Computational Fluid Dynamics

T. J. Chung
University of Alabama, Huntsville, USA

Increasingly, computational fluid dynamics (CFD) techniques are being used to study and solve complex fluid flow and heat transfer problems. This book ranges from elementary concepts for the beginner to state-of-the-art CFD for the practitioner. It begins with CFD preliminaries, in which the basic principles of finite difference (FD), finite element (FE), and finite volume (FV) methods are discussed and illustrated through examples, with step-by-step hand calculations. Then, FD and FE methods respectively are covered, including both historical developments and recent contributions. The next section is devoted to structured and unstructured grids, adaptive methods, computing techniques, and parallel processing. Finally, the author describes a variety of practical applications to problems in turbulence, reacting flows and combustion, acoustics, combined mode radiative heat transfer, multiphase flows, electromagnetic fields, and relativistic astrophysical flows. Students and practitioners – particularly in mechanical, aerospace, chemical, and civil engineering – will use this authoritative text to learn about and apply numerical techniques to the solution of fluid dynamics problems.

Features
- Comprehensive coverage – from general introduction, to detailed treatment of specific techniques, and practical applications
- Packed with examples and illustrations to make this difficult subject more easily understandable
- Author is an internationally known researcher in CFD and has developed widely used CFD techniques


2002 1036pp 377 illustrations £75.00

Breakup of Liquid Sheets and Jets

S. P. Lin
Clarkson University, New York, USA

The theme of this book is an exposition of what we know about the physics underlying the onset of instability in liquid sheets and jets. Wave motion and breakup phenomena subsequent to the onset of instability are also carefully explained. Physical concepts are established through rigorous mathematics, accurate numerical analyses and comparison of theory with experiment.

Features
- Suitable for students and researchers who wish to learn spatio-temporal stability analysis for the first time
- Rational approaches are used to establish physical concepts which have wide practical applications


July 2003 163pp 15 illustrations £55.00
Fluid Mechanics

Generalized Riemann Problems in Computational Fluid Dynamics
Matania Ben-Artzi and Joseph Falcovitz
Both from Hebrew University of Jerusalem, Israel

The Generalized Riemann Problem (GRP) algorithm comprises common schemes of numerical simulation of compressible, inviscid time-dependent flow. This monograph, including examples illustrating the algorithm’s applications, presents the GRP methodology beginning with its underlying mathematical principles to both researchers and graduate students of applied mathematics, science and engineering.

Features
• Presents the relevant mathematical background along with systematic analysis of the GRP methods
• Introduces basic mathematical concepts first in simpler scalar conservation laws, repeats the process for more general settings
• Includes detailed ‘construction’ tables, allowing for the actual writing of suitable computer codes

Contents:

2003 366pp 106 illustrations
0 521 77296 6 Hardback £55.00

Internal Flow
Concepts and Applications
Edward Greitzer and C. S. Tan
Both from Massachusetts Institute of Technology, USA
and Martin B. Graf
Mars & Co

Here the analysis and behavior of internal flows encountered in propulsion systems, fluid machinery (compressors, turbines, and pumps) and ducts (diffusers, nozzles and combustion chambers) are described. The focus is on phenomena that are important in setting the performance of a broad range of fluid devices. The book equips students and practicing engineers with a range of new analytical tools. These tools offer enhanced interpretation and application of both experimental measurements and the computational procedures that characterize modern fluids engineering.

Features
• Provides insights by explaining key principles with reference to a broad range of applications
• Develops the ability of the reader to interpret, and thus use more effectively, experimental measurements and modern techniques of computational fluid dynamics
• Authors have a broad range of experience, spanning the spectrum from dealing with applications in an industrial environment to teaching them.

Contents:

2002 644pp 227 illustrations
0 521 53169 1 Paperback £35.00

Perspectives in Fluid Dynamics
A Collective Introduction to Current Research
Edited by G. K. Batchelor, H. K. Moffatt and M. G. Worster
All from University of Cambridge, UK

Now in paperback, this popular graduate text consists of eleven chapters, each by established authorities, that introduce and review different branches of the subject, making it suitable for graduate-level courses, or for specialists seeking introductions to other areas.

“... all chapters are exquisitely written and do provide a superb introduction and significant understanding to their respective topics ... The book is a joy to read.”


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Closure Strategies for Turbulent and Transitional Flows

Edited by B. E. Launder
University of Manchester Institute of Science and Technology, UK
and N. D. Sandham
University of Southampton, UK

Turbulence modelling is critically important for industries dealing with fluid flow and for applied mathematicians. This collection of lecture courses presented at a Newton Institute instructional conference on the title topic by leading researchers has been edited or rewritten to provide a coherent account suitable for self-study.

Features
- Written by the leading experts
- Contains introductory course material making it suitable for self-study, and current material making it suitable for experts


2002 768pp 263 illustrations 0 521 79208 8 Hardback £90.00

The Physics and Mathematics of Adiabatic Shear Bands

T. W. Wright
Army Research Laboratory, Maryland, USA

Depending on the application, shear bands may be harmful or beneficial, but to be controlled, they must first be understood. This book establishes the mathematical setting within which shear bands may be studied and uses well established asymptotic techniques to obtain scaling laws that describe major aspects of the formation and morphology of shear bands.

Features
- Equations are established within the setting of finite deformation plasticity
- Summarizes recent results in two dimensional experiments and analyses
- Establishes the foundations from which shear mechanics may grow to take its place as a major companion to fracture mechanics


2002 260pp 105 illustrations 0 521 63195 5 Hardback £45.00

Theory and Computation in Hydrodynamic Stability

W. Criminale
University of Washington, USA
T. L. Jackson
University of Illinois, Urbana-Champaign, USA
and R. D. Joslin
Office of Naval Research, Arlington, USA

This treatise covers both classical and modern aspects of the fundamental topic of hydrodynamic stability, considering linear and nonlinear situations, and analysing temporal and spatial aspects. The authors examine each problem both analytically and numerically: every chapter ends with an appendix outlining full direct numerical simulation (DNS) computer code. The text is enriched with many exercises, copious illustrations and an extensive bibliography.

Features
- Fully up-to-date, covering classical and modern, linear and nonlinear aspects, from both numerical and analytic views
- Systematic presentation, progressing from simple to complicated, with exercises and computer code for each chapter.
- All physical problems of note are investigated: confined shear flows; boundary layers; free flow; geophysical flows.


November 2003 432pp 144 illustrations 60 exercises 0 521 63200 5 Hardback £60.00
Hydrodynamic Stability
Second edition
P. G. Drazin
University of Bristol, UK
and W. H. Reid

Hydrodynamic stability is of fundamental importance in fluid dynamics and is concerned with the transition from laminar to turbulent flow. This new edition of this celebrated introduction differs principally by the inclusion of detailed solutions for the exercises, and by the addition of a Foreword by Professor J. W. Miles.

Review from the First edition
• The work is undeniably of high scholarship, consummate accuracy and penetrating insight ... All specialists in stability theory will be happy that two such authorities have found the time, and spared so few pains, to produce a work of such excellence.

Contents:
Foreword; Preface; 1. Introduction; 2. Thermal instability; 3. Centrifugal instability; 4. Parallel shear flows; 5. Uniform asymptotic approximations; 6. Additional topics in linear stability theory; 7. Nonlinear stability; Appendix A: A class of generalized Airy functions; Appendix B: Solutions to the problems; Bibliography; Motion picture index; Subject index.

November 2003   600pp   114 illustrations
81 exercises
0 521 52541 1 Paperback £25.00

Introduction to Hydrodynamic Stability
P. G. Drazin
University of Bristol, UK

Instability of flows and their transition to turbulence are widespread phenomena in engineering and nature, and are also important in many applied sciences. This is a textbook to introduce these phenomena at a level suitable for a graduate course, by modelling them mathematically, and describing numerical simulations and laboratory experiments.

Features
• A companion text to the classic Drazin and Reid
• Includes many examples and exercises, making it an ideal textbook

Contents:

2002   276pp   78 illustrations
0 521 00965 0 Paperback £21.95
0 521 80427 2 Hardback £65.00

Computational Models for Turbulent Reacting Flows
Rodney Fox
Iowa State University, USA

Presenting the current state of the art in computational models for turbulent reacting flows, and analyzes carefully the strengths and weaknesses of the various techniques described. The focus is on formulation of practical models as opposed to numerical issues arising from their solution. A theoretical framework based on the one-point, one-time joint probability density function (PDF) is developed. It is shown that all commonly employed models for turbulent reacting flows can be formulated in terms of the joint PDF of the chemical species and enthalpy.

Features
• Provides a unified modern treatment of computational fluid dynamics models for turbulent reacting flow
• Emphasizes models that can handle detailed finite-rate chemistry as opposed to specialized applications (e.g., combustion)
• Treats CFD models for reacting flows from the standpoint of chemical reactor design

Contents:

November 2003   430pp   104 illustrations
0 521 65907 8 Paperback £38.95
0 521 65049 6 Hardback £80.00
An Introduction to Turbulent Flow
Jean M. Mathieu and Julian F. Scott
Both from Ecole Centrale de Lyon, France

An Introduction to Turbulent Flow develops both physical insight and the mathematical framework needed to express the theory. It begins with a review of the physical nature of turbulence, statistical tools, and space and time scales of turbulence. Basic theory is presented next, with examples of simple turbulent flows and classical models of jets, wakes, and boundary layers. Remaining chapters cover spectral analysis and its applications and the numerical simulation of turbulent flows.

... chapters are well balanced and self-contained and the reader is naturally guided through the subject... provides a balanced introduction to the main elements of the study of turbulence in an uncluttered and literary fashion ... an easily digestible introduction to turbulent flows.

The Times Higher Education Supplement


2002 384pp 81 illustrations
0 521 77538 8 Paperback £27.95

Turbulent Flows
Stephen B. Pope
Cornell University, New York, USA

Comprehensive and designed for teaching it is based on a course taught by the author at Cornell University for a number of years. Part I provides a general introduction to turbulent flows, how they behave, how they can be described quantitatively, and the fundamental physical process involved. Part II examines different approaches for simulating turbulent flows.

... an excellent textbook that can be heartily recommended to anyone teaching a course in this subject.

International Journal of Multiphase Flow

Contents: Part I. Fundamentals; Part II. Modelling and Simulation; Part III. Appendices; Bibliography.
2000 806pp 279 illustrations 384 exercises
0 521 59886 9 Paperback £35.00
0 521 59125 2 Hardback £80.00

Flow Measurement Handbook
Industrial Designs, Operating Principles, Performance, and Applications
Roger C. Baker
An information-packed reference for engineers on flow measuring techniques and instruments.

... the text is readable and clearly written ... the material would appeal to anyone working with flow meters in any capacity. The effort put into this text by the author is enormous, and the text itself is outstanding.

Applied Mechanical Review


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Linear Water Waves
A Mathematical Approach
N. Kuznetsov
Russian Academy of Sciences, Russia
V. Maz’ya
University of Linköping, Sweden
and B. Vainberg
University of North Carolina, USA
A self-contained and up-to-date account of mathematical results in the linear theory of water waves. Linear Water Waves will serve as an ideal reference for those working in fluid mechanics, applied mathematics, and engineering.
Contents:
Part I. Time-Harmonic Waves; Part II. Ship Waves on Calm Water; Part III. Unsteady Waves
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Waves in Fluids
James Lighthill
University of Cambridge, UK
This comprehensive text describes the science of waves in liquids and gases. It will be invaluable to engineers, physicists, geophysicists, applied mathematicians and researchers concerned with wave motions or fluid flows.
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Ocean Waves and Oscillating Systems
Linear Interactions Including Wave-Energy Extraction
Johannes Falnes
Norwegian University of Science and Technology, Trondheim, Norway
This book examines the interaction between ocean waves and oscillating systems. Topics covered include the background mathematics of oscillations, gravity waves on water, the dynamics of wave-body interactions, and the absorption of wave energy by oscillating bodies. Linear algebra, complex numbers, differential equations, and Fourier transformation are utilized as bases for the analysis, and each chapter ends with problems. While the book’s focus is on linear theory, the practical application of energy storage and transport is interwoven throughout.
Features
• Written by an internationally recognized expert
• Each chapter concludes with exercises
• Has applications to the field of renewable energy, an important world issue
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Theory of Vortex Sound
M. S. Howe
Boston University, USA
An introduction to theory of sound generation by fluid flow, specially written for a one semester course at advanced undergraduate or graduate level. Problems are provided at the end of each chapter, many of which can be used for extended student projects. A whole chapter is devoted to worked examples.
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Flow Control
Passive, Active, and Reactive Flow Management
Mohamed Gad-el-Hak
University of Notre Dame, Indiana, USA
A thorough treatment of the basics of flow control and control practices that can be used to produce desired effects.

I would certainly recommend the book, at the very least as a useful source of information, but also as a thought provoking read for all those interested in the field.

The Aeronautical Journal

Contents:

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An Introduction to Fluid Dynamics
G.K. Batchelor
University of Cambridge, UK
First published in 1967, Professor Batchelor’s classic text on fluid dynamics is one of the foremost texts in the subject and is still timely and applicable, even in these days of almost limitless computer power.

... an excellent introduction to fluid dynamics ... many interesting and important photographs of fluid flows are included in order to help the students who do not have an opportunity of observing flow phenomena in a laboratory. ... I find this book by Batchelor especially stimulating and useful for students of applied mathematics and engineering.

Zentralblatt MATH

Contents:

2000   635pp   172 illustrations
0521 663962 Paperback £23.95

High-Order Methods for Incompressible Fluid Flow
M. O. Deville
École Polytechnique Fédérale, Lausanne, Switzerland
E. H. Mund
Argonne National Laboratory, Illinois, USA
and Paul F. Fischer
Université Libre de Bruxelles and Université Catholique de Louvain, Belgium
This book considers the range of mathematical, engineering, and computer science topics that form the foundation of high-order numerical methods for the simulation of incompressible fluid flows in complex domains. Numerous examples are provided throughout to illustrate the capabilities of high-order methods in actual applications.

Contents:

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The Motion of Bubbles and Drops in Reduced Gravity
R. Shankar Subramanian
Clarkson University, New York, USA
and R. Balasubramaniam
NASA John H. Glenn Research Center, USA
Provides a clear, thorough review of the motion of bubbles and drops in reduced gravity.

Contents:
Part I. Introduction; Part II. The Motion of Isolated Bubbles and Drops; Part III. Interactions of Bubbles and Drops; Part IV. Related Topics

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