Flow Analysis And Nozzle Shape Optimization For The Cold


A study was made to design two types of overrunning nacelles for an existing wing-body at a design condition of Mach = 0.8 and C sub L = 0.2. Internal and external surface contours were developed for nacelles having either a D-shaped nozzle or a high-aspect-ratio nozzle for upper-surface blowing in the powered-lift mode of operation. The goal of the design was the development of external nacelle lines that would minimize high-speed aerodynamic interference effects. Each nacelle type was designed for both two- and four-engine airplanes using an iterative process of aerodynamic potential flow analysis. Incremental nacelle drag estimates were made for flow-through wind tunnel models of each configuration. A new technique is presented for the numerical solution of quasi-one-dimensional, vibrational and chemical nonequilibrium nozzle flows including nonequilibrium conditions both upstream and downstream of the throat. This new technique is a time-dependent analysis which entails the explicit finite-difference solution of the quasi-one-dimensional unsteady flow equations in steps of time, starting with assumed initial distributions throughout the nozzle. The steady-state solution is approached at large values of time. A virtue of the present time-dependent analysis is its simplicity, which prevails from its initial physical formulation to the successful receipt of numerical results. Also, the present solution yields the transient as well as the steady-state nonequilibrium nozzle flows. To exemplify the present analysis, results are given for several cases of vibrational and chemical nonequilibrium expansions through nozzles. (Author). Set includes some issues published under later name: RT O AGARDograph, e.g. no. 301, v. 16.An advanced textbook on AFD introducing astrophysics students to the necessary fluid dynamics, first published in 2007. The definitive text on rocket propulsion—now revised to reflect advancements in the field For sixty years, Sutton's Rocket Propulsion Elements has been regarded as the single most authoritative sourcebook on rocket propulsion technology. As with the previous edition, coauthored with Oscar Bibealr, the Eighth Edition of Rocket Propulsion Elements offers a thorough introduction to basic principles of rocket propulsion for guided missiles, space flight, or satellite flight. It describes the physical mechanisms and design for various types of rockets and provides an understanding of how rocket propulsion is applied to flying vehicles. Updated and strengthened throughout, the Eighth Edition explores: The fundamentals of rocket propulsion, its essential technologies, and its key design rationale The various types of propulsion system components, physical phenomena, and essential relationships The latest advances in the field such as changes in materials, systems design, propellants, and manufacturing technologies, with a separate new chapter devoted to turbopumps Liquid propellant rocket engines and solid propellant rocket motors, the two most prevalent of the rocket propulsion systems, with in-depth consideration of advances in hybrid rockets and electrical space propulsion Comprehensive and ever-increasingly comprehensive, this seminal text guides readers everhandlier through the complex factors that shape rocket propulsion, with both theory and practical design considerations. Professional engineers in the aerospace and defense industries as well as students in mechanical and aerospace engineering will find this updated classic indispensable for its scope of coverage and utility. An analytical technique suitable for the solution of complex energy transfer problems involving coupled radiant and convective energy transfer is developed. Solutions for the coupled axial wall energy flux distribution in rocket nozzles using hydrogen as a propellant are presented. Flow rates and temperatures studied are near those forecast for gaseous-core nuclear-propulsion systems. Parameters varied are nozzle shape, inlet propellant temperature, mean reactor cavity temperature, and nozzle wall temperature level. The effects of variation of the propellant radiation absorption coefficient with pressure, temperature, and wavelength are presented, and real property variations are used where they appear to be significant. Comparison is made to a simplified, coupled solution using a modified second-order one-dimensional diffusion equation for the radiative transfer. At the temperature levels assumed, radiative transfer may account for a greater portion of the total energy transfer over important portions of the nozzle, and its effects cannot, therefore, be neglected. Extreme energy fluxes (near 3X10 to the 8 Btu/(hr)(sq ft)) are observed for certain cases, and this implies that new nozzle cooling techniques must be developed. A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in Scientific and technical aerospace reports (STAR) and International aerospace abstracts (IAA)

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