Design Of An Axial Turbine And Thermodynamic Analysis And

Aircraft Engines and Gas Turbines is widely used as a text in the United States and abroad, and has also become a standard reference for professionals in the aircraft engine industry. Unique in treating the engine as a complete system at increasing levels of sophistication, it covers all types of modern aircraft engines, including turbojets, turbofans, and turboprops, and also discusses hypersonic propulsion systems of the future. Performance is described in terms of the fluid dynamic and thermodynamic limits on the behavior of the principal components: inlets, compressors, combustors, turbines, and nozzles. Environmental factors such as atmospheric pollution and noise are treated along with performance.This new edition has been substantially revised to include more complete and up-to-date coverage of compressors, turbines, and combustion systems, and to introduce current research directions. The discussion of high-bypass turbofans has been expanded in keeping with their great commercial importance. Propulsion for civil supersonic transports is taken up in the current context. The chapter on hypersonic air breathing engines has been expanded to reflect interest in the use of scramjets to power the National Aerospace Plane. The discussion of exhaust emissions and noise and associated regulatory structures have been updated and there are many corrections and clarifications.Jack L. Kerrebrock is Richard Cockburn Maclaurin Professor of Aeronautic's and Astronautics at the Massachusetts Institute of Technology.

Addressing the optimization and design of an axial flow turbine, this volume details a method for selecting the best turbine design, taking into account a range of parameters including size, stress, and number of stages. Topics covered include basic turbine design, stage calculations, thermodynamics and blade shapes, and a design example.

Turbomachines, which comprise turbines, compressors and fans, are used in electricpower generation, aircraft propulsion and a wide variety of medium and heavy industries.The importance of this class of machines can be understood by the examples of2000 MW steam turbines, turbojet engines, etc.This book is a self-contained treatise in the theory, design and application ofturbomachines. The book deals with the use of turbomachines in air handling, powergeneration, aircraft propulsion and several industrial applications. It covers the basictheory and working of all kinds of turbomachines. In addition, the book discusses:* The role of individual turbomachines in a plant* Dimensional analysis and flow through cascades* Fans, blowers, high-temperature turbine stages and aerospace engineering* Problems on hydraulic turbines and pumps

Computer code TD2 computes design point velocity diagrams and performance for multistage, multishaft, cooled or uncooled, axial flow turbines. This streamline analysis code was recently modified to upgrade modeling related to turbine cooling and to the internal loss correlation. These modifications are presented in this report along with descriptions of the code's expanded input and output. This report serves as the users manual for the upgraded code, which is named TD2-2. Glassman, Arthur J. Unspecified Center NAG3-1165; RTOP 505-69-50...

This book provides a thorough description of an aerodynamic design and analysis systems for Axial-Flow Compressors. It describes the basic fluid dynamic and thermodynamic principles, empirical models and numerical methods used for the full range of procedures and analytical tools that an engineer needs for virtually any tupe of Axial-Flow Compressor, aerodynamic design or analysis activity. It reviews and evaluates several design strategies that have been recommended in the literature or which have been found to be effective. It gives a complete description of an actual working system, such that readers can implement all or part of the system. Engineers responsible for developing, maintaining of improving design and analysis systems can benefit greatly from this type of reference. The technology has become so complex and the role of computers so pervasive that about the only way this can be done today is to concentrate on a specific design and analysis system. The author provides practical methodology as well as the details needed to implement the suggested procedures.

This book is a monograph on aerodynamics of aero-engine gas turbines focusing on the new progresses on flow mechanism and design methods in the recent 20 years. Starting with basic principles in aerodynamics and thermodynamics, this book systematically expounds the recent research on mechanisms of flows in axial gas turbines, including high pressure and low pressure turbines, inter-turbine ducts and turbine rear frame ducts, and introduces the classical and innovative numerical evaluation methods in different dimensions. This book also summarizes the latest research achievements in the field of gas turbine aerodynamic design and flow control, and the multidisciplinary conjugate problems involved with gas turbines. This book should be helpful for scientific and technical staffs, college teachers, graduate students, and senior college students, who are involved in research and design of gas turbines.

An axial-flow turbine off-design performance computer code used for preliminary studies of gas turbine systems was modified and calibrated based on the experimental performance of large aircraft-type turbines. The flow- and loss-model modifications and calibrations are presented in this report. Comparisons are made between computed performances and experimental data for seven turbines over wide ranges of speed and pressure ratio. This report also serves as the users manual for the revised code, which is named AXOD. Glassman, Arthur J. Unspecified Center NAG3-1165; RTOP 505-69-50...

Turbomachinery presents the theory and design of turbomachines with step-by-step procedures and worked-out examples. This comprehensive reference emphasizes fundamental principles and construction guidelines for enclosed rotators and contains end-of-chapter problem and solution sets, design formulations, and equations for clear understanding of key aspects in machining function, selection, assembly, and construction. Offering a wide range of illustrative examples, the book evaluates the components of incompressible and compressible fluid flow machines and analyzes the kinematics and dynamics of turbomachines with valuable definitions, diagrams, and dimensionless parameters.

Renewable energies constitute excellent solutions to both the increase of energy consumption and environment problems. Among these energies, wind energy is very interesting. Wind energy is the subject of advanced research. In the development of wind turbine, the design of its different structures is very important. It will ensure: the robustness of the system, the energy efficiency, the optimal cost and the high reliability. The use of advanced control technology and new technology products allows bringing the wind energy conversion system in its optimal operating mode. Different strategies of control can be applied on generators, systems relating to blades, etc. in order to extract maximal power from the wind. The goal of this book is to present recent works on design, control and applications in wind energy conversion systems.

This book presents a selection of preliminary sizing procedures for turbomachinery. Applicable to both conventional and non-conventional fluids, these procedures enable users to optimize the kinematics, thermodynamics and geometry of the turbomachinery (in the preliminary design phase) using geometric correlations and losses models; to accurately predict the efficiency of turbomachinery – in most cases, in excellent agreement with CFD calculations; and to consistently analyze all turbomachines (axial and radial turbines, axial and centrifugal compressors, centrifugal pumps). The book is intended for bachelor's and master's students in industrial, mechanical and energy engineering, as well as researchers and professionals in the energy systems and turbomachinery sectors, guiding them step by step through the first sizing of turbomachines and the verification of the technological feasibility of turbomachines designed for new conversion systems operating with unconventional fluids.

The program method is based on a mean-diameter flow analysis. Input design requirements include power or pressure ratio, flow, temperature, pressure, and speed. Turbine designs are generated for any specified number of stages and for any of three types of velocity diagrams (symmetrical, zero exit swirl, or impulse). Exit turning vanes can be included in the design. Program output includes inlet and exit annulus dimensions, exit temperature and pressure, total and static efficiencies, blading angles, and last-stage critical velocity ratios. The report presents the analysis method, a description of input and output with sample cases, and the program listing.

Turbine AerodynamicsAxial-flow and Radial-inflow Turbine Design and AnalysisAmer Society of Mechanical

The Gas Turbine Engineering Handbook has been the standard for engineers involved in the design, selection, and operation of gas turbines. This revision includes new case histories, the latest techniques, and new designs to comply with recently passed legislation. By keeping the book up to date with new, emerging topics, Boyce ensures that this book will remain the standard and most widely used book in this field. The new Third Edition of the Gas Turbine Engineering Hand Book updates the book to cover the new generation of Advanced gas Turbines. It examines the benefit and some of the major problems that have been encountered by these new turbines. The book keeps abreast of the environmental changes and the industries answer to these new regulations. A new chapter on case histories has been added to enable the engineer in the field to keep abreast of problems that are being encountered and the solutions that have resulted in solving them. Comprehensive treatment of Gas Turbines from Design to Operation and Maintenance. In depth treatment of Compressors with emphasis on surge, rotating stall, and choke; Combustors with emphasis on Dry Low NOx Combustors; and Turbines with emphasis on Metallurgy and new cooling schemes. An excellent introductory book for the student and field engineers A special maintenance section dealing with the advanced gas turbines, and special diagnostic charts have been provided that will enable the reader to troubleshoot problems he encounters in the field The third edition consists of many Case Histories of Gas Turbine problems. This should enable the field engineer to avoid some of these same generic problems

Organic Rankine Cycle (ORC) Power Systems: Technologies and Applications provides a systematic and detailed description of organic Rankine cycle technologies and the way they are increasingly of interest for cost-effective sustainable energy generation. Popular applications include cogeneration from biomass and electricity generation from geothermal reservoirs and concentrating solar power installations, as well as waste heat recovery from gas turbines, internal combustion engines and medium- and low-temperature industrial processes. With hundreds of ORC power systems already in operation and the market growing at a fast pace, this is an active and engaging area of scientific research and technical development. The book is structured in three main parts: (i) Introduction to ORC Power Systems, Design and Optimization, (ii) ORC Plant Components, and (iii) Fields of Application. Provides a thorough introduction to ORC power systems Contains detailed chapters on ORC plant components Includes a section focusing on ORC design and optimization Reviews key applications of ORC technologies, including cogeneration from biomass, electricity generation from geothermal reservoirs and concentrating solar power installations, waste heat recovery from gas turbines, internal combustion engines and medium- and low-temperature industrial processes Various chapters are authored by well-known specialists from Academia and ORC manufacturers

Mechanical Engineering Design and Analysis of Axlal and Radial Turbines.

Logan's Turbomachinery: Flowpath Design and Performance Fundamentals, Third Edition is the long-awaited revision of this classic textbook, thoroughly updated by Dr. Bijay Sultanian. While the basic concepts remain constant, turbomachinery design has advanced since the Second Edition was published in 1993. Airfoils in modern turbomachines feature three-dimensional geometries, Computational Fluid Mechanics (CFD) has become a standard design tool, and major advances have been made in the materials and manufacturing technologies that affect turbomachinery design. The new edition adresses these trends to best serve today's students, and design engineers working in turbomachinery industries.

This volume presents selected papers presented during the National Aerospace Propulsion Conference (NAPC) held at Indian Institute of Technology Kharagpur. It brings together contributions from the entire propulsion community, spanning air-breathing and non-air-breathing propulsion. The papers cover aerospace propulsion-related topics, and discuss relevant research advances made in this field. It will be of interest to researchers in industry and academia working on gas turbine, rocket, and jet engines.

A novel humidification dehumidification desalination system was developed at the Rohseneow Kendall Heat Transfer Laboratory. The HDH system runs by having different pressures in the humidifier and dehumidifier. One of the components that will keep the different pressures is an expander. The expander specification is to work with a pressure ratio of 1.2 while having a high efficiency. Two approaches were developed to achieve this result, one was through the design of a turbine and the second was through the selection and testing of a car turbocharger. The design of a turbine is given in detail and follows the process given in "Design of High- Efficiency Turbomachinery and Gas Turbines" by David Wilson. The final design of the turbine blades was sand cast. Due to the sand casting process, cavitation on the blade

material was shown and testing of the blades was not pursued for fear of fast fracturing. The second option of selecting a turbocharger is shown and the process which led to its selection is explained. Through such process a K03 turbocharger was selected to be suitable to run at the low pressure ratios with a moderate efficiency. Testing of the K03 was conducted. The static-to-static isentropic efficiency calculated was 53% ± 11% for a pressure ratio of 1.2 while the total-to-total isentropic efficiency 60% ± 14% at a pressure ratio of 1.2. The high error associated with the efficiencies are due to the turbine experiencing small temperature drops in the order of 10°C or less. The K03 turbocharger is meant to run at higher pressure ratios, in the order of 2 with a manufacturer specified efficiency of 70%. Running the K03 at a pressure ratio of 1.2 decreases the efficiency since its not specified to run at those low pressure ratios. If a turbine or a turbocharger is designed for the exact specifications of the desalination system, it can work with low pressure ratios and be highly efficient.

The second edition of a comprehensive textbook that introduces turbomachinery and gas turbines through design methods and examples. This comprehensive textbook is unique in its design-focused approach to turbomachinery and gas turbines. It offers students and practicing engineers methods for configuring these machines to perform with the highest possible efficiency. Examples and problems are based on the actual design of turbomachinery and turbines. After an introductory chapter that outlines the goals of the book and provides definitions of terms and parts, the book offers a brief review of the basic principles of thermodynamics and efficiency definitions. The rest of the book is devoted to the analysis and design of real turbomachinery configurations and gas turbines, based on a consistent application of thermodynamic theory and a more empirical treatment of fluid dynamics that relies on the extensive use of design charts. Topics include turbine power cycles, diffusion and diffusers, the analysis and design of three-dimensional free-stream flow, and combustion systems and combustion calculations. The second edition updates every chapter, adding material on subjects that include flow correlations, energy transfer in turbomachines, and three-dimensional design. A solutions manual is available for instructors. This new MIT Press edition makes a popular text available again, with corrections and some updates, to a wide audience of students, professors, and professionals.

It is well known that improvements in space and aviation are the leader of today's technology, and the aircraft is the most important product of aviation. Because of this fact, the books on aircraft are always at the center of interest. In most cases, technologies designed for the aerospace industry are rapidly extending into other areas. For example, although composite materials are developed for the aerospace industry, these materials are not often used in aircraft. However, composite materials are utilized significantly in many different sectors, such as automotive, marine and civil engineering. And materials science in aviation, reliability and efficiency in aircraft technology have a major importance in aircraft design.

This book provides a thorough description of actual, working aerodynamic design and analysis systems, for both axial-flow and radial-flow turbines. It describes the basic fluid dynamic and thermodynamic principles, empirical models and numerical methods used for the full range of procedures and analytical tools that an engineer needs for virtually any type of aerodynamic design or analysis activity for both types of turbine. The book includes sufficient detail for readers to implement all or part of the systems. The author provides practical and effective design strategies for applying both turbine types, which are illustrated by design examples. Comparisons with experimental results are included to demonstrate the prediction accuracy to be expected. This book is intended for practicing engineers concerned with the design and development of turbines and related machinery.

This book written by a world-renowned expert with more than forty years of active gas turbine R&D experience comprehensively treats the design of gas turbine components and their integration into a complete system. Unlike many currently available gas turbine handbooks that provide the reader with an overview without in-depth treatment of the subject, the current book is concentrated on a detailed aero-thermodynamics, design and off-deign performance aspects of individual components as well as the system integration and its dynamic operation.This new book provides practicing gas turbine designers and young engineers working in the industry with design material that the manufacturers would keep proprietary. The book is also intended to provide instructors of turbomachinery courses around the world with a powerful tool to assign gas turbine components as project and individual modules that are integrated into a complete system. Quoting many statements by the gas turbine industry professionals, the young engineers graduated from the turbomachinery courses offered by the author, had the competency of engineers equivalent to three to four years of industrial experience.

A Users Guide for the axial flow turbine off-design computer program AXOD2 is composed in this paper. This Users Guide is supplementary to the original Users Manual of AXOD. Three notable contributions of AXOD2 to its predecessor AXOD, both in the context of the Guide or in the functionality of the code, are described and discussed in length. These are: 1) a rational representation of the mathematical principles applied, with concise descriptions of the formulas implemented in the actual coding. Their physical implications are addressed; 2) the creation and documentation of an Addendum Listing of input namelist-parameters unique to AXOD2, that differ from or are in addition to the original input-namelists given in the Manual of AXOD. Their usages are discussed; and 3) the institution of proper stoppages of the code execution, encoding termination messaging and error messages of the execution to AXOD2. These measures are to safe-guard the integrity of the code execution, such that a failure mode encountered during a case-study would not plunge the code execution into indefinite loop, or cause a blow-out of the program execution. Details on these are discussed and illustrated in this paper. Moreover, this computer program has since been reconstructed substantially. Standard FORTRAN Langue was instituted, and the code was formatted in Double Precision (REAL*8). As the result, the code is now suited for use in a local Desktop Computer Environment, is perfectly portable to any Operating System, and can be executed by any FORTRAN compiler equivalent to a FORTRAN 9095 compiler. AXOD2 will be available through

NASA Glenn Research Center (GRC) Software Repository. Chen, Shu-Cheng S. Glenn Research Center NASA/TM-2014-218301, E-18884, GRC-E-DAA-TN12340 WBS 794072.02.03.05.04 AXIAL FLOW TURBINES; GAS TURBINE ENGINES; USER MANUALS (COMPUTER PROGRAMS); COMPUTER PROGRAMS; FORTRAN; MANUALS; FAILURE MODES

Everything you wanted to know about industrial gas turbines for electric power generation in one source with hard-to-find, hands-on technical information.

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