J. Fluid Mech. (2001), *vol.* 444, *pp.* 408–411. Printed in the United Kingdom

BOOK REVIEWS

Wave Motion. By J. BILLINGHAM & A. C. KING. Cambridge University Press, 2001. 468 pp. ISBN 0521 634504. £24.95.

Readers of JFM will be familiar with the two classical textbooks on the mathematical theory of unsteady wave motions in continuum mechanics – Whitham's *Linear and Nonlinear Waves*, published in 1976 by Wiley, and Lighthill's *Waves in Fluids*, published in 1978 by CUP. In many ways the material in these two great works is complementary: Whitham's book, although certainly containing sections on dispersive waves and solitons, is more biased towards consideration of nonlinear waves in gas dynamics; while Lighthill's book is in the main concerned with linear theory, especially of surface and internal gravity waves. Both books have stood the test of time as primary references and source material for researchers, and will no doubt continue to do so. However, as textbooks for advanced undergraduate courses they have some shortcomings. For instance, neither book contains exercises for the reader, both (but perhaps especially Lighthill's) now seem more challenging than one might wish for in an elementary text, and sadly Whitham's book is now very expensive and difficult to obtain.

Wave Motion, by John Billingham and Andrew King, addresses this need for a textbook suitable for undergraduates studying an introductory course on wave motion in perhaps their final year (although it also does much more besides, see below). The authors have obviously set themselves the aim of producing a book which describes the widest possible range of wave phenomena in an attractive and accessible way, an aim which, I must say straightaway, is fully met. The book is sensibly divided into three parts. Part one comprises introductory material, and describes the theory of linear waves in acoustics, in gravity-driven flows, in elasticity, and in electromagnetism. In each application a thumb-nail sketch of the derivation of the corresponding wave equations is given, so for instance there is a two-page summary of the derivation of the elasto-dynamic equations, and an exceedingly brief canter through Maxwell's equations. The brevity and cursory nature of these short sections will perhaps irritate some readers, but of course the aim of this book is to describe the solution of the various wave equations, and the authors have done a good job of conveying some feeling about where these equations come from. The great strength of this book, though, lies in the clarity of exposition of the mathematical solution of the wave equations, and of the physical interpretation of these solutions. The obvious reality and applicability of the subject is greatly enhanced by some excellent photographs, and by the frequent evaluation of theoretical results in dimensional units and for realistic parameter values! The pedagogical value is enhanced yet further by the provision of a comprehensive set of exercises at the end of each chapter, a significant advantage over the Whitham and Lighthill volumes.

Part one of the book would form the majority of an introductory course, but another strength of this book is that the remaining two parts provide additional material, suitable for more advanced students. Part two is concerned with nonlinear waves. A nice feature here is that basic concepts are introduced first in the context of kinematic waves in traffic flow, which not only provides a clean mathematical framework but also represents a particularly appealing practical application. Discussion of the more

traditional theory of gas dynamics and shocks then follows naturally from this (with more details of weak shock theory reserved till part three). Aspects of nonlinear water waves are discussed, and part two is then rounded off with an excellent chapter on waves in chemical reactions. Part three contains more advanced material, which would perhaps be suitable as part of a graduate course, including chapters on the Wiener–Hopf technique as applied to the classical Sommerfeld problem of the scattering of plane waves by a sharp edge, and the application of the inverse scattering technique to obtaining soliton solutions of the Korteweg–de Vries equation. In some sense, these latter chapters are perhaps the least satisfactory parts of the book. For instance, one does not really get a full sense of the power of the Wiener–Hopf technique from the solution of a single example, nor is the full richness of the diffraction problem brought out because the Fresnel regions are not considered. However, the important thing is that a clear and stimulating introduction to this advanced material is presented, which can be followed up by the enthusiast through the literature (the bibliography provided, although not extensive, is quite adequate for this purpose).

In summary, this is an excellent book, which is thoroughly recommended. It bears very favourable comparison with the distinguished texts in the subject mentioned above, and ought to become the standard textbook for anyone taking an undergraduate course in mathematical wave theory.

N. Peake

SHORT NOTICES

Fluid Dynamics at Interfaces. Edited by W. Shyy & R. Narayanan. Cambridge University Press, 1999. 461 pp. ISBN 0 521 64266 3. £65 or US$100.

A symposium was held in June 1998 in memory of Professor C.-S. Yih, and this volume is a report of the proceedings. There are 34 multiauthored papers concerned with various interfacial phenomena, especially waves and instabilities. Physical effects discussed include: convection, evaporation, thermocapillarity, shear, stratification, phase changes, combustion and plasma heating.

Simulation and Identification of Organized Structures in Flows. Edited by J. N. Sorensen, E. J. Hopfinger & N. Aubry. Kluwer, 1999. 515 pp. ISBN 0 7923 56039. NLG 395 or US$237 or £104.

This is a straightforward reproduction of the papers presented at an IUTAM Symposium in May 1997 held at Lyngby, Denmark. Seven of the papers are invited review lectures; in addition there are 44 papers reviewed by the editors. Topics include flow control, coherent structures, rotating and stratified flows, experimental techniques, and data analysis techniques including proper orthogonal decomposition, wavelet transforms, and linear stochastic estimation. The editors conclude that 'there is still no consensus on definitions of structures based on clear physical meaning'. Perhaps appropriately there is no index.

Turbulence Structure and Vortex Dynamics. Edited by J. C. R. Hunt & J. C. Vassilicos. Cambridge University Press, 2000. 306 pp. ISBN 0 521 78131 0. £55 or US$80.

Intermittency in Turbulent Flows. Edited by J. C. Vassilicos. Cambridge University Press, 2000. 276 pp. ISBN 0 521 79221 5. £45 or US$74.95.

These volumes report the proceedings of two symposia held at the Isaac Newton Institute in Cambridge during 1999 as part of a six-month programme on turbulence. The first contains 15 papers, the majority concerned with the evolution of vortical structures within turbulence. The second contains 16 papers – only three of the authors here overlapping with those in the first book – with a focus on the intermittency of turbulent flows and other dynamical systems. Both books contain a mixture of papers, some concerned with theory, some with numerical simulation and some describing experimental results. Neither has an index.

Satellite Altimetry and Earth Sciences. Edited by L.-L. Fu & A. Cazenave. Academic Press, 2000. 463 pp. ISBN 0 12 269545 3. US$104.95.

Subtitled 'A handbook of techniques and applications', this book consists of 12 chapters by varying authors that describe the basis of the satellite altimetry method (more than a quarter of the entire book) and the applications to oceanography and geology. The ocean aspects (occupying half the book) include currents, tides, waves and ice sheet dynamics. The book is in A4 format and is generously illustrated with diagrams, photographs and some colour plates.

Detonation: Theory and Experiment. By W. Fickett & W. C. Davis. Dover, 2000. 386 pp. ISBN 0 486414566. US$18.95.

Dover have produced a facsimile edition of the book first published in 1979. Some minor errors have been corrected.

Differential Equations and Nonlinear Mechanics. Edited by K. Vajravelu. Kluwer, 2001. 435 pp. ISBN 0792 368673. £105, US$167.

This volume presents part of the proceedings of a conference held in Orlando, FL, in March 1999. Some 29 multiauthored papers are reproduced including asymptotic and numerical treatments of problems from disparate areas of fluid and solid mechanics.

Annual Review of Fluid Mechanics, vol. 33. Edited by J. L. Lumley, S. H. Davis & H. L. Reed. Annual Reviews, 2001. 714 pp. ISBN 0 8243 0733 X.

Here is a list of articles and authors in the current volume of this periodical.

James Lighthill and His Contributions to Fluid Mechanics, T. J. Pedley
Steady Streaming, N. Riley
On the Fluid Mechanics of Fires, S. R. Tieszen
Experiments on Thermocapillary Instabilities, M. F. Schatz & G. P. Neitzel
Robert Legendre and Henri Werlé: Toward the Elucidation of
Three-Dimensional Separation, J. M. Délery
Surface Pressure Measurements Using Luminescent Coatings,
J. H. Bell, E. T. Schairer, L. A. Hand & R. D. Mehta

Rossby Wave Hydraulics, E. R. Johnson & S. R. Clarke
Spin-Up of Homogeneous and Stratified Fluids, P. W. Duck & M. R. Foster
Extrusion Instabilities and Wall Slip, M. M. Denn
Turbulent Relative Dispersion, B. Sawford
Early Work on Fluid Mechanics in the IC Engine, J. L. Lumley
Mechanics of Coastal Forms, P. Blondeaux
Aerodynamics of High-Speed Trains, J. A. Schetz
Junction Flows, R. L. Simpson
Modeling of Fluid-Structure Interaction, E. H. Dowell & K. C. Hall
Compression System Stability and Active Control, J. D. Paduano, E. M. Greitzer & A. H. Epstein
Spilling Breakers, J. H. Duncan
Shelterbelts and Windbreaks: Mathematical Modeling and Computer Simulations of Turbulent Flows, H. Wang, E. S. Takle & J. Shen
Drag Due to Lift: Concepts for Prediction and Reduction, I. Kroo
Inertial Effects in Suspension and Porous-Media Flows, D. L. Koch & R. J. Hill