

# LIMITED ACCESS GAS DYNAMICS BY RATHAKRISHNAN

## **GAS DYNAMICS, Seventh Edition**

This revised and updated seventh edition continues to provide the most accessible and readable approach to the study of all the vital topics and issues associated with gas dynamic processes. At every stage, the physics governing the process, its applications and limitations are discussed in detail. With a strong emphasis on the basic concepts and problem-solving skills, this text is suitable for a course on Gas

Dynamics\Compressible Flows/High-speed Aerodynamics at both undergraduate and postgraduate levels in aerospace engineering, mechanical engineering, chemical engineering and applied physics. The elegant and concise style of the book along with illustrations and worked-out examples makes it eminently suitable for self-study by students and also for scientists and engineers working in the field of gas dynamics in industries and research laboratories. The computer program to calculate the coordinates of contoured nozzle, with the method of characteristics, has been given in C-language. The program listing along with a sample output is given in the Appendix. **NEW TO THE EDITION** • A new chapter on the 'Power of Compressible Bernoulli Equation' • Extra chapter-end examples in Chapter 5 • Additional exercise problems in Chapters 5, 6, 7, and 8 **KEY FEATURES** • Concise coverage of the thermodynamic concepts to serve as a revision of the background material • Introduction to measurements in compressible flows and optical flow visualization techniques • Introduction to rarefied gas dynamics and high-temperature gas dynamics • Solutions Manual for instructors containing the complete worked-out solutions to chapter-end problems • In-depth presentation of potential equations for compressible flows, similarity rule and two-dimensional compressible flows • Logical and systematic treatment of fundamental aspects of gas dynamics, waves in the supersonic regime and gas dynamic processes **TARGET AUDIENCE** • BE/B.Tech (Mechanical Engineering, Aeronautical Engineering) • ME/M.Tech (Thermal Engineering, Aeronautical Engineering)

## **GAS DYNAMICS**

This revised and updated fourth edition continues to provide the most accessible and readable approach to the study of all the vital topics and issues associated with gas dynamic processes. At every stage, the physics governing the process, its applications and limitations are discussed in depth. With a strong emphasis on the basic concepts and problem-solving skills, this text is suitable for a course on Gas Dynamics/Compressible Flows/High-speed Aero-dynamics at both undergraduate and postgraduate levels in aerospace engineering, mechanical engineering, chemical engineering and applied physics. The elegant and concise style of the book, along with illustrations and worked examples, makes it eminently suitable for self-study by scientists and engineers working in the field of gas dynamics in industries and research laboratories. Some of the Distinguishing Features of the Book : Concise coverage of the thermodynamic concepts to serve as a revision of the background material. Logical and systematic treatment of fundamental aspects of gas dynamics, waves in the supersonic regime and gas dynamic processes. In-depth presentation of potential equations for compressible flows, similarity rule and two-dimensional compressible flows. Introduction to measurements in compressible flows and optical flow visualization techniques. Introduction to rarefied gas dynamics and high-temperature gas dynamics. Solution Manual for instructors containing the complete worked-out solutions to chapter-end problems. New to the Fourth Edition : Some vital aspects associated with the compression and expansion waves are explained, with suitable worked numerical examples. A brief section on critical Mach number is added in Chapter 8, highlighting its influence on the aerodynamic efficiency of flying mechanics. Nozzle flow process has been illustrated with worked examples focusing on the design and application aspects. A considerable number of worked examples are added, focusing attention on the design

aspects. Some new problems along with answers are added at the end of many chapters.

## **Applied Gas Dynamics**

A revised edition to applied gas dynamics with exclusive coverage on jets and additional sets of problems and examples The revised and updated second edition of Applied Gas Dynamics offers an authoritative guide to the science of gas dynamics. Written by a noted expert on the topic, the text contains a comprehensive review of the topic; from a definition of the subject, to the three essential processes of this science: the isentropic process, shock and expansion process, and Fanno and Rayleigh flows. In this revised edition, there are additional worked examples that highlight many concepts, including moving shocks, and a section on critical Mach number is included that helps to illuminate the concept. The second edition also contains new exercise problems with the answers added. In addition, the information on ram jets is expanded with helpful worked examples. It explores the entire spectrum of the ram jet theory and includes a set of exercise problems to aid in the understanding of the theory presented. This important text: Includes a wealth of new solved examples that describe the features involved in the design of gas dynamic devices Contains a chapter on jets; this is the first textbook material available on high-speed jets Offers comprehensive and simultaneous coverage of both the theory and application Includes additional information designed to help with an understanding of the material covered Written for graduate students and advanced undergraduates in aerospace engineering and mechanical engineering, Applied Gas Dynamics, Second Edition expands on the original edition to include not only the basic information on the science of gas dynamics but also contains information on high-speed jets.

## **GAS DYNAMICS**

This revised and updated fifth edition continues to provide the most accessible and readable approach to the study of all the vital topics and issues associated with gas dynamic processes. At every stage, the physics governing the process, its applications and limitations are discussed in-depth. With a strong emphasis on the basic concepts and problem-solving skills, this text is suitable for a course on Gas Dynamics/Compressible Flows/High-speed Aerodynamics at both undergraduate and postgraduate levels in aerospace engineering, mechanical engineering, chemical engineering and applied physics. The elegant and concise style of the book, along with illustrations and worked examples, makes it eminently suitable for self-study by scientists and engineers working in the field of gas dynamics in industries and research laboratories. In this edition, several new solved examples on stationary and moving shocks have been introduced. Besides, the book contains an example that highlights the application of shock-expansion theory and thin aerofoil theory. New problems have been added in a number of chapters to help students practice application of the theory studied. The computer program to calculate the coordinates of contoured nozzle, with the method of characteristics, has been given in C-language. The program listing along with a sample output is given in the Appendix. Some of the Distinguishing Features of the Book • Concise coverage of the thermodynamic concepts to serve as a revision of the background material. • Logical and systematic treatment of fundamental aspects of gas dynamics, waves in the supersonic regime and gas dynamic processes. • In-depth presentation of potential equations for compressible flows, similarity rule and two-dimensional compressible flows. • Introduction to measurements in compressible flows and optical flow visualization techniques. • Introduction to rarefied gas dynamics and high-temperature gas dynamics. • Solution Manual for instructors containing the complete worked-out solutions to chapter-end problems.

## **Gas Dynamics**

A revised edition to applied gas dynamics with exclusive coverage on jets and additional sets of problems and examples The revised and updated second edition of Applied Gas Dynamics offers an authoritative guide to the science of gas dynamics. Written by a noted expert on the topic, the text contains a comprehensive review of the topic; from a definition of the subject, to the three essential processes of this science: the isentropic process, shock and expansion process, and Fanno and Rayleigh flows. In this revised edition, there

are additional worked examples that highlight many concepts, including moving shocks, and a section on critical Mach number is included that helps to illuminate the concept. The second edition also contains new exercise problems with the answers added. In addition, the information on ram jets is expanded with helpful worked examples. It explores the entire spectrum of the ram jet theory and includes a set of exercise problems to aid in the understanding of the theory presented. This important text: Includes a wealth of new solved examples that describe the features involved in the design of gas dynamic devices Contains a chapter on jets; this is the first textbook material available on high-speed jets Offers comprehensive and simultaneous coverage of both the theory and application Includes additional information designed to help with an understanding of the material covered Written for graduate students and advanced undergraduates in aerospace engineering and mechanical engineering, Applied Gas Dynamics, Second Edition expands on the original edition to include not only the basic information on the science of gas dynamics but also contains information on high-speed jets.

## **Gas Dynamics**

This revised and updated sixth edition continues to provide the most accessible and readable approach to the study of all the vital topics and issues associated with gas dynamic processes. With a strong emphasis on the basic concepts and problem-solving skills, this text is suitable for a course on Gas Dynamics/Compressible Flows/High-speed Aerodynamics at both undergraduate and postgraduate levels in aerospace engineering, mechanical engineering, chemical engineering and applied physics. In this edition, detailed analytical derivations of the shock polar relation, expressions for the pressure and density ratio across an expansion fan, the relation between the Mach numbers of incident and reflected shocks and the mathematical steps in arriving at the  $q^*_2/q^*_1$  relation of oblique shock are incorporated. Besides, the book includes several new solved examples on important analytical relations. New problems have been added in a number of chapters to help students practice applications of the theory studied. Some of the Distinguishing Features of the Book

- Concise coverage of the thermodynamic concepts to serve as a revision of the background material.
- Logical and systematic treatment of fundamental aspects of gas dynamics, waves in the supersonic regime and gas dynamic processes.
- In-depth presentation of potential equations for compressible flows, similarity rule and two-dimensional compressible flows.
- Introduction to measurements in compressible flows and optical flow visualization techniques.
- Introduction to rarefied gas dynamics and high-temperature gas dynamics.
- Solutions Manual for instructors containing the complete worked-out solutions to chapter-end problems.
- Computer program to calculate the coordinates of contoured nozzle in C-language.

## **Applied Gas Dynamics**

This is an introductory level textbook which explains the elements of high temperature and high-speed gas dynamics. written in a clear and easy to follow style, the author covers all the latest developments in the field including basic thermodynamic principles, compressible flow regimes and waves propagation in one volume covers theoretical modeling of High Enthalpy Flows, with particular focus on problems in internal and external gas-dynamic flows, of interest in the fields of rockets propulsion and hypersonic aerodynamics High enthalpy gas dynamics is a compulsory course for aerospace engineering students and this book is a result of over 25 years' teaching by the author accompanying website includes a Solutions Manual for exercises listed at the end of each chapter, plus lecture slides

## **GAS DYNAMICS**

This book provides the essence of aerodynamics, fluid mechanics, experimental methods, gas dynamics, high enthalpy gas dynamics, helicopter aerodynamics, heat transfer, and thermodynamics, describing the underlying principles of these subjects before listing the set of multiple choice questions of each subject, which will prove to be useful for engineering students to comfortably face and win in the competitive examinations for engineering studies, engineering services, civil services, doctoral Degree program entrance and so on. This book will also be of value for those facing job interviews for academic positions in

universities and research organizations or laboratories.

## **High Enthalpy Gas Dynamics**

This book was developed using material from teaching courses on fluid mechanics, high-speed flows, aerodynamics, high-enthalpy flows, experimental methods, aircraft design, heat transfer, introduction to engineering, and wind engineering. It precisely presents the theoretical and application aspects of the terms associated with these courses. It explains concepts such as cyclone, typhoon, hurricane, and tornado, by highlighting the subtle difference between them. The text comprehensively introduces the subject vocabulary of fluid mechanics for use in courses in engineering and the physical sciences. This book • Presents the theoretical aspects and applications of high-speed flows, aerodynamics, high-enthalpy flows, and aircraft design. • Provides a ready reference source for readers to learn essential concepts related to flow physics, rarefied, and stratified flows. • Comprehensively covers topics such as laser Doppler anemometer, latent heat of fusion, and latent heat of vaporisation. • Includes schematic sketches and photographic images to equip the reader with a better view of the concepts. This is ideal study material for senior undergraduate and graduate students in the fields of mechanical engineering, aerospace engineering, flow physics, civil engineering, automotive engineering, and manufacturing engineering.

## **Gas Dynamics (work Book)**

Mechanical engineers involved with flow mechanics have long needed an authoritative reference that delves into all the essentials required for experimentation in fluids, a resource that can provide fundamental review, as well as the details necessary for experimentation on everything from household appliances to hi-tech rockets. Instrumentation, Measurements, and Experiments in Fluids meets this challenge, as its author is not only a highly respected pioneer in fluids, but also possesses twenty years experience teaching students of all levels. He clearly explains fundamental principles as well the tools and methods essential for advanced experimentation. Reflecting an awe for flow mechanics, along with a deep-rooted knowledge, the author has assembled a fourteen chapter volume that is destined to become a seminal work in the field. Providing ample detail for self study and the sort of elegant writing rarely found in so thorough a treatment, he provides insight into all the vital topics and issues associated with the devices and instruments used for fluid mechanics and gas dynamics experiments. Extremely organized, this work presents easy access to the principles behind the science and goes on to elucidate the current research and findings needed by those seeking to make further advancement. Unique and Thorough Coverage of Uncertainty Analysis The author provides valuable insight into the vital issues associated with the devices used in fluid mechanics and gas dynamics experiments. Leaving nothing to doubt, he tackles the most difficult concepts and ends the book with an introduction to uncertainty analysis. Structured and detailed enough for self study, this volume also provides the backbone for both undergraduate and graduate courses on fluids experimentation.

## **Gas Dynamics**

The Fourth Edition of this easy-to-understand text continues to provide students with a sound understanding of the fundamental concepts of various physical phenomena of science of fluid mechanics. The third edition of this book, developed to serve as text for a course in fluid mechanics at the introductory level for undergraduate course and for an advanced level course at graduate level, was well received all over the world, because of its completeness and proper balance of theoretical and application aspects of this science. Over the years, the feedback received from the faculty and students made the author to realize the need for adding following material to serve as text for students of all branches of engineering. • Three new chapters on: o Pipe Flows o Flow with Free Surface o Hydraulics Machinery • Large number of solved examples in all the chapters to enable the user to gain an insight in to the theory and application aspects of the concepts introduced. • A Solution Manual that contains solutions to all the end-of-chapter problems for instructors. TARGET AUDIENCE • B.Tech (All Branches)

## **Gas Dynamics 2Nd Ed.**

Instrumentation, Measurements, and Experiments in Fluids, Second Edition is primarily focused on essentials required for experimentation in fluids, explaining basic principles, and addressing the tools and methods needed for advanced experimentation. It also provides insight into the vital topics and issues associated with the devices and instruments used for fluid mechanics and gas dynamics experiments. The second edition adds exercise problems with answers, along with PIV systems of flow visualization, water flow channel for flow visualization, and pictures with Schlieren and shadowgraph—from which possible quantitative information can be extracted. Ancillary materials include detailed solutions manual and lecture slides for the instructors.

## **Fluid and Thermal Dynamics Answer Bank for Engineers**

New edition of the popular textbook, comprehensively updated throughout and now includes a new dedicated website for gas dynamic calculations The thoroughly revised and updated third edition of Fundamentals of Gas Dynamics maintains the focus on gas flows below hypersonic. This targeted approach provides a cohesive and rigorous examination of most practical engineering problems in this gas dynamics flow regime. The conventional one-dimensional flow approach together with the role of temperature-entropy diagrams are highlighted throughout. The authors—noted experts in the field—include a modern computational aid, illustrative charts and tables, and myriad examples of varying degrees of difficulty to aid in the understanding of the material presented. The updated edition of Fundamentals of Gas Dynamics includes new sections on the shock tube, the aerospoke nozzle, and the gas dynamic laser. The book contains all equations, tables, and charts necessary to work the problems and exercises in each chapter. This book's accessible but rigorous style: Offers a comprehensively updated edition that includes new problems and examples Covers fundamentals of gas flows targeting those below hypersonic Presents the one-dimensional flow approach and highlights the role of temperature-entropy diagrams Contains new sections that examine the shock tube, the aerospoke nozzle, the gas dynamic laser, and an expanded coverage of rocket propulsion Explores applications of gas dynamics to aircraft and rocket engines Includes behavioral objectives, summaries, and check tests to aid with learning Written for students in mechanical and aerospace engineering and professionals and researchers in the field, the third edition of Fundamentals of Gas Dynamics has been updated to include recent developments in the field and retains all its learning aids. The calculator for gas dynamics calculations is available at <https://www.oscarbiblarz.com/gascalculator> gas dynamics calculations

## **Encyclopedia of Fluid Mechanics**

Written for chemical, mechanical, and aerospace engineering students taking courses on heat and mass transfer, this textbook presents the basics and proceeds to the required theory and its application aspects. Major topics covered include conduction, convection, radiation, boiling, heat exchangers, and mass transfer and are explained in a detailed, to-the-point manner. Along with coverage of the topics, the author provides appropriate numerical examples to clarify theory and concepts. Exercise problems are presented at the end of each chapter to test the understanding gained within each subject. A solutions manual and PowerPoint slides accompany the text, upon qualification.

## **Instrumentation, Measurements, and Experiments in Fluids**

The third edition of this easy-to-understand text continues to provide students with a sound understanding of the fundamental concepts of various physical phenomena of science of fluid mechanics. It adds a new chapter (Vortex Theory) which presents a vivid interpretation of vortex motions that are of fundamental importance in aerodynamics and in the performance of many other engineering devices. It elaborately explains the dynamics of vortex motion with the help of Helmholtz's theorems and provides illustrations of how the manifestations of Helmholtz's theorems can be observed in daily life. Several new problems along with answers are added at the end of Chapter 4 on Boundary Layer. The book is suitable for a one-semester course in fluid mechanics for undergraduate students of mechanical, aerospace, civil and chemical engineering

students. A Solutions Manual containing solutions to end-of-chapter problems is available for use by instructors.

## **FLUID MECHANICS, FOURTH EDITION**

Serves as a reference for mechanical, aerospace, and civil engineering professionals and students interested in experimental fluid mechanics. This work provides insight into the vital issues associated with the devices used in fluid mechanics and gas dynamics experiments.

### **Instrumentation, Measurements, and Experiments in Fluids**

THE FACT that most books on gas dynamics include separate tables for each simplified flow process casts a shadow of inadequacy over the conventional approach. Why is each process treated as though it were entirely unrelated to the others? Why isn't there, we asked, a generalized approach based on fundamental equations which act as progenitors for the specific equations of all the simplified flow processes, and which provide insight to more general flow processes? As our solution to the above dilemma, we present a complete treatment of one-dimensional gas dynamics, stressing a fundamental approach. A unified description of this subject is accomplished by means of a single numerical table applicable to the particular gas under study. Separate treatments for the various flow processes are thus combined into one all-encompassing analysis. These tables are intended for the large group of practicing engineers, of which we are members, who daily must solve routine problems in gas dynamics. Aero dynamic, chemical, and mechanical engineers, as well as students of thermo dynamics and gas dynamics, should find these tables useful. The book is divided into five parts. In Chapter 1, we present a generalized compressible flow function  $r$ , which is shown to have direct application in the treatment of many simplified one-dimensional flow processes.

### **Gas Tables (Revised)**

Theoretical Aerodynamics is a user-friendly text for a full course on theoretical aerodynamics. The author systematically introduces aerofoil theory, its design features and performance aspects, beginning with the basics required, and then gradually proceeding to higher level. The mathematics involved is presented so that it can be followed comfortably, even by those who are not strong in mathematics. The examples are designed to fix the theory studied in an effective manner. Throughout the book, the physics behind the processes are clearly explained. Each chapter begins with an introduction and ends with a summary and exercises. This book is intended for graduate and advanced undergraduate students of Aerospace Engineering, as well as researchers and Designers working in the area of aerofoil and blade design. Provides a complete overview of the technical terms, vortex theory, lifting line theory, and numerical methods Presented in an easy-to-read style making full use of figures and illustrations to enhance understanding, and moves well simpler to more advanced topics Includes a complete section on fluid mechanics and thermodynamics, essential background topics to the theory of aerodynamics Blends the mathematical and physical concepts of design and performance aspects of lifting surfaces, and introduces the reader to the thin aerofoil theory, panel method, and finite aerofoil theory Includes a Solutions Manual for end-of-chapter exercises, and Lecture slides on the book's Companion Website

### **Instrumentation, Measurements, and Experiments in Fluids, Second Edition**

A comprehensive examination of the fundamentals of compressible flow and gas dynamics.

### **Fundamentals of Gas Dynamics**

Compressible Fluid Dynamics (or Gas Dynamics) has a wide range of applications in Mechanical, Aeronautical and Chemical Engineering. It plays a significant role in the design and development of

compressors, turbines, missiles, rockets and aircrafts. This comprehensive and systematically organized book gives a clear analysis of the fundamental principles of Compressible Fluid Dynamics. It discusses in rich detail such topics as isentropic, Fanno, Rayleigh, simple and generalised one-dimensional flows. Besides, it covers topics such as conservation laws for compressible flow, normal and oblique shock waves, and measurement in compressible flow. Finally, the book concludes with detailed discussions on propulsive devices. The text is amply illustrated with worked-out examples, tables and diagrams to enable the students to comprehend the subject with ease. Intended as a text for undergraduate students of Mechanical, Aeronautical and Chemical Engineering, the book would also be extremely useful for practising engineers.

## **Elements of Heat Transfer**

Aimed at both researchers and professionals who deal with this topic in their routine work, this introduction provides a coherent and rigorous access to the field including relevant methods for practical applications. No preceding knowledge of gas dynamics is assumed.

## **FLUID MECHANICS**

Provides a broad and accessible introduction to the field of aerospace engineering, ideal for semester-long courses Aerospace engineering, the field of engineering focused on the development of aircraft and spacecraft, is taught at universities in both dedicated aerospace engineering programs as well as in wider mechanical engineering curriculums around the world-yet accessible introductory textbooks covering all essential areas of the subject are rare. Filling this significant gap in the market, Introduction to Aerospace Engineering: Basic Principles of Flight provides beginning students with a strong foundational knowledge of the key concepts they will further explore as they advance through their studies. Designed to align with the curriculum of a single-semester course, this comprehensive textbook offers a student-friendly presentation that combines the theoretical and practical aspects of aerospace engineering. Clear and concise chapters cover the laws of aerodynamics, pressure, and atmospheric modeling, aircraft configurations, the forces of flight, stability and control, rockets, propulsion, and more. Detailed illustrations, well-defined equations, end-of-chapter summaries, and ample review questions throughout the text ensure students understand the core topics of aerodynamics, propulsion, flight mechanics, and aircraft performance. Drawn from the author's thirty years' experience teaching the subject to countless numbers of university students, this much-needed textbook: Explains basic vocabulary and fundamental aerodynamic concepts Describes aircraft configurations, low-speed aerofoils, high-lift devices, and rockets Covers essential topics including thrust, propulsion, performance, maneuvers, and stability and control Introduces each topic in a concise and straightforward manner as students are guided through progressively more advanced material Includes access to companion website containing a solutions manual and lecture slides for instructors Introduction to Aerospace Engineering: Basic Principles of Flight is the perfect "one stop" textbook for instructors, undergraduates, and graduate students in Introduction to Aerospace Engineering or Introduction to Flight courses in Aerospace Engineering or Mechanical Engineering programs.

## **Instrumentation, Measurements, and Experiments in Fluids**

Rarefied Gas Dynamics is a collection of selected papers presented at the Eighth International Symposium on Rarefied Gas Dynamics, held at Stanford University in July 1972. The book is a record of the significant advances in the broad field of Rarefied Gas Dynamics that are considered to be of general and continuing interest. The articles in this compendium are organized under 10 main topics. The text presents research papers on the kinetic theory of gases; studies and experiments on shock structures of gases; use of kinetic theory for the solution of problems in evaporation and condensation; gas expansions and jets; and techniques and methods applied to the study of rarefied gas dynamics. The book also includes works on gas-solid interactions; descriptions of basic notions of current polyatomic gas kinetics; and observation of the gas dynamic phenomena in space. Physicists, aeronautical engineers, mechanical engineers, researchers, and students in the field of aircraft design will find this book a good source of knowledge and information.

## **Handbook of Generalized Gas Dynamics**

Primarily intended for the undergraduate students of mathematics, physics and engineering, this text gives in-depth coverage of differential equations and the methods for solving them. The book begins with the definitions, the physical and geometric origins of differential equations, and the methods for solving the first order differential equations. Then it goes on to give the applications of these equations to such areas as biology, medical sciences, electrical engineering and economics. The text also discusses, systematically and logically, higher order differential equations and their applications to telecommunications, civil engineering, cardiology and detection of diabetes, as also the methods of solving simultaneous differential equations and their applications. Besides, the book provides a detailed discussion on Laplace transforms and their applications, partial differential equations and their applications to vibration of stretched string, heat flow, transmission lines, etc., and calculus of variations and its applications. The book, which is a happy fusion of theory and application, would also be useful to postgraduate students. **NEW TO THIS EDITION** • New sections on: (a) Equations reducible to linear partial differential equations (b) General method for solving the second order non-linear partial differential equations (Monge's Method) (c) Lagrange's equations of motion • Number of solved examples in Chapters 5, 7, 8, 9 and 10.

## **Theoretical Aerodynamics**

Designed to serve as a textbook for postgraduate students of physics and chemistry, this second edition improves the clarity of treatment, extends the range of topics, and includes more worked examples with a view to providing all the material needed for a course in molecular spectroscopy—from first principles to the very useful spectral data that comprise figures, charts and tables. To improve the conceptual appreciation and to help students develop more positive and realistic impressions of spectroscopy, there are two new chapters—one on the spectra of atoms and the other on laser spectroscopy. The chapter on the spectra of atoms is a detailed account of the basic principles involved in molecular spectroscopy. The chapter on laser spectroscopy covers some new experimental techniques for the investigation of the structure of atoms and molecules. Additional sections on interstellar molecules, inversion vibration of ammonia molecule, fibre-coupled Raman spectrometer, Raman microscope, supersonic beams and jet-cooling have also been included. Besides worked-out examples, an abundance of review questions, and end-of-chapter problems with answers are included to aid students in testing their knowledge of the material contained in each chapter. Solutions manual containing the complete worked-out solutions to chapter-end problems is available for instructors.

## **Fluid Mechanics**

Provides all necessary equations, tables, and charts as well as self tests. Included chapters cover reaction propulsion systems and real gas effects. Written and organized in a manner that makes it accessible for self learning.

## **Gas Dynamics For Engineers, 1/e**

Gas Dynamics

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