal interviews with a multistage area probability sample of 7969 women aged 15-44. A detailed series of questions was asked to obtain relatively complete estimates of the extent and type of family planning services received. Statistics on family planning services are limited to women who were able to conceive 3 years before the interview date. Overall, 79% of currently mrried nonsterile women reported using some type of family planning service during the previous 3 years. There were no statistically significant differences between white (79%), black (75%) or Hispanic (77%) wives, or between the 2 income groups. The 1982 survey questions were more comprehensive than those of earlier cycles of the survey. The annual rate of visits for family planning services in 1982 was 1077 visits /1000 women. Teenagers had the highest annual visit rate (1581/1000) of any age group for all sources of family planning services combined. Visit rates declined sharply with age from 1447 at ages 15-24 to 479 at ages 35-44. Similar declines with age also were found in the visit rates for white and black women separately. Nevertheless, the annual visit rate for black women (1334/1000) was significantly higher than that for white women (1033). The highest overall visit rate was for black women 15-19 years of age (1867/1000). Nearly 2/3 of all family planning visits were to private medical sources. Teenagers of all races had higher family planning service visit rates to clinics than to private medical sources, as did black women age 15-24. White women age 20 and older had higher visit rates to private medical services than to clinics. Never married women had higher visit rates to clinics than currently or formerly married women. Data were also collected in 1982 on use of medical services for infertility by women who had difficulty in conceiving or carrying a pregnancy to term. About 1 million ever married women had 1 or more infertility visits in the 12 months before the interview. During the 3 years before interview,

about 1.9 million women had infertility visits. For all ever married women, as well as for white and black women separately, infertility services were more likely to be secured from private medical sources than from clinics. The survey design, reliability of the estimates and the terms used are explained in the technical notes.

Technology for Large Space Systems

These proceedings collect the papers presented at the 30th International Symposium on Shock Waves (ISSW30), which was held in Tel-Aviv Israel from July 19 to July 24, 2015. The Symposium was organized by Ortra Ltd. The ISSW30 focused on the state of knowledge of the following areas: Nozzle Flow, Supersonic and Hypersonic Flows with Shocks, Supersonic Jets, Chemical Kinetics, Chemical Reacting Flows, Detonation, Combustion, Ignition, Shock Wave Reflection and Interaction, Shock Wave Interaction with Obstacles, Shock Wave Interaction with Porous Media, Shock Wave Interaction with Granular Media, Shock Wave Interaction with Dusty Media, Plasma, Magnetohyrdrodynamics, Re-entry to Earth Atmosphere, Shock Waves in Rarefied Gases, Shock Waves in Condensed Matter (Solids and Liquids), Shock Waves in Dense Gases, Shock Wave Focusing, Richtmyer-Meshkov Instability, Shock Boundary Layer Interaction, Multiphase Flow, Blast Waves, Facilities, Flow Visualization, and Numerical Methods. The two volumes serve as a reference for the participants of the ISSW30 and anyone interested in these fields.

Space Shuttle Main Engine Structural Analysis and Data Reduction/Evaluation. Volume 2

The U.S. Army Research Laboratory, NASA Glenn Research Center, and Rolls-Royce Allison are working collaboratively to demonstrate the benefits and viability of a wave-rotor-topped gas turbine engine. The self-cooled wave rotor is predicted to increase the engine overall pressure ratio and peak temperature by 300% and 25 to 30%, respectively, providing substantial improvements in engine efficiency and specific power. Such performance improvements would significantly reduce engine emissions and the fuel logistics trails of armed forces. Progress towards a planned demonstration of a wave-rotor-topped Rolls-Royce Allison model 250 engine has included completion of the preliminary design and layout of the engine, the aerodynamic design of the wave rotor component and prediction of its aerodynamic performance characteristics in on- and off-design operation and during transients, and the aerodynamic design of transition ducts between the wave rotor and the high pressure turbine. The topping cycle increases the burner entry temperature and poses a design challenge to be met in the development of the demonstrator engine.

Thermal/structural Tailoring of Engine Blades (T/SEAEBL). Theoretical Manual

A potential fission power system for in-space missions is a heat pipe-cooled reactor coupled to a Brayton cycle. In this system, a heat exchanger (HX) transfers the heat of the reactor core to the Brayton gas. The Safe Affordable Fission Engine-(SAFE-) 100a is a test program designed to thermally and hydraulically simulate a

95 Btu/s prototypic heat pipe-cooled reactor using electrical resistance heaters on the ground. This Technical Memorandum documents the thermal and structural assessment of the HX used in the SAFE-100a program.Steeve, B. E.Marshall Space Flight CenterBRAYTON CYCLE; HEAT EXCHANGERS; STRUCTURAL ANALYSIS; THERMAL ANALYSIS; FISSION; NUCLEAR REACTORS; STRESS ANALYSIS

Proceedings of Regional Tribology Conference 2011

This book deals with structural failure (induced by mechanical, aerodynamic, acoustic and aero-thermal, loads, etc.) of modern aerospace vehicles, in particular high-speed aircraft, solid propellant rocket systems and hypersonic flight vehicles, where structural integrity, failure prediction and service life assessment are particularly challenging, due to the increasingly more demanding mission requirements and the use of non-traditional materials, such as non-metallic composites, in their construction. Prediction of the complex loading environment seen in high-speed operation and constitutive / fracture models which can adequately describe the non-linear behaviour exhibited by advanced alloys and composite materials are critical in analyzing the non-linear structural response of modern aerospace vehicles and structures. The state-of-the-art of the different structural integrity assessment and prediction methodologies (including non-destructive structural health monitoring techniques) used for the structural design, service life assessment and failure analysis of the different types of aerospace vehicles are presented. The chapters are written by experts from aerospace / defence research organizations and academia in the fields of solid mechanics, and structural mechanics and dynamics of aircraft, rocket and hypersonic systems. The book will serve as a useful reference document containing specialist knowledge on appropriate prediction methodologies for a given circumstance and experimental data acquired from multi-national collaborative programs.

Computer Program Abstracts

Propulsion Branch at ARL is reviewing the direction of its research activities into the integrity, durability and life extension of aircraft turbine engine components. Hot section repairs dominate the costs of engine overhaul, so resources are being redeployed from other programs on life of engine components toward this area of high potential benefit. Engine hot section life is an area of great complexity and wide scope. Despite the technical difficulties and limits in resources, the Branch can make a useful contribution with carefully selected research. New areas or extensions proposed are structural analysis of high temperature components under cycles of thermal loading, and thermal analysis of components to determine temperature distribution which characterises the thermo-mechanical loading. While structural analysis can build upon existing related expertise, little experience exists in thermal analysis and its core discipline of heat transfer, so a program to build up this technology base is proposed and options are examined.

Turbine Engine Hot

Section Technology, 1985
The high-pressure oxidizer turbopump (HPOTP) consists of two centrifugal pumps, on a common shaft, that are directly driven by a hot-gas turbine. Pump shaft axial thrust is balanced in that the double-entry main inducer/impeller is inherently balanced and the thrusts of the preburner pump and turbine are nearly equal but opposite. Residual shaft thrust is controlled by a self-compensating, non-rubbing, balance piston. Shaft hang-up must be avoided if the balance piston is to perform properly. One potential cause of shaft hang-up is contact between the Phase 2 bearing support and axial spring cartridge of the HPOTP main pump housing. The status of the bearing support/axial spring cartridge interface is investigated under current loading conditions. An ANSYS version 4.3, three-dimensional, finite element model was generated on Lockheed's VAX 11/785 computer. A nonlinear thermal analysis was then executed on the Marshall Space Flight Center Engineering Analysis Data System (EADS). These thermal results were then applied along with the interference fit and bolt preloads to the model as load conditions for a static analysis to determine the gap status of the bearing support/axial spring cartridge interface. For possible further analysis of the local regions of HPOTP main pump housing assembly, detailed ANSYS submodels were generated using I-DEAS Geomod and Supertab (Appendix A). Sisk, Gregory A. Unspecified Center...
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