The Mathematical Theory of Compressible Fluid Flow
Richard Von Mises

Mathematical Theory of Compressible Fluid Flow-Richard Von Mises 1932-02-21 Suitable for advanced undergraduate and graduate students, this text covers general theorems, conservation equations, waves, shocks, and nonisentropic flows, with emphasis on the basics, both conceptual and mathematical. 1956 edition. Introduction to the Mathematical Theory of Compressible Flow-Antonino Noreto 2004-06-17 These parts are written in a textbook style with auxiliary material in supporting segments. This book is designed as an introduction to the problems involving singular limits based on the concept of weak or variational solutions. The primitive system consists of a complete system of partial differential equations describing the time evolution of the three basic state variables: the density, the velocity, and the absolute temperature associated to a fluid, which is supposed to be compressible, viscous, and heat conducting. The concept of weak or variational solutions...
incompressible and compressible Navier-Stokes equations are considered, as well as stability theory and numerical methods in fluid mechanics. Although the book is primarily written for researchers in the field, it will also serve as a valuable source of information to graduate students.

Similar topics in Thermodynamics of Viscous Fluids-Eduard Feinheil 2009-03-28 Many interesting problems in mathematical fluid dynamics involve the behavior of solutions of nonlinear systems of partial differential equations as certain parameters vanish or become infinite. Frequently the limiting solution, provided the limit exists, satisfies a qualitatively different system of differential equations. This book is designed as an introduction to the problems involving singular limits based on the concept of weak or variational solutions. The primitive system consists of a complete system of partial differential equations describing the time evolution of the three basic state variables: the density, the velocity, and the absolute temperature associated to a fluid, which is supposed to be compressible, viscous, and heat conducting. It can be represented by the Navier-Stokes-Fourier-system that combines Newton's rheological law for the viscous stress and Fourier's law for heat conduction in the internal energy flux. As a summary, this book studies singular limits of weak solutions to the system governing the flow of thermally conducting compressible viscous fluids.

Nonlinear Problems of Engineering-William F. Ames 2014-05-12 Nonlinear Problems of Engineering reviews certain nonlinear problems of engineering. This book provides a discussion of nonlinear problems that occur in four areas, namely, mathematical methods, fluid mechanics, mechanics of solids, and transport phenomena. Organized into fifteen chapters, this book begins with an overview of some of the fundamental ideas of two mathematical theories, namely, invariant imbedding and dynamic programming. This text then explores nonlinear integral equations, which have long occupied a prominent place in mathematical analysis. Other chapters consider the phenomena associated with essentially divergent small-dissipator series, such as may occur in the formal solution of differential equations that represent the oscillations of -conservative dynamic systems. This book discusses as well the mechanics of idealized textiles consisting of inextensible filaments. The final chapter deals with the use of the Peaceman-Rachford alternating direction implicit method for solving the finite difference analog of boundary value problems. This book is a valuable resource for engineers and mathematicians.

Magnetohydrodynamics with Hydrodynamics-Peter C. Kendall 2013-09-03 Magnetohydrodynamics with Hydrodynamics, Volume 1 details various concepts in magnetohydrodynamics as it relates to hydrodynamics. The title first covers the methods and techniques appropriate to an elementary discussion of magnetohydrodynamics, and then proceeds to tackling the fundamental results of fluid dynamics. Next, the selection discusses the electromagnetic effects, along with the motion of a fluid in a uniform magnetic field. In the last chapter, the text talks about steady states and equilibrium configuration. The book will be of great interest to students, researchers, and practitioners of physics and engineering.

Mathematical Theory of Oil and Gas Recovery-Pavel Bedrikovetsky 1993-07-31 It is a pleasure to be asked to write the foreword to this interesting new book. When Professor Bedrikovetsky first accepted my invitation to spend an extended sabbatical period in the Department of Mineral Resources Engineering at Imperial College of Science, Technology and Medicine, I hoped it would be a period of fruitful collaboration. This book, a short course and a variety of technical papers are tangible evidence of a successful stay in the UK. I am also pleased that Professor Bedrikovetsky acted on my suggestion to publish this book with Kluwer as part of the petroleum publications for which I am Series Editor. The book derivs much of its origin from the unpublished Doctor of Science thesis which Professor Bedrikovetsky prepared in Russian while at the Gubkin Institute. The original DSc contained a number of discrete publications unified by an analytical mathematics approach to fluid flow in petroleum reservoirs. During his sabbatical stay at Imperial College, Professor Bedrikovetsky has refined and extended many of the chapters and has discussed each one with internationally recognized experts in the field. He received great encouragement and editorial advice from Dr Gren Rowan, who pioneered analytical methods in reservoir modelling at BP for many years.

An Elementary Treatise on the Mathematical Theory of Perfectly Elastic Solid-William John Sibbett 1887 Handbook of Mathematical Fluid Dynamics-S. Friedlander 2007-05-16 This is the fourth volume in a series of surveys covering many aspects of mathematical fluid dynamics, a viable source of open mathematical problems and exciting pharo. Mathematical Theory of Incompressible Non viscous Fluids-Marchioro 1993-11-05 Fluid dynamics is an ancient science incredibly alive today. Modern technol ogy and new needs require a deeper knowledge of the behavior of real fluids, and new discovery or steps forward pose, quite often, challenging and difficult new mathematical problems. In this framework, a special role is played by incompressible inviscid (sometimes called perfect) flows. This is a mathematical model consisting essentially of an evolution equation (the Euler equations) for the velocity field of fluids. Such a system, which is nothing other than the Navier-Stokes equations with some additional structural hypotheses, was discovered by Euler in 1755, and although it is more than two centuries old, many fundamental questions concerning its solutions are still open. In particular, it is not known whether the solutions, for reasonably general initial conditions, develop singularities in a finite time, and very little is known about the long-term behavior of smooth solutions. These and other basic problems are still open, and this is one of the reasons why the mathematical theory of perfect flows is far from being completed. Incompressible flows have been attached, by many distinguished mathe maticians, with a large variety of mathematical techniques so that, today, this field constitutes a very rich and stimulating part of applied mathematics. Dynamics of Evolutionary Equations-George R. Sell 2002-01-22 The theory and applications of infinite dimensional dynamical systems have attracted the attention of scientists for quite some time. This book serves as an entry for scholars beginning their journey into the world of dynamical systems, especially infinite dimensional spaces. The main approach involves the theory of evolutionary equations.

Elements of Gasodynamics-Hans Wolfgang Liepmann 1957 The increasing importance of concepts from compressible fluid flow theory for aeronautical applications makes the reproduction of this first-rate text particularly timely. Intended mainly for aeronautics students, the text will also be helpful to practicing engineers and scientists who work on problems involving the aerodynamics of compressible fluids. Covering the general principles of gas dynamics to provide a working understanding of the essentials of gas flow, the contents of this book form the foundation for a study of the specialized literature and should give the necessary background for reading original papers on the subject. Topics include introductory concepts from thermodynamics, including entropy, reciprocity relations, equilibrium conditions, the law of mass action and condensation; one-dimensional gasdynamics, one-dimensional wave motion, waves in supersonic flow, flow in ducts and tunnels, methods of measurement, the equations of finite/infinite wave, small-perturbation theory, transonic flow, effects of viscosity and conductivity, and much more. The text includes numerous detailed figures and several useful tables, while concluding exercises demonstrate the application of the text in the test and outline additional subjects. Advanced undergraduate or graduate physics and engineering students with at least a working knowledge of calculus and basic physics will profit immensely from studying this outstanding volume.

Vectors, Tensor and the Basic Equations of Fluids-Richard S. Renardy 2012-08-21 Introductory text, geared toward advanced undergraduate and graduate students, applies mathematics of Cartesian and general tensors to physical fluid theories and demonstrates them in terms of the theory of fluid mechanics. 1962 edition.

Weakly Compressible Flow-Hillary Ockendon 2004-01-27 This book covers compressible flow however the authors also show how wave phenomena in electromagnetism and solid mechanics can be treated using similar mathematical methods. It raters to the needs of the modern student by providing the tools necessary for a mathematical analysis of most kinds of waves liable to be encountered in modern science and technology. At the same time emphasis is laid on the physical background and modeling that requires these tools. Progress in Theoretical and Computational Fluid Mechanics-G P Galdi 1994-05-18 This volume presents a series of lectures given at the Winter School in Fluid Dynamics held in Paukcy, Czech Republic in December 1993. Including original research and important new results, it contains a detailed investigation of some methods used towards the proof of global regularity for the Navier-Stokes equations. It also explores new formulations of the free-boundary in the dynamics of viscous fluids, and different methods for conservation laws in several space-dimensions and related numerical schemes. The final contribution examines the existence and stability of non-isothermal compressible fluids and their relation with incompressible models.

Vorticity and Incompressible Flow-Andrew J. Majda 2003 This book is a comprehensive introduction to the mathematical theory of vorticity and incompressible flow ranging from elementary introductory material to current research topics. While the contents center on mathematical theory, many parts of the book showcase the interaction between rigorous mathematical theory, numerical, asymptotic, and qualitative simplified modeling, and physical phenomena. The first half forms an introductory graduate course on vorticity and incompressible flow. The second half comprises a modern applied mathematics graduate course on the weak solution theory for incompressible flow.

Theory of Jets in Ideal Fluids-M. I. Gueresh 2014-05-12 Theory of Jets in Ideal Fluids focuses on the use of hydrodynamics in the theory of jets in ideal fluids. The publication first offers information on the introduction to the theory of plane and steady jet flows and flow from a vessel. Discussions focus on flow from a rectangular vessel with an orifice at a corner; vessel with a funnel-shaped bottom and Borda's nozzle; flow from the opening between two flat plates; and Kirchhoff's method. The text then examines infinite flow past a polygonal obstacle, flow around curvilinear obstacles, and flow around a body at small cavitation number. Topics include: caviating flow around a circular cylinder; cavitating flow around a thin profile at an arbitrary angle of attack; cavitating flow around a flat plate; Villa's integral; differential equation and the existence and uniqueness of the solution; and flow past a plate with the separation from its upper surface. The book takes a look at the flow of a heavy fluid and the effects of surface tensions, axi-symmetric flow, jet flow of compressible fluid, and unsteady flows. The publication is a dependable reference for hydrodynamicists wanting to explore the theory of jets in ideal fluids.

Complex Integral Operators in Mathematical Physics-Eberhard Lanchier 1993 Mathematical Theory Of Compressible Fluid Flow Richard Von Mises