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AN INTRODUCTION TO COMBUSTION

CONCEPTS AND APPLICATIONS

AN INTRODUCTION TO COMBUSTION

CONCEPTS AND APPLICATIONS

McGraw-Hill Education Introduction to Combustion is the leading combustion textbook for undergraduate and graduate students because of its easy-to-understand analyses of basic combustion concepts and its introduction of a wide variety of practical applications that motivate or relate to the various theoretical concepts. This is a text that is useful for junior/senior undergraduates or graduate students in mechanical engineering and practicing engineers. The third edition updates and adds topics related to protection of the environment, climate change, and energy use. Additionally, a new chapter is added on fuels due to the continued focus on conservation and energy independence.

AN INTRODUCTION TO COMBUSTION

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SOFTWARE TO ACCOMPANY AN INTRODUCTION TO COMBUSTION CONCEPTS AND APPLICATIONS BY STEPHEN R. TURNS

COMBUSTION

Academic Press Throughout its previous four editions, Combustion has made a very complex subject both enjoyable and understandable to its student readers and a pleasure for instructors to teach. With its clearly articulated physical and chemical processes of flame combustion and smooth, logical transitions to engineering applications, this new edition continues that tradition. Greatly expanded end-of-chapter problem sets and new areas of combustion engineering applications make it even easier for students to grasp the significance of combustion to a wide range of engineering practice, from transportation to energy generation to environmental impacts. Combustion engineering is the study of rapid energy and mass transfer usually through the common physical phenomena of flame oxidation. It covers the physics and chemistry of this process and the engineering applications—including power generation in internal combustion automobile engines and gas turbine engines. Renewed concerns about energy efficiency and fuel costs, along with continued concerns over toxic and particulate emissions, make this a crucial area of engineering. New chapter on new combustion concepts and technologies, including discussion on nanotechnology as related to combustion, as well as microgravity combustion, microcombustion, and catalytic combustion—all interrelated and discussed by considering scaling issues (e.g., length and time scales) New information on sensitivity analysis of reaction mechanisms and generation and application of reduced mechanisms Expanded coverage of turbulent reactive flows to better illustrate real-world applications Important new sections on stabilization of diffusion flames—for the first time, the concept of triple flames will be introduced and discussed in the context of diffusion flame stabilization

AN INTRODUCTION TO COMBUSTION CONCEPTS AND APPLICATIONS

McGraw-Hill

AN INTRODUCTION OF COMBUSTION CONCEPTS AND APPLICATIONS

THERMODYNAMICS

CONCEPTS AND APPLICATIONS

Cambridge University Press The focus of Thermodynamics: Concepts and Applications is on traditional thermodynamics topics, but structurally the book introduces the thermal-fluid sciences. Chapter 2 includes essentially all material related to thermodynamic properties clearly showing the hierarchy of thermodynamic state relationships. Element conservation is considered in Chapter 3 as a way of expressing conservation of mass. Constant-pressure and volume combustion are considered in Chapter 5 - Energy Conservation. Chemical and phase equilibria are treated as a consequence of the 2nd law in Chapter 6. 2nd law topics are introduced hierarchically in one chapter, important structure for a beginner. The book is designed for the instructor to select topics and combine them with material from other chapters seamlessly. Pedagogical devices include: learning objectives, chapter overviews and summaries, historical perspectives, and numerous examples, questions and problems and lavish illustrations. Students are encouraged to use the National Institute of Science and Technology (NIST) online properties database.

SOFTWARE TO ACCOMPANY AN INTRODUCTION TO COMBUSTION

CONCEPTS AND APPLICATIONS

SOLUTIONS MANUAL TO ACCOMPANY AN INTRODUCTION TO COMBUSTION

CONCEPTS AND APPLICATIONS

INTRODUCTION TO CATALYTIC COMBUSTION

Routledge In a clear and concise manner, this book explains how to apply concepts in chemical reaction engineering and transport phenomena to the design of catalytic combustion systems. Although there are many textbooks on the subject of chemical reaction engineering, catalytic combustion is mentioned either only briefly or not at all. The authors have chosen three examples where catalytic combustion is utilized as a primary combustion process and natural gas is used as a fuel - stationary gas turbines, process fluid heaters, and radiant heaters; these cover much of the area where research is currently most active. In each of these there are clear environmental benefits to be gained illustrating catalytic combustion as a "cleaner primary combustion process" . The dominant heat transfer

processes in each of the applications are different, as are the support systems, flow geometrics and operating conditions.

SOLUTIONS MANUAL TO ACCOMPANY AN INTRODUCTION TO COMBUSTION

CONCEPTS AND APPLICATIONS

AN INTRODUCTION TO COMBUSTION

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FUNDAMENTALS OF COMBUSTION PROCESSES

Springer Science & Business Media Fundamentals of Combustion Processes is designed as a textbook for an upper-division undergraduate and graduate level combustion course in mechanical engineering. The authors focus on the fundamental theory of combustion and provide a simplified discussion of basic combustion parameters and processes such as thermodynamics, chemical kinetics, ignition, diffusion and pre-mixed flames. The text includes exploration of applications, example exercises, suggested homework problems and videos of laboratory demonstrations

LOOSE LEAF FOR AN INTRODUCTION TO COMBUSTION: CONCEPTS AND APPLICATIONS

McGraw-Hill Education Introduction to Combustion is the leading combustion textbook for undergraduate and graduate students because of its easy-to-understand analyses of basic combustion concepts and its introduction of a wide variety of practical applications that motivate or relate to the various theoretical concepts. This is a text that is useful for junior/senior undergraduates or graduate students in mechanical engineering and practicing engineers. The fourth edition updates and adds topics related to the role of combustion in a sustainable energy future, and modern open-source software has been integrated throughout.

PROPERTIES TABLES BOOKLET FOR THERMAL FLUIDS ENGINEERING

Cambridge University Press This booklet is an ideal supplement for any course in thermodynamics or the thermal fluid sciences and a handy reference for the practising engineer. The tables in the booklet complement and extend the property tables in the appendices to Stephen Turn's *Thermodynamics: Concepts and Applications* and *Thermal-Fluid Sciences: An Integrated Approach*. In addition to duplicating the SI tables in these books it extends the tables to cover US customary units as well. The booklet also contains property data for the refrigerant R-134a and properties of the atmosphere at high altitudes.

COMBUSTION

FROM BASICS TO APPLICATIONS

John Wiley & Sons Combustion, the process of burning, is defined as a chemical reaction between a combustible reactant (the fuel) and an oxidizing agent (such as air) in order to produce heat and in most cases light while new chemical species (e.g., flue gas components) are formed. This book covers a gap on the market by providing a concise introduction to combustion. Most of the other books currently available are targeted towards the experienced users and contain too many details and/or contain knowledge at a fairly high level. This book provides a brief and clear overview of the combustion basics, suitable for beginners and then focuses on practical aspects, rather than theory, illustrated by a number of industrial applications as examples. The content is aimed to provide a general understanding of the various concepts, techniques and equipment for students at all level as well as practitioners with little or no prior experience in the field. The authors are all international experts in the field of combustion technology and adopt here a clear didactic style with many practical examples to cover the most common solid, liquid and gaseous fuels. The associated environmental impacts are also discussed so that readers can develop an understanding of the major issues and the options available for more sustainable combustion processes. With a foreword by Katharina Kohse-Höinghaus

PRINCIPLES OF COMBUSTION

Wiley-Interscience This comprehensive text covers principles and applications with an emphasis on the theoretical modeling of combustion. Addresses chemical thermodynamics and kinetics, conservation equations for multi-component reacting flows, deflagration and detonation waves, premixed laminar flames, spray combustion of fuel droplets, ignition, and related topics. Many examples are included to demonstrate the application of theory. Emphasizes the use of digital computers for solutions.

UNSTEADY COMBUSTOR PHYSICS

Cambridge University Press Explore a unified treatment of the dynamics of combustor systems, including acoustics, fluid mechanics, and combustion in a single rigorous text. This updated new edition features an expansion of data and experimental material, updates the coverage of flow stability, and enhanced treatment of flame dynamics. Addresses system dynamics of clean energy and propulsion systems used in low emissions systems. Synthesizing the fields of fluid mechanics and combustion into a coherent understanding of the intrinsically unsteady processes in combustors. This is a perfect reference for engineers and researchers in fluid mechanics, combustion, and clean energy.

FUNDAMENTALS OF COMBUSTION

PHI Learning Pvt. Ltd. Designed for both undergraduate and postgraduate students of mechanical, aerospace, chemical and metallurgical engineering, this compact and well-knitted textbook provides a sound conceptual basis in fundamentals of combustion processes, highlighting the basic principles of natural laws. In the initial part of the book, chemical thermodynamics, kinetics, and conservation equations are reviewed extensively with a view to preparing students to assimilate quickly intricate aspects of combustion covered in later chapters. Subsequently, the book provides extensive treatments of 'pre-mixed laminar flame', and 'gaseous diffusion flame', emphasizing the practical aspects of these flames. Besides, liquid droplet combustion under quiescent and convective environment is covered in the book. Simplified analysis of spray combustion is carried out which can be used as a design tool. An extensive treatment on the solid fuel combustion is also included. Emission combustion systems, and how to control emission from them using the latest techniques, constitute the subject matter of the final chapter. Appropriate examples are provided throughout to foster better understanding of the concepts discussed. Chapter-end review questions and problems are included to reinforce the learning process of students.

FUNDAMENTALS OF FIRE PHENOMENA

John Wiley & Sons Incorporated Understanding fire dynamics and combustion is essential in fire safety engineering and in fire science curricula. Engineers and students involved in fire protection, safety and investigation need to know and predict how fire behaves to be able to implement adequate safety measures and hazard analyses. Fire phenomena encompass everything about the scientific principles behind fire behavior. Combining the principles of chemistry, physics, heat and mass transfer, and fluid dynamics necessary to understand the fundamentals of fire phenomena, this book integrates the subject into a clear discipline: Covers thermochemistry including mixtures and chemical

reactions; Introduces combustion to the fire protection student; Discusses premixed flames and spontaneous ignition; Presents conservation laws for control volumes, including the effects of fire; Describes the theoretical bases for empirical aspects of the subject of fire; Analyses ignition of liquids and the importance of evaporation including heat and mass transfer; Features the stages of fire in compartments, and the role of scale modeling in fire. Fundamentals of Fire Phenomena is an invaluable reference tool for practising engineers in any aspect of safety or forensic analysis. Fire safety officers, safety practitioners and safety consultants will also find it an excellent resource. In addition, this is a must-have book for senior engineering students and postgraduates studying fire protection and fire aspects of combustion.

COMBUSTION ENGINEERING, SECOND EDITION

CRC Press Combustion Engineering, Second Edition maintains the same goal as the original: to present the fundamentals of combustion science with application to today's energy challenges. Using combustion applications to reinforce the fundamentals of combustion science, this text provides a uniquely accessible introduction to combustion for undergraduate students, first-year graduate students, and professionals in the workplace. Combustion is a critical issue impacting energy utilization, sustainability, and climate change. The challenge is to design safe and efficient combustion systems for many types of fuels in a way that protects the environment and enables sustainable lifestyles. Emphasizing the use of combustion fundamentals in the engineering and design of combustion systems, this text provides detailed coverage of gaseous, liquid and solid fuel combustion, including focused coverage of biomass combustion, which will be invaluable to new entrants to the field. Eight chapters address the fundamentals of combustion, including fuels, thermodynamics, chemical kinetics, flames, detonations, sprays, and solid fuel combustion mechanisms. Eight additional chapters apply these fundamentals to furnaces, spark ignition and diesel engines, gas turbines, and suspension burning, fixed bed combustion, and fluidized bed combustion of solid fuels. Presenting a renewed emphasis on fundamentals and updated applications to illustrate the latest trends relevant to combustion engineering, the authors provide a number of pedagogic features, including: Numerous tables with practical data and formulae that link combustion fundamentals to engineering practice Concise presentation of mathematical methods with qualitative descriptions of their use Coverage of alternative and renewable fuel topics throughout the text Extensive example problems, chapter-end problems, and references These features and the overall fundamentals-to-practice nature of this book make it an ideal resource for undergraduate, first level graduate, or professional training classes. Students and practitioners will find that it is an excellent introduction to meeting the crucial challenge of engineering sustainable combustion

systems in a cost-effective manner. A solutions manual and additional teaching resources are available with qualifying course adoption.

SYSML DISTILLED

A BRIEF GUIDE TO THE SYSTEMS MODELING LANGUAGE

Pearson Education SysML Distilled is a go-to reference for everyone who wants to start creating accurate and useful system models with SysML. Drawing on his pioneering experience creating models for Lockheed Martin and NASA, Lenny Delligatti illuminates SysML's core components, and shows how to use them even under tight deadlines and other constraints. The reader needn't know all of SysML to create effective models: SysML Distilled quickly teaches what does need to be known, and helps deepen the reader's knowledge incrementally as the need arises.

ADVANCED THERMODYNAMICS FOR ENGINEERS

Butterworth-Heinemann Although the basic theories of thermodynamics are adequately covered by a number of existing texts, there is little literature that addresses more advanced topics. In this comprehensive work the author redresses this balance, drawing on his twenty-five years of experience of teaching thermodynamics at undergraduate and postgraduate level, to produce a definitive text to cover thoroughly, advanced syllabuses. The book introduces the basic concepts which apply over the whole range of new technologies, considering: a new approach to cycles, enabling their irreversibility to be taken into account; a detailed study of combustion to show how the chemical energy in a fuel is converted into thermal energy and emissions; an analysis of fuel cells to give an understanding of the direct conversion of chemical energy to electrical power; a detailed study of property relationships to enable more sophisticated analyses to be made of both high and low temperature plant and irreversible thermodynamics, whose principles might hold a key to new ways of efficiently covering energy to power (e.g. solar energy, fuel cells). Worked examples are included in most of the chapters, followed by exercises with solutions. By developing thermodynamics from an explicitly equilibrium perspective, showing how all systems attempt to reach a state of equilibrium, and the effects of these systems when they cannot, the result is an unparalleled insight into the more advanced considerations when converting any form of energy into power, that will prove invaluable to students and professional engineers of all disciplines.

AN INTRODUCTION TO FIRE DYNAMICS

Wiley An Introduction to Fire Dynamics Second Edition Dougal Drysdale University of Edinburgh, UK Fire Safety Engineering, identified in the original edition as 'a relatively new discipline', has since grown significantly in stature, as Fire Safety Engineers around the world begin to

apply their skills to complex issues that defy solution by the old 'prescriptive' approach to fire safety. This second edition has the same structure as the first highly successful text, but has been updated with the latest research results. Fire processes are discussed and quantified in terms of the mechanisms of heat transfer and fluid flow. Problems addressed include: * The conditions necessary for ignition and steady burning of combustible materials to occur * How large a fire has to become before fire detectors and sprinkler heads will operate * The circumstances that can lead to flashover in a compartment This book is unique in that it identifies fire science and fire dynamics and provides the scientific background necessary for the development of fire safety engineering as a professional discipline. It is essential reading for all those involved in this wide ranging field, from Fire Prevention Officers to Consulting Engineers, whether involved in problems of fire risk assessment, fire safety design, or fire investigation. It will also be of considerable interest and value to research scientists working in building design, fire physics and chemistry.

COMBUSTION SCIENCE AND ENGINEERING

CRC Press Students embarking on their studies in chemical, mechanical, aerospace, energy, and environmental engineering will face continually changing combustion problems, such as pollution control and energy efficiency, throughout their careers. Approaching these challenges requires a deep familiarity with the fundamental theory, mathematics, and physical concepts of combustion. Based on more than two decades of teaching experience, Combustion Science and Engineering lays the necessary groundwork while using an illustrative, hands-on approach. Taking a down-to-earth perspective, the book avoids heavy mathematics in the first seven chapters and in Chapter 17 (pollutants formation and destruction), but considers molecular concepts and delves into engineering details. It begins with an outline of thermodynamics; basics of thermochemistry and chemical equilibrium; descriptions of solid, liquid, and gaseous fuels; chemical kinetics and mass transfer; and applications of theory to practical systems. Beginning in chapter 8, the authors provide a detailed treatment of differential forms of conservation equations; analyses of fuel combustion including jet combustion and boundary layer problems; ignition; flame propagation; interactive and group combustion; pollutant formation and control; and turbulent combustion. In addition, this textbook includes abundant examples, illustrations, and exercises, as well as spreadsheet software in combustion available for download. This software allows students to work out the examples found in the text. Combustion Science and Engineering imparts the skills and foundational knowledge necessary for students to successfully approach and solve new problems.

NONLINEAR MODEL PREDICTIVE CONTROL OF COMBUSTION ENGINES

FROM FUNDAMENTALS TO APPLICATIONS

Springer Nature This book provides an overview of the nonlinear model predictive control (NMPC) concept for application to innovative combustion engines. Readers can use this book to become more expert in advanced combustion engine control and to develop and implement their own NMPC algorithms to solve challenging control tasks in the field. The significance of the advantages and relevancy for practice is demonstrated by real-world engine and vehicle application examples. The author provides an overview of fundamental engine control systems, and addresses emerging control problems, showing how they can be solved with NMPC. The implementation of NMPC involves various development steps, including: • reduced-order modeling of the process; • analysis of system dynamics; • formulation of the optimization problem; and • real-time feasible numerical solution of the optimization problem. Readers will see the entire process of these steps, from the fundamentals to several innovative applications. The application examples highlight the actual difficulties and advantages when implementing NMPC for engine control applications. **Nonlinear Model Predictive Control of Combustion Engines** targets engineers and researchers in academia and industry working in the field of engine control. The book is laid out in a structured and easy-to-read manner, supported by code examples in MATLAB®/Simulink®, thus expanding its readership to students and academics who would like to understand the fundamental concepts of NMPC. **Advances in Industrial Control** reports and encourages the transfer of technology in control engineering. The rapid development of control technology has an impact on all areas of the control discipline. The series offers an opportunity for researchers to present an extended exposition of new work in all aspects of industrial control.

FLASHBACK MECHANISMS IN LEAN PREMIXED GAS TURBINE COMBUSTION

Academic Press Blending fuels with hydrogen offers the potential to reduce NO_x and CO₂ emissions in gas turbines, but doing so introduces potential new problems such as flashback. Flashback can lead to thermal overload and destruction of hardware in the turbine engine, with potentially expensive consequences. The little research on flashback that is available is fragmented. **Flashback Mechanisms in Lean Premixed Gas Turbine Combustion** by Ali Cemal Benim will address not only the overall issue of the flashback phenomenon, but also the issue of fragmented and incomplete research. Presents a coherent review of flame flashback (a classic problem in premixed combustion) and its connection with the growing trend of popularity of more-efficient hydrogen-blend fuels Begins with a brief review of industrial gas turbine combustion technology Covers current environmental and economic motivations for replacing natural gas with hydrogen-blend fuels

NOVEL COMBUSTION CONCEPTS FOR SUSTAINABLE ENERGY DEVELOPMENT

Springer This book comprises research studies of novel work on combustion for sustainable energy development. It offers an insight into a few viable novel technologies for improved, efficient and sustainable utilization of combustion-based energy production using both fossil and bio fuels. Special emphasis is placed on micro-scale combustion systems that offer new challenges and opportunities. The book is divided into five sections, with chapters from 3-4 leading experts forming the core of each section. The book should prove useful to a variety of readers, including students, researchers, and professionals.

ADVANCED STRENGTH AND APPLIED STRESS ANALYSIS

McGraw-Hill Science Engineering This book provides a broad and comprehensive coverage of the theoretical, experimental, and numerical techniques employed in the field of stress analysis. Designed to provide a clear transition from the topics of elementary to advanced mechanics of materials. Its broad range of coverage allows instructors to easily select many different topics for use in one or more courses. The highly readable writing style and mathematical clarity of the first edition are continued in this edition. Major revisions in this edition include: an expanded coverage of three-dimensional stress/strain transformations; additional topics from the theory of elasticity; examples and problems which test the mastery of the prerequisite elementary topics; clarified and additional topics from advanced mechanics of materials; new sections on fracture mechanics and structural stability; a completely rewritten chapter on the finite element method; a new chapter on finite element modeling techniques employed in practice when using commercial FEM software; and a significant increase in the number of end of chapter exercise problems some of which are oriented towards computer applications.

INTRODUCTION TO PHYSICS AND CHEMISTRY OF COMBUSTION

EXPLOSION, FLAME, DETONATION

Springer Science & Business Media Most of the material covered in this book deals with the fundamentals of chemistry and physics of key processes and fundamental mechanisms for various combustion and combustion related phenomena in gaseous combustible mixture. It provides the reader with basic knowledge of burning processes and mechanisms of reaction wave propagation. The combustion of a gas mixture (flame, explosion, detonation) is necessarily accompanied by motion of the gas. The process of combustion is therefore not only a chemical phenomenon but also one of gas dynamics. The material selection focuses on the gas phase and with premixed gas combustion. Premixed gas combustion is of practical importance in engines, modern gas turbine and

explosions, where the fuel and air are essentially premixed, and combustion occurs by the propagation of a front separating unburned mixture from fully burned mixture. Since premixed combustion is the most fundamental and potential for practical applications, the emphasis in the present work is placed on regimes of premixed combustion. This text is intended for graduate students of different specialties, including physics, chemistry, mechanical engineering, computer science, mathematics and astrophysics.

LEAN COMBUSTION

TECHNOLOGY AND CONTROL

Academic Press Combustion under sufficiently fuel-lean conditions can have the desirable attributes of high efficiency and low emissions, this being particularly important in light of recent and rapid increases in the cost of fossil fuels and concerns over the links between combustion and global climate change. Lean Combustion is an eminently authoritative, reference work on the latest advances in lean combustion technology and systems. It will offer engineers working on combustion equipment and systems both the fundamentals and the latest developments in more efficient fuel usage and in much-sought-after reductions of undesirable emissions, while still achieving desired power output and performance. This volume brings together research and design of lean combustion systems across the technology spectrum in order to explore the state-of-the-art in lean combustion and its role in meeting current and future demands on combustion systems. Readers will learn about advances in the understanding of ultra lean fuel mixtures and how new types of burners and approaches to managing heat flow can reduce problems often found with lean combustion such as slow, difficult ignition and frequent flame extinction. The book will also offer abundant references and examples of recent real-world applications. Covers all major recent developments in lean combustion science and technology, with new applications in both traditional combustion schemes as well as such novel uses as highly preheated and hydrogen-fueled systems Offers techniques for overcoming difficult ignition problems and flame extinction with lean fuel mixtures Covers new developments in lean combustion using high levels of pre-heat and heat re-circulating burners, as well as the active control of lean combustion instabilities

THERMODYNAMICS

CONCEPTS AND APPLICATIONS

Cambridge University Press The focus of Thermodynamic Concepts and Applications is on traditional thermodynamics topics, while structurally the book introduces the thermal-fluid sciences. 2nd law topics are introduced hierarchically in one chapter, important structure for a beginner. The book

is designed for the instructor to select topics and combine them with material from other chapters seamlessly. Pedagogical devices include: learning objectives, chapter overviews and summaries, historical perspectives, and numerous examples, questions and problems and lavish illustrations. Students are encouraged to use the National Institute of Science and Technology (NIST) online properties database.

FOREST-BASED BIOMASS ENERGY

CONCEPTS AND APPLICATIONS

CRC Press What is forest-based biomass energy and why should we care? Written by environmental expert Frank Spellman, *Forest-Based Biomass Energy: Concepts and Applications* details how forest biomass can be converted to energy and energy products, including direct combustion, pellets, gasification, and co-firing. It explores the possibilities of forest-based

ACOUSTICS

AN INTRODUCTION TO ITS PHYSICAL PRINCIPLES AND APPLICATIONS

Springer This corrected version of the landmark 1981 textbook introduces the physical principles and theoretical basis of acoustics with deep mathematical rigor, concentrating on concepts and points of view that have proven useful in applications such as noise control, underwater sound, architectural acoustics, audio engineering, nondestructive testing, remote sensing, and medical ultrasonics. Since its publication, this text has been used as part of numerous acoustics-related courses across the world, and continues to be used widely today. During its writing, the book was fine-tuned according to insights gleaned from a broad range of classroom settings. Its careful design supports students in their pursuit of a firm foundation while allowing flexibility in course structure. The book can easily be used in single-term or full-year graduate courses and includes problems and answers. This rigorous and essential text is a must-have for any practicing or aspiring acoustician.

COMBUSTION FOR MATERIAL SYNTHESIS

CRC Press Exposes a Powerful Material-Making Tool Dedicated to the physical, chemical, and structural transformations that take place during combustion synthesis (CS) of advanced materials, *Combustion for Material Synthesis* analyzes the nature of solid flame phenomenon and provides readers with undisputed proof that fire is a powerful tool used in making materials

TURBULENT COMBUSTION

Cambridge University Press The combustion of fossil fuels remains a key

technology for the foreseeable future. It is therefore important that we understand the mechanisms of combustion and, in particular, the role of turbulence within this process. Combustion always takes place within a turbulent flow field for two reasons: turbulence increases the mixing process and enhances combustion, but at the same time combustion releases heat which generates flow instability through buoyancy, thus enhancing the transition to turbulence. The four chapters of this book present a thorough introduction to the field of turbulent combustion. After an overview of modeling approaches, the three remaining chapters consider the three distinct cases of premixed, non-premixed, and partially premixed combustion, respectively. This book will be of value to researchers and students of engineering and applied mathematics by demonstrating the current theories of turbulent combustion within a unified presentation of the field.

INTRODUCTION TO MODELING AND CONTROL OF INTERNAL COMBUSTION ENGINE SYSTEMS

Springer Science & Business Media Internal combustion engines still have a potential for substantial improvements, particularly with regard to fuel efficiency and environmental compatibility. These goals can be achieved with help of control systems. Modeling and Control of Internal Combustion Engines (ICE) addresses these issues by offering an introduction to cost-effective model-based control system design for ICE. The primary emphasis is put on the ICE and its auxiliary devices. Mathematical models for these processes are developed in the text and selected feedforward and feedback control problems are discussed. The appendix contains a summary of the most important controller analysis and design methods, and a case study that analyzes a simplified idle-speed control problem. The book is written for students interested in the design of classical and novel ICE control systems.

AN INTRODUCTION TO STOCHASTIC MODELING

Academic Press An Introduction to Stochastic Modeling provides information pertinent to the standard concepts and methods of stochastic modeling. This book presents the rich diversity of applications of stochastic processes in the sciences. Organized into nine chapters, this book begins with an overview of diverse types of stochastic models, which predicts a set of possible outcomes weighed by their likelihoods or probabilities. This text then provides exercises in the applications of simple stochastic analysis to appropriate problems. Other chapters consider the study of general functions of independent, identically distributed, nonnegative random variables representing the successive intervals between renewals. This book discusses as well the numerous examples of Markov branching processes that arise naturally in various scientific disciplines. The final chapter deals with queueing models, which aid the design process by

predicting system performance. This book is a valuable resource for students of engineering and management science. Engineers will also find this book useful.

FUNDAMENTALS AND APPLICATIONS OF SUPERCRITICAL CARBON DIOXIDE (SCO₂) BASED POWER CYCLES

Woodhead Publishing **Fundamentals and Applications of Supercritical Carbon Dioxide (SCO₂) Based Power Cycles** aims to provide engineers and researchers with an authoritative overview of research and technology in this area. Part One introduces the technology and reviews the properties of SCO₂ relevant to power cycles. Other sections of the book address components for SCO₂ power cycles, such as turbomachinery expanders, compressors, recuperators, and design challenges, such as the need for high-temperature materials. Chapters on key applications, including waste heat, nuclear power, fossil energy, geothermal and concentrated solar power are also included. The final section addresses major international research programs. Readers will learn about the attractive features of SCO₂ power cycles, which include a lower capital cost potential than the traditional cycle, and the compounding performance benefits from a more efficient thermodynamic cycle on balance of plant requirements, fuel use, and emissions. Represents the first book to focus exclusively on SCO₂ power cycles Contains detailed coverage of cycle fundamentals, key components, and design challenges Addresses the wide range of applications of SCO₂ power cycles, from more efficient electricity generation, to ship propulsion