Download Free Gas Turbine Engine Performance

The primary human activities that release carbon dioxide (CO2) into the atmosphere are the combustion of fossil fuels (coal, natural gas, and oil) to generate electricity, the provision of energy for transportation, and as a consequence of some industrial processes. Although aviation CO2 emissions only make up approximately 2.0 to 2.5 percent of total global annual CO2 emissions, research to reduce CO2 emissions is urgent because (1) such reductions may be legislated even as commercial air travel grows, (2) because it takes new technology a long time to propagate into and through the aviation fleet, and (3) because of the ongoing impact of global CO2 emissions. Commercial Aircraft Propulsion and Energy Systems Research develops a national research agenda for reducing CO2 emissions from commercial aviation. This report focuses on propulsion and energy technologies for reducing carbon emissions from large, commercial aircraft—single-aisle and twin-aisle aircraft that carry 100 or more passengers—because such aircraft account for more than 90 percent of global emissions from commercial aircraft. Moreover, while smaller aircraft also emit CO2, they make only a minor contribution to global emissions, and many technologies that reduce CO2 emissions for large aircraft also apply to smaller aircraft. As commercial aviation continues to grow in terms of revenue-passenger miles and cargo ton miles, CO2 emissions are expected to increase. To reduce the contribution of aviation to climate change, it is essential to improve the effectiveness of...
Improved Gas Turbine Engine Maintenance Through Management and Analysis of Engine Performance Data

This document is intended as an introduction to the analysis of gas turbine engine cycles using the Numerical Propulsion System Simulation (NPSS) code. It is assumed that the analyst has a firm understanding of fluid flow, gas dynamics, thermodynamics, and turbomachinery theory. The purpose of this paper is to provide for the novice the information necessary to begin cycle analysis using NPSS. This paper and the annotated example serve as a starting point and by no means cover the entire range of information and experience necessary for engine performance simulation. NPSS syntax is presented but for a more detailed explanation of the code the user is referred to the NPSS User Guide and Reference document.

Gas Turbine Engine Performance

Although gas turbine engines are designed to use dry air as the working fluid, the great demand over the last decades for air travel at several altitudes and speeds has increased aircraft’s exposure to inclement weather conditions. Although, they are required to perform safely under the effect of various meteorological phenomena, in which air entering the engine contains water, several incidents have been reported to the aviation authorities about power loss during flight at inclement weather. It was understood that the rain ingestion into a gas turbine engine influences the performance of the engine and, in particular, the compressor and the combustor. The effects of water ingestion on gas turbine engines are aerodynamic, thermodynamic, and mechanical. These effects occur simultaneously and affect each other. Considering the above effects and the fact that they are time-dependent, there are few gas turbine performance simulation tools, which take into account the water ingestion phenomenon. This study is a new research of investigating theoretically the water ingestion effects on gas turbine performance. It focuses on the aerodynamic and mechanical effects of the phenomenon on the compressor and the combustor. The application of Computational Fluid Dynamics (CFD) is the basic methodology to examine the details of the flow in an axial compressor and how it is affected by the presence of water. The calculations of water film thickness, which is formed on the rotor blade, its motion (direction and speed) and the extra torque demand, are provided by a code created by the author using FORTRAN programming language. Considering the change in blade’s profile and the wavy characteristics of the liquid film, the compressor’s performance deterioration is calculated. The compressor and combustor’s deterioration data are imported to a gas turbine simulation code, which is upgraded to calculate overall engine’s performance deterioration. The results show a considerable alteration in engine’s performance parameters and arrive at the same conclusions with the relevant experimental observations.

Performance Benefits for Wave Rotor-Topped Gas Turbine Engines

Propulsion and Power

The escalating use of aircraft in the 21st century demands a thorough understanding of engine propulsion concepts, including the performance of aero engines. Among other critical activities, gas turbines play an extensive role in electric power generation, and marine propulsion for naval vessels and cargo ships. In the most exhaustive volume to date, this text examines the foundation of aircraft propulsion: aerodynamics interwoven with thermodynamics, heat transfer, and mechanical design. With a finely focused approach, the author devotes each chapter to a particular engine type, such as ramjet and pulsejet, turbojet, and turbofan. Supported by actual case studies, he illustrates engine performance under various operating conditions. Part I discusses the history, classifications, and performance of air breathing engines. Beginning with Leonardo and continuing on to the emergence of the jet age and beyond, this section chronicles inventions up through the 20th century. It then moves into a detailed discussion of different engine types, including pulsejet, ramjet, single- and multi-spool turbojet, and turbofan in both subsonic and supersonic applications. The author discusses Vertical Take Off and Landing aircraft, and provides a comprehensive examination of hypersonic scramjet and turbo ramjet engines. He also analyzes the different types of industrial gas turbines having single-and multi-spool with intercoolers, regenerators, and reheaters. Part II investigates the design of rotating compressors and turbines, and non-rotating components, intakes, combustion chambers, and nozzles for all modern jet propulsion and gas turbine engine systems, along with their performance. Every chapter concludes with illustrative examples followed by a problems section; for greater clarity, some provide a listing of important mathematical relations.

Real Time Modeling Methods for Gas Turbine Engine Performance
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Generic Analysis Methods for Gas Turbine Engine Performance

This book written by a world-renowned expert with more than forty years of active gas turbine R&D experience

Progress in Gas Turbine Performance

The book is written for engineers and students who wish to address the preliminary design of gas turbine engines, as well as the associated performance calculations, in a practical manner. A basic knowledge of thermodynamics and turbomachinery is a prerequisite for understanding the concepts and ideas described. The book is also intended for teachers as a source of information for lecture materials and exercises for their students. It is extensively illustrated with examples and data from real engine cycles, all of which can be reproduced with GasTurb (TM). It discusses the practical application of thermodynamic, aerodynamic and mechanical principles. The authors describe the theoretical background of the simulation elements and the relevant correlations through which they are applied, however they refrain from detailed scientific derivations.

The Effect of Jet Pipe Length on Gas Turbine Engine Performance

Industrial Gas Turbines: Performance and Operability explains important aspects of gas turbine performance such as performance deterioration, service life and engine emissions. Traditionally, gas turbine performance has been taught from a design perspective with insufficient attention paid to the operational issues of a specific site. Operators are not always sufficiently familiar with engine performance issues to resolve operational problems and optimise performance. Industrial Gas Turbines: Performance and Operability discusses the key factors determining the performance of compressors, turbines, combustion and engine controls. An accompanying engine simulator CD illustrates gas turbine performance from the perspective of the operator, building on the concepts discussed in the text. The simulator is effectively a virtual engine and can be subjected to operating conditions that would be dangerous and damaging to an engine in real-life conditions. It also deals with issues of engine deterioration, emissions and turbine life. The combined use of text and simulators is designed to allow the reader to better understand and optimise gas turbine operation. Discusses the key factors in determining the performance of compressors, turbines, combustion and engine controls Explains important aspects of gas turbine performance such as service life and engine emissions Accompanied by CD illustrating gas turbine performance, building on the concepts discussed in the text

Water Ingestion Effects on Gas Turbine Engine Performance

Improvements in Gas-turbine Performance Through the Use of Multiple Turbine Inter-stage Burners
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The book 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 detailed aero-thermodynamics, design and off-design 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.

Commercial Aircraft Propulsion and Energy Systems Research

Aircraft Propulsion and Gas Turbine Engines, Second Edition builds upon the success of the book's first edition, with the addition of three major topic areas: Piston Engines with integrated propeller coverage; Pump Technologies; and Rocket Propulsion. The rocket propulsion section extends the text's coverage so that both Aerospace and Aeronautical topics can be studied and compared. Numerous updates have been made to reflect the latest advances in turbine engines, fuels, and combustion. The text is now divided into three parts, the first two devoted to air breathing engines, and the third covering non-air breathing or rocket engines.

A wide range of issues related to analysis of gas turbines and their engineering applications are considered in the book. Analytical and experimental methods are employed to identify failures and quantify operating conditions and efficiency of gas turbines. Gas turbine engine defect diagnostic and condition monitoring systems, operating conditions of open gas turbines, reduction of jet mixing noise, recovery of exhaust heat from gas turbines, appropriate materials and coatings, ultra micro gas turbines and applications of gas turbines are discussed. The open exchange of scientific results and ideas will hopefully lead to improved reliability of gas turbines.

Gas Turbines for Electric Power Generation

Practical Techniques for Modeling Gas Turbine Engine Performance

An Application of a Gas Turbine Engine Performance Computer to a Twin-Spool Engine

Industrial Gas Turbines

Aircraft Propulsion and Gas Turbine Engines

Everything you wanted to know about industrial gas turbines for electric power generation in one source with hard-to-find, hands-on technical information.
There has been a remarkable difference in the research and development regarding gas turbine technology for transportation and power generation. The former remains substantially florid and unaltered with respect to the past as the superiority of air-breathing engines compared to other technologies is by far immense. On the other hand, the world of gas turbines (GTs) for power generation is indeed characterized by completely different scenarios in so far as new challenges are coming up in the latest energy trends, where both a reduction in the use of carbon-based fuels and the raising up of renewables are becoming more and more important factors. While being considered a key technology for base-load operations for many years, modern stationary gas turbines are in fact facing the challenge to balance electricity from variable renewables with that from flexible conventional power plants. The book intends in fact to provide an updated picture as well as a perspective view of some of the abovementioned issues that characterize GT technology in the two different applications: aircraft propulsion and stationary power generation. Therefore, the target audience for it involves design, analyst, materials and maintenance engineers. Also manufacturers, researchers and scientists will benefit from the timely and accurate information provided in this volume. The book is organized into three main sections including 10 chapters overall: (i) Gas Turbine and Component Performance, (ii) Gas Turbine Combustion and (iii) Fault Detection in Systems and Materials.