REVIEWS

Disorder and Mixing. Edited by E. GUYON, J.-P. NADAL and Y. POMEAU. Kluwer, 1988. 345 pp. $79 or £47.

This volume contains the texts of lectures and shorter contributions presented at the 1987 NATO Advanced Study Institute on Disorder and Mixing at Cargèse. The editors state that the aim of the Institute was to 'associate statistical physicists, fluid mechanicians and specialists of chemical engineering with the problems of the relation between disorder and mixing'. They have attempted to 'harmonize the contents and styles of...scientists trained in different communities and using different languages and techniques to describe similar problems'.

Several of the lecturers will be well known to the fluid mechanics community. Chapters III and IX derive from surveys by E. J. Hinch of 'Hydrodynamics at low Reynolds number: a brief and elementary introduction' and 'Sedimentation of small particles'. Chapter VI by J. F. Brady and D. L. Koch is entitled 'Dispersion in porous media' and is followed by the related chapter by J. Koplik on 'Hydrodynamic dispersion in random networks'. Chapters XI and XIV by G. M. Homsy are on 'Aspects of flow and mixing behavior in fluidized beds' and on 'The effect of dispersion on fingering in miscible displacement'. Chapter XVI by J. E. Broadwell deals with 'Molecular mixing and chemical reactions in turbulent shear flows', and chapter XVII by P. Clavin is simply entitled 'Theory of flames'.

A few chapters deal with generic topics in mathematical physics of interest to the description of mixing, dispersion, diffusion and reaction, such as random walks (chapter I), and fractals (chapter II). Most of the remaining chapters deal with applications: problems in chemical engineering (chapter IV), pollutant dispersal in the ocean (chapter VIII), the theory of filtration processes (chapter X), transport of polymers (chapter XII), magnetic resonance techniques (chapter XVIII) and stereological analysis (chapter XIX).

The coverage is broad, and although the editors have attempted to impart some unity to the subjects treated, few readers are likely to embark on all the papers. Even though mixing and disorder arise in a variety of systems, most of the more detailed developments quickly become context specific and great unity of description is not attained. We should, however, emphasize the two 'paradigms' highlighted by the Institute, where certain general theoretical ideas do seem to apply across disciplinary boundaries: for diffusion and dispersion processes, the theory of Brownian motion and its generalizations; for complex spatial structure, the theory of fractals and multifractals. As the editors note in their closing essay on 'Lagrangian mixing', the emergence of chaos in the Lagrangian description of particle trajectories during mixing may be a third paradigm, which was, however, not well represented in the sessions of this Institute. Maybe this will be remedied at a later date. The present meeting was a 'première'.

The volume will be of interest to workers in applications of mixing and disordered systems because of the high quality and broad scope of the lectures. It will be of interest to physicists and applied mathematicians as an introduction to a range of challenging problems of considerable practical importance.

HASSAN AREF

SHORTER NOTICES

Computational Hydraulics: An Introduction. By C. B. VREUGDENHIL. Springer, 1989. 182 pp. DM 58.

This book has 21, mostly brief chapters. Many of them remind the reader of some problem in civil-engineering hydraulics and then proceed to develop or extend a relevant numerical method. In this way certain numerical topics are spread over several chapters. Examples are chosen to ensure that the reader is aware of truncation errors, numerical instability, numerical diffusion and similar topics. Hyperbolic and parabolic partial differential equations dominate the book, which concludes with two chapters on potential flow and one on finite elements. Many comments show the author's own experience and make this a suitable introduction for appropriate students.

Annual Review of Fluid Mechanics, vol. 22. Edited by J. L. LUMLEY and M. VAN DYKE. Annual Reviews Inc, 1990.

This year's collection of short reviews of the state of knowledge of specific topics in fluid mechanics is as follows:

Note on the History of the Reynolds Number, by N. Rott.

Issues in Viscoelastic Fluid Mechanics, by Morton M. Denn.

Wave Loads on Offshore Structures, by O. M. Faltinsen.

Rapid Granular Flows, by Charles S. Campbell.

Aerodynamics of Human-Powered Flight, by Mark Drela.

Boundary Layers in the General Ocean Circulation, by Glenn R. Ierley.

Parametrically Forced Surface Waves, by John Miles and Diane Henderson.

Wave–Mean Flow Interactions in the Equatorial Ocean, by M. J. McPhaden and P. Ripa.

Mixing, Chaotic Advection, and Turbulence, by J. M. Ottino.

Panel Methods in Computational Fluid Dynamics, by J. L. Hess.

Numerical Multipole and Boundary Integral Equation Techniques in Stokes Flow, by Sheldon Weinbaum, Peter Ganatos, and Zong-Yi Yan.

Plasma Turbulence, by P. L. Similon and R. N. Sudan.

Scientific Methods in Yacht Design, by Lars Larsson.

Optical Rheometry, by Gerald G. Fuller.

Aerothermodynamics and Transition in High-Speed Wind Tunnels at NASA Langley, by I. E. Beckwith and C. G. Miller III.

Viscous-Flow Paradoxes, by M. A. Goldshtik.

Local and Global Instabilities in Spatially Developing Flows, by Patrick Huerre and Peter A. Monkewitz.

Wakes Behind Blunt Bodies, by H. Oertel, Jr.

Introduction to Nonlinear Fluid-Plasma Waves. By B. K. SHIVAMOGGI. Kluwer, 1988. 202 pp. £44 or $79.

Shivamoggi begins his book by reviewing the major topics in this field, providing brief physical explanations and lists of relevant references. In the subsequent chapters the author expands on each phenomenon, covering nonlinear oscillations in an electron plasma, nonlinear ion-acoustic waves (including shocks and interacting solitons), parametric excitations of plasma waves, modulational instabilities and envelope solitons, and nonlinear relativistic waves, ending with a brief account of

waves in inhomogeneous plasmas. Two appendices summarizing the essentials of linear waves complete the text.

Each chapter is largely self-contained, with analysis presented in detail. Extensive references, many contemporary, appear throughout, and experimental evidence is reproduced in full where appropriate. Minor quibbles include the use of cgs units rather than mks, and some early conflict in notation, largely associated with typing errors. In summary, this introductory text exploits the use of generic equations to describe a wide range of wave phenomena in plasmas.

Applied Differential Geometry. By W. L. BURKE. Cambridge University Press, 1985. 414 pp. £35 (hardback), £15 (paperback).

This is a modern text using concepts of manifolds, differential forms, exterior calculus, fibre bundles, etc. The author aims to use index notation only when it is an improvement on coordinate free notation, which is developed somewhat further than usual. The target audience is made up of graduate physicists. Despite this, the many applications described do include examples of fluid flow, thermodynamics and wave propagation, which may make the book useful to fluid dynamicists.

The following volumes of conference proceedings have also been received:

Advances in Fluid Dynamics. Edited by W. F. BALLHAUS and M. Y. HUSSAINI. Springer, 1989. 330 pp. DM 94.

Cellular Automata and Modeling of Complex Physical Systems. Edited by P. MANNEVILLE, N. BOCCARA, G. Y. VICHNIAC and R. BIDAUX. Springer, 1989. 350 pp. DM 96.

PDEs and Continuum Models of Phase Transitions. Edited by M. RASCLE, D. SERRE and M. SLEMROD. Springer, 1989. 229 pp. DM 55.

Turbulence Measurements and Flow Modeling. Edited by C. J. CHEN, L.-D. CHEN and F. M. HOLLY. Hemisphere, 1987. 869 pp.

Recent Developments in Structured Continua. Edited by D. DE KEE and P. N. KALONI. Longman, 1990. 340 pp. £25.

Advances in Underwater Inspection and Maintenance. Graham & Trotman, 1989. 175 pp. £45.

Second Generation Subsea Production Systems. Graham & Trotman, 1989. 245 pp. £68.50.

Diverless and Deepwater Technology. Edited by E. R. JEFFREYS and A. J. FYFE. Graham & Trotman, 1989. 151 pp. £55.

Design, Modeling and Control of Pumps. Edited by C. R. BURROUGHS and N. D. VAUGHAN. Research Studies Press, 1989. 174 pp. £39.50.

Drag Reduction in Fluid Flows. Edited by R. H. J. SELLIN and R. T. MOSES. Ellis Horwood, 1989. 377 pp. £39.95.

Movable Bed Physical Models. Edited by H. W. SHEN. Kluwer, 1990. 171 pp.

Electrorheological Fluids. Edited by J. D. CARLSON, A. F. SPRECHER and H. CONRAD. Technomic, 1990. 454 pp.