Engine Thermal Structural Analysis Using Ansys

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.

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.

Fatigue Failures Of Blades Is One Of The Most Vexing Problems Of Turbomachine Manufacturers, Ever Since The Steam Turbine Became The Main Stay For Power Generating Equipment And Gas Turbines Are Increasingly Used In The Air Transport. The Problem Is Very Complex, Involving The Excitation Due To Aerodynamic Stage Interaction; Damping Due To Material Deformation, Friction At Slip Surfaces And Aerodynamic Damping; Vibration Of An Asymmetric Aerofoil Tapered Along Its Length And Mounted On A Rotating Disc At A Stagger Angle. The Problem Is Also Governed By Heat Transfer Analysis And Thermal Stresses.His Book Deals With A Basic Understanding Of Free Vibratory Behaviour Of Turbine Blades- Free Standing, Packetted, And Bladed-Discs. The Analysis Is Based On Continuous And Discrete Models Using Energy Principles And Finite Element Techniques. A Clear Understanding Of The Interference Phenomenon In A Thin Cambered Airfoil Stage In Subsonic Flow Is Presented To Determine The Nonsteady Excitation Forces Acting On The Blades. A Comprehensive Treatment On The Blade Damping Phenomenon That Occurs In Turbines Is Given. The Nonlinear Damping Models Account For Material Damping And Friction Damping As A Function Of Rotational Speed For Each Mode. Resonant Response Calculation Procedures For The Steadily Running As Well As

Accelerating Blades Are Given.Cumulative Damage Calculations Are Then Outlined For Fatigue Life Estimation Of Turbomachine Blades. The Book Also Deals With Heat Transfer Analysis And Thermal Stress Calculations Which Help In A Comprehensive Understanding Of The Blade Problems.

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

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...

Safe Affordable Fission Engine-(Safe-) 100a Heat Exchanger Thermal and Structural AnalysisCreatespace Independent Publishing Platform

This book is a compilation of papers presented at the Regional Tribology Conference 2011 (RTC2011) - Langkawi, Malaysia on 22 ~ 24 November 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.

The book describes the recent progress in some hypersonic technologies such as the aerodynamic modeling and numerical simulations of rarefied flows, boundary layer receptivity, coupled aerodynamics, and heat transfer problems, including fluid-thermal-structure interactions and launcher aerodynamic design as well as other miscellaneous topics, such as porous ceramic composite phase change control system and vehicle profile, following LQR design. Both the researchers and the students should find the material useful in their work.

A significant area of interest in design of complex structures involves the study of multidisciplined problems. The coordination of several different intricate areas of study to obtain a particular design of a structure is a new and pressing area of research. In the past, each discipline would perform its task consecutively using the appropriate inputs from the other disciplines. This process usually required several time-consuming iterations to obtain a satisfactory design. The alternative pursued here is combining various participating disciplines and specified design requirements into a formal structural computer code. The main focus of this research is to develop a multidiscipline structural tailoring method for select composite structures and to demonstrate its application to specific areas. The development of an integrated computer program involves the coupling of three independent computer programs using an excutive module. This module will be the foundation for integrating a structural optimizer, a composites analyzer and a thermal analyzer. With the completion of the executive module, the first step was taken toward the evolution of multidiscipline software in the field of composite mechanics. Through the use of an array of cases involving a variety of objective functions/constraints and thermal-mechanical load conditions, it became evident that simple composite structures can be designed to a combined loads environment. Acquaviva, Thomas H. Glenn Research Center COMPOSITE STRUCTURES; COMPUTER AIDED DESIGN; FIBER COMPOSITES; STRUCTURAL ANALYSIS; THERMAL ANALYSIS; COMPUTER PROGRAMS; ENGINE PARTS; FINITE ELEMENT METHOD; HEAT TRANSFER; LAMINATES; MICROMECHANICS...

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

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

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.