J. Fluid Mech. (1997), *vol.* 351, *pp.* 379–381. Printed in the United Kingdom

BOOK REVIEWS

Fluid Mechanics. By D. PNUELI & C. GUTFINGER. Cambridge University Press, 1997. 482 pp. ISBN 0521 587972. £19.95.

This is a textbook for undergraduate classes in fluid mechanics. It is the soft-cover edition of a hard-cover book first published in 1992. In the preface, the authors state: 'In writing this book, extreme effort has been made to present fluid mechanics in an exact manner, while at the same time to keep the mathematics under control such that the student's attention is not drawn away from the physics.' This reviewer confirms that their efforts have been successful. The authors deserve a special commendation for writing a clear, comprehensive, instructive, and useful book that can be used not only by undergraduates, but also by postgraduate students who are not familiar with certain topics. Another book that has enjoyed such a broad usage is the legendary *Transport Phenomena* by Bird, Stewart, & Lightfoot.

It is rather curious that, with few exceptions, graduate and undergraduate textbooks are typically written with distinct styles; the former usually introduce fluid mechanics from the more general framework of continuum mechanics, while the latter often motivate fluid mechanics by example. Undergraduate texts that adopt the continuum-mechanics approach are rare; the main reason probably is the difficulty of explaining, in simple terms, abstract mathematical concepts such as tensors. In this book, the challenge of reducing a graduate to an undergraduate textbook without compromising rigour or becoming simplistic and vague was met. The order and level of presentation and the notation have been selected carefully, and the quality of writing is uniformly good; there is no fill-in material or superfluous sections in this book, and each one of the numerous problems serves a purpose. I especially liked the problem-solution sessions dispersed throughout the text. The visual derivation of the Reynolds transport theorem is ingenious. Occasional glitches exist (an incompressible fluid is inaccurately defined as a fluid with constant density), but should be forgiven in light of the overall quality.

The book is suitable for classroom instruction in a wide variety of disciplines. I recommend it for aerospace, chemical, mechanical, and civil engineering. Physicists and mathematicians should benefit from the engineering perspective. The chapter titles are: Introduction; Stress in a fluid; Fluid statics; Fluids in motion – integral analysis; Fluids in motion – differential analysis; Exact solutions of the Navier-Stokes equations; Energy equations; Similitude and order of magnitude; Flows with negligible acceleration; High Reynolds number flows – regions far from solid boundaries; High Reynolds number flows – the boundary layer; Turbulent flow; Compressible flow; Non-Newtonian fluids. The chapters can be read and taught in a strictly sequential manner, but some of the later chapters can be transposed or skipped.

I strongly recommend this book for instruction and self-study. The authors have done the teaching profession a great service by providing a text that will drastically reduce the lecture preparation time.

C. POZRIKIDIS

Pulses and Other Wave Processes in Fluids. By M. KELBERT & I. SAZONOV. Kluwer, 1996. 236 pp. ISBN 0-7923-3928-2. NLG 165.00, $115.00, £75.00.

This book is devoted to the description of pulse and other transient wave problems in fluids and other continuous media. Attention is confined to media uniform in the (usually streamwise) direction Ox, but with non-uniform mean properties laterally, these associated for example, with density stratification or mean shear variation. The problems addressed are all within the realm of linear theory, but with the inclusion of a variety of dissipative and dispersive effects, including relaxation processes and anisotropic dispersion, and the aim is to reveal the structure of the wave fields generated at large times following the switching-on of a monochromatic (single-frequency) source, or the launching of a rectangular pulse, etc. Typically, the task is to obtain an integral representation of the solution, and to subject it to asymptotic evaluation for large times and in various spatial domains, by saddle-point methods, having regard to the complications of many branch points, to the needs of causality, and to non-uniformities arising from proximity and coalescence of singularities. This is all carried out very nicely by the authors, with good explanations of how the mathematical results have beautifully precise physical interpretation. The book is well illustrated, with clear diagrams, whether referring to wave structures in physical space or to the topography of the complex plane.

All this would make it required reading for students of wave theory, and the more so because most texts give little attention to transient wave processes, and concentrate instead almost exclusively on monochromatic waves. I would recommend it without reservation if the publishers had done justice to the scientific work of the authors by paying adequate attention to the need for competent sub-editing. The authors have an attractive way of expressing their ideas, and if their work had been rendered in perfect English, free of grammatical errors and other minor infelicities while preserving the admirable style of the authors, the book would have been even more of a pleasure to study.

D. G. CRIGHTON

Computational Fluid Dynamics Review 1995. Edited by M. HAFEZ & K. OSHIMA. Wiley, 1995. 932 pp. ISBN 0-471-95589-2. £125.

One of the main supporting pillars of the scientific enterprise is the traditional model of information dissemination. New and original results are written up in research reports which, in the fullness of time, find their way to learned journals. As collective wisdom accumulates, it finds its way to monographs and textbooks. We have all been brought up with this comforting model and it is enough to survey the progress of science in the last century to convince ourselves that, cynicism and occasional glitches notwithstanding, it has worked surprisingly well. Yet, there is a measure of feeling that the days of the traditional model are numbered. As more and more individuals wish to publish their results, we are flooded by increasing amounts of information. Good results, bad results, results that shift the paradigm and results that keep the tenure committee happy…. The traditional image of an academic visiting the library once in a while and scanning new journals to find out 'what's going on' is becoming increasingly unrealistic.

The information capacity of a 'typical' researcher being time-independent, the most obvious way of coping with greater flow is to restrict the width of the channel. Thus, to keep up with the developments in our areas of active research, we are being forced into an ever-narrower range of interests. This is derogatory not just on broader cultural grounds but also since important scientific progress often occurs through lateral thinking and cross-fertilisation across neighbouring disciplines.

A partial answer to the strains on the traditional model of information dissemination is a technological fix: the use of new methods of electronic publishing and information retrieval. However, a much more radical remedy is required! Hence the growth in the last few years of several annual volumes, dedicated to surveys of specific subjects. Although the format of these volumes differs widely, they all share an important common denominator. An editorial board decides the contents and asks experts to survey them in depth. Essentially, such an editorial board will ask itself the question 'What are the important advances in our discipline in the last few years and who are the best individuals to survey them?' The outcome is an 'information capsule' which is accessible to a wide range of researchers, cuts across narrow subject boundaries and is an excellent starting point toward an exploration of literature by more traditional means.

Given the tremendous expansion in the scope and techniques of computational fluid dynamics, the subject is obviously ripe for an annual review, and the present volume discharges this task in a most impressive manner. It comprises 51 papers, written by most of the leading authorities in the subject. The papers are grouped under five headings: general topics; numerical methods; flow physics; interdisciplinary areas; parallel computations and flow visualization. Clearly, the core of the book is the second heading, which surveys a wide range of new and evolving numerical techniques. The exposition is broad in scope and it addresses a wide range of ideas, both core algorithms in the discretization of partial differential equations (finite differences, finite elements, spectral methods,…) and their practical implementation: grid adaptation and the iterative solution of sparse algebraic equations.

My favourite, though, is the first heading where five of the leading CFD world authorities (Peter Lax, Guri Marchuk, S. K. Godunov, Jacques-Louis Lions and Heinz Kreiss) address more contemplative issues, like history, underlying the philosophy and the future of CFD. It is a real delight to tap into this fount of wisdom!

Overall, this volume is a remarkable resource to any worker in the subject, from research students to experienced CFD professionals, who wish to keep their heads above the water. To continue such an endeavour on an annual basis will be a remarkable feat – as a managing editor of a similar annual, I appreciate the enormity of the task and wish the editors the best of luck.

A. Iserles