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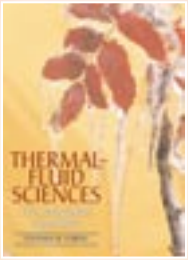

TWO REVOLUTIONARY NEW TEXTBOOKS FOR TODAY'S STUDENTS

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An Integrated Approach

Stephen Turns, *Pennsylvania State University*

Thermal-Fluid Sciences is a truly integrated textbook for engineering courses covering thermodynamics, heat transfer and fluid mechanics. This integration is based on: 1. The fundamental conservation principles of mass, energy, and momentum; 2. A hierarchical grouping of related topics; 3. The early introduction and revisiting of practical device examples and applications. As with all great textbooks the focus is on accuracy and accessibility. To enhance the learning experience Thermal-Fluid Sciences features full color illustrations. The robust pedagogy includes: chapter learning objectives, overviews, historical vignettes, numerous examples which follow a consistent problem-solving format enhanced by innovative self tests and color coding to highlight significant equations and advanced topics. Each chapter concludes with a brief summary and a unique checklist of key concepts and definitions. Integrated tutorials show the student how to use modern software including the NIST Database (included on the in-text CD) to obtain thermodynamic and transport properties.

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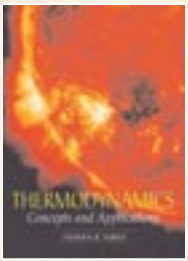

TEXTBOOK

Thermodynamics

Concepts and Applications

Stephen R. Turns, *Pennsylvania State University*

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.

CONTENTS: Preface; 1. Beginnings; 2. Thermodynamic properties, property relationships and processes; 3. Conservation of mass; 4. Energy and energy transfer; 5. Conservation of energy; 6. Second law of thermodynamics and some of its consequences; 7. Steady-flow devices; 8. Systems for power production, propulsion, heating and cooling; Appendix A. Historical timeline; Appendix B. Thermodynamic properties of ideal gases and carbon; Appendix C. Thermodynamic and thermo-physical properties of air; Appendix D. Thermodynamic properties of H20; Appendix E. Various thermodynamic data; Appendix F. Thermo-physical properties of selected gases at 1ATM; Appendix G. Thermo-physical properties of selected liquids; Appendix H. Thermo-physical properties of hydrocarbon fuels; Appendix I. Thermo-physical properties of selected solids; Appendix J. Radiation properties of selected materials and substances; Appendix K. Mach number relationships for compressible flow; Appendix L. Psychometric charts; Answers to Selected Problems; Index.

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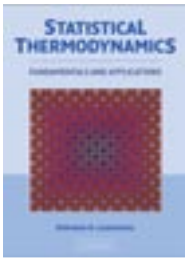

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Normand Laurendeau, *Purdue University, Indiana*

This new textbook discusses the fundamentals and applications of statistical thermodynamics for beginning graduate students in the engineering sciences. Building on the Maxwell-Boltzmann method of step-by-step development of the subject, this book makes few presumptions concerning students, previous exposure to statistics, quantum mechanics or spectroscopy. The book begins with the fundamentals of statistical thermodynamics, pauses to recover needed knowledge from quantum mechanics and spectroscopy, and then moves on to applications involving ideal gases, the solid state and radiation. A full introduction to kinetic theory is provided, including its applications to transport phenomena and chemical kinetics. Modern applications, such as laser-based diagnostics, are also discussed. Each chapter is carefully written to address student difficulties in learning this challenging subject, which is fundamental to combustion, propulsion, transport phenomena, spectroscopic measurements and nanotechnology. Students are made comfortable with their new knowledge by the inclusion of both example and prompted homework problems.

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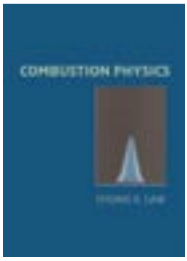

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Combustion Physics

Chung K. Law, *Princeton University*

In the past several decades, combustion has evolved from a scientific discipline that was largely empirical to one that is quantitative and predictive. These advances are characterized by the canonical formulation of the theoretical foundation, the strong interplay between theory, experiment, and computation, and the unified description of the roles of fluid mechanics and chemical kinetics. This graduate-level text incorporates these advances in a comprehensive treatment of the fundamental principles of combustion physics. The presentation emphasizes analytical proficiency and physical insight, with the former achieved through complete, though abbreviated, derivations at different levels of rigor, and the latter through physical interpretations of analytical solutions, experimental observations, and computational simulations. Exercises are mostly derivative in nature in order to further strengthen the student's mastery of the theory. Implications of the fundamental knowledge gained herein on practical phenomena are discussed whenever appropriate. These distinguishing features provide a solid foundation for an academic program in combustion science and engineering.

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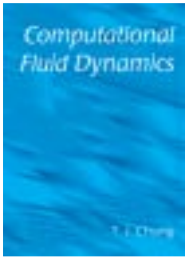

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non-dimensionalization, and approximations that can be used to obtain solutions due either to geometric simplifications, or large or small values of dimensionless parameters. The author emphasizes setting up problems and extracting as much information as possible short of obtaining detailed solutions of differential equations. The book is also focused on the solutions of representative problems. This reflects the author's bias toward learning to think about the solution of transport problems.

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Large-Eddy Simulation for Acoustics

Edited by Claus Wagner, *German Aerospace Center, Göttingen*
Thomas Hüttl, *MTU Aero Engines GmbH, München*
and Pierre Sagaut, *University Pierre et Marie Curie, Paris*

Noise pollution around airports, trains, and industries increasingly attracts environmental concern and regulation. Designers and researchers have intensified the use of large-eddy simulation (LES) for noise reduced industrial design and acoustical research. This book, written by 30 experts, presents the theoretical background of acoustics and of LES, followed by details about numerical methods, e.g. discretization schemes, boundary conditions, coupling aspects. Industrially relevant, hybrid RANS/LES techniques for acoustic source predictions are presented in detail. Many applications are featured ranging from simple geometries for mixing layers and jet flows to complex wing and car geometries. Selected applications include recent scientific investigations at industrial and university research institutions. Presently one can't

offer perfect solution methodologies that address all relevant applications, however the book presents a state of the art collection of methods, tools and evaluation methodologies. The advantage and weaknesses of both the commercial and the research methodologies is also carefully presented.

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FORTHCOMING

Implicit Large Eddy Simulation

Computing Turbulent Fluid Dynamics

Edited by Fernando F. Grinstein, *Naval Research Laboratory, Washington DC*
Leonard Margolin, *Los Alamos National Laboratory*
and William Rider, *Los Alamos National Laboratory*

The numerical simulation of turbulent flows is a subject of great practical importance to scientists and engineers. The difficulty in achieving predictive simulations is perhaps best illustrated by the wide range of approaches that have been developed and are still being used by the turbulence modeling community. In this book the authors describe one of these approaches, Implicit Large Eddy Simulation (ILES). ILES is a relatively new approach that combines generality and computational efficiency with documented success in many areas of complex fluid flow. This book synthesizes the current understanding of the theoretical basis of the ILES methodology and reviews its accomplishments. ILES pioneers and lead researchers combine here their experience to present the first comprehensive description of the methodology. This book should be of fundamental interest to graduate students, basic research scientists, as well as professionals involved in the design and analysis of complex turbulent flows.

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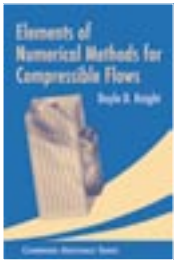

GRADUATE TEXTBOOK

Elements of Numerical Methods for High Speed Flows

Doyle D. Knight, *Rutgers University, New Jersey*

The purpose of this book is to present the basic elements of numerical methods for compressible flows. It is appropriate for advanced students and specialists working in high speed flows. The focus is on the unsteady one-dimensional Euler equations which form the basis for numerical algorithms in compressible fluid mechanics. The book is restricted to the basic concepts of finite volume methods, and even in this regard is not intended to be exhaustive in its treatment. Although the practical applications of the one-dimensional Euler equations are limited, virtually all numerical algorithms for inviscid compressible flow in two and three dimensions owe their origin to techniques developed in the context of the one-dimensional Euler equations. The author

believes it is therefore essential to understand the development and implementation of these algorithms in their original one-dimensional context. The text is supplemented by numerous end-of-chapter exercises.

CONTENTS: 1. Governing equations; 2. Mathematical nature of 1-D Euler equations; 3. 1-D Euler equations; 4. Reconstruction; 5. Godunov methods; 6. Flux vector splitting methods; 7. Temporal quadrature; 8. TVD methods; Index; Notes; Bibliography.

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The Linked Twist Map as a Paradigm in Applications: Micro to Macro, Fluids to Solids

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Julio M. Ottino, *Northwestern University*
and Stephen Wiggins, *University of Bristol*

Mixing processes occur in many technological and natural applications, with length and time scales ranging from the very small to the very large. The diversity of problems can give rise to a diversity of approaches. Are there concepts that are central to all of them? Are there tools that allow for prediction and quantification? The authors show how a variety of flows in very different settings possess the characteristic of streamline crossing. This notion can be placed on firm mathematical footing via Linked Twist Maps (LTMs), which is the central organizing principle of this book. The authors discuss the definition and construction of LTMs, provide examples of specific mixers that can be analyzed in the LTM framework and introduce a number of mathematical techniques which are then brought to bear on the problem of fluid mixing. In a final chapter, they present a number of open problems and new directions.

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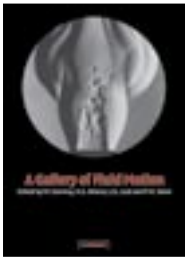

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