

REVIEWS

SHORTER NOTICES

Structure and Dynamics of Partially Solidified Systems. Edited by D. E. LOPER.
Martinus Nijhoff, 1987. 506 pp. Dfl. 250 or £91.25.

This book presents 22 of the 50 papers delivered at a stimulating, multi-disciplinary workshop held at Lake Tahoe in May 1986. The papers have been divided into 4 parts. The first concentrates on results obtained mainly from laboratory experiments; the second on theoretical investigations of phase changes and the resultant crystal growth; the third on models for slurries and mushy zones; and the fourth considers numerous geological situations in which solidification plays an important role. Scientists who want to learn about some of the problems currently generating excitement in this rapidly growing field would find something of interest in many of the papers. The book ends with a bibliography of approximately 500 recent papers on many of the different areas of direct relevance to partially solidified systems. This compilation will undoubtedly prove to be very useful.

Numerical Techniques in Continuum Mechanics. Notes on Numerical Fluid Mechanics, Volume 16. Edited by W. HACKBUSCH and K. WITSCH. Vieweg, 1987. 124 pp. £17.95.

This volume, printed from camera-ready copy, contains 11 contributions selected from those given at the Second GAMM Seminar, at Kiel in 1986. The papers included are as follows:

1. K. Eriksson, C. Johnson and J. Lennblad. Optimal error estimates and adaptive time and space step control for linear parabolic problems.
2. L. Fuchs. An efficient numerical scheme for vortical flows.
3. F. K. Hebeker. On the numerical treatment of viscous flows past bodies with corners and edges by boundary element and multigrid methods.
4. B. Kroplin. A technique for structural instability analysis.
5. P. Le Tallec and A. Lofti. Decomposition methods for adherence problems in finite elasticity.
6. H. D. Mittelman and B. H. Thomson. An algorithm that exploits symmetries in bifurcation problems.
7. P. Neittaanmaki and M. Krizek. Post-processing of a finite element scheme with linear elements.
8. J. Pitkaranta. On a simple finite element method for plate bending problems.
9. R. Rannacher. Richardson extrapolation with finite elements.
10. R. Stenberg. On the post-processing of mixed equilibrium finite element methods.
11. O. B. Widlund. An extension theorem for finite element spaces with three applications.

As may be judged from this list, the bias is heavily towards finite elements, and many of the papers represent the mathematical rather than the applied end of the numerical analysis spectrum. Most of the applications are taken from solid mechanics

rather than fluid mechanics, so that one may feel the title to contain something of a misnomer. The only two contributions dealing specifically with problems in fluid mechanics are papers 2 and 3, which are concerned with efficient methods for solving the Euler equations in compressible flow, and with the treatment of corners and edges in slow, viscous flow.

Research in Numerical Fluid Mechanics. Notes on Numerical Fluid Mechanics, Volume 17. Edited by P. WESSELING. Vieweg, 1987. 129 pp. £18.75.

This volume contains the proceedings of the 25th meeting of the Dutch Association for Numerical Fluid Mechanics, and has been produced from camera-ready copy. Nine papers are included:

1. J. W. Boerstoel, A. E. P. Veldman, J. van der Vooren and A. J. van der Wees. Trends in CFD for aeronautical 3-D steady applications: the Dutch situation.
2. C. Cuvelier. On the computation of free boundaries.
3. D. van Essen, G. Kupers and H. Mes. Thermal hydraulic modeling studies on heat exchanging components.
4. M. Hoekstra. Computation of steady viscous flow near a ship's stern.
5. C. J. Hoogendoorn and Th. H. van der Meer. Convection-diffusion phenomena and a Navier-Stokes processor.
6. M. A. Hulsen and J. van der Zanden. Problems, analysis and solutions of the equations for viscoelastic flow.
7. B. Koren and S. Spekreijse. Multigrid and defect correction for the efficient solution of the steady Euler equations.
8. A. J. Renkema, R. Verstappen, R. W. de Vries and P. J. Zandbergen. Some experiences with spectral methods.
9. G. K. Verboom and A. Segal. Weakly-reflective boundary conditions for shallow water equations.

Papers 1, 3 and 5 are principally concerned with applications of computational fluid dynamics (CFD) rather than with the development of new techniques. The first of these represents an interesting description of the integration of CFD with computer-aided design methods at the Dutch National Aerospace Laboratory. At the other extreme, paper 6 is a mathematical account of some of the difficulties encountered in modelling viscoelastic flows. The remaining contributions, whose titles are self-explanatory, present a mixture of novel numerical techniques and illustrative examples.

Annual Review of Fluid Mechanics, Volume 19. Edited by J. L. LUMLEY, M. VAN DYKE and H. L. READ. Annual Reviews Inc., 1987. 626 pp. \$32.00 (\$35.00 outside USA).

The contents of the 1987 volume in the series, always the year's best buy for those wishing to keep up with the many branches of fluid mechanics, are:

- Ludwig Prandtl and his Kaiser-Wilhelm-Institut, by K. Oswatitsch and K. Wieghardt.
- Confined Vortices in Flow Machinery, by Marcel Escudier.
- Turbulent Secondary Flows, by Peter Bradshaw.
- Upstream Blocking and Airflow Over Mountains, by Peter G. Baines.

- Cavitation Bubbles Near Boundaries, by J. R. Blake and D. C. Gibson.
 A Description of Eddying Motions and Flow Patterns Using Critical-Point Concepts, by A. E. Perry and M. S. Chong.
 Viscoelastic Flows Through Contractions, by D. V. Boger.
 Theory of Solute Transport by Groundwater, by Gedeon Dagan.
 Tsunamis, by S. S. Voit.
 Turbulent Premixed Flames, by S. B. Pope.
 Viscous Fingering in Porous Media, by G. M. Homsy.
 Computation of Flows With Shocks, by Gino Moretti.
 Spectral Methods in Fluid Dynamics, by M. Y. Hussaini and T. A. Zang.
 Dynamics of Tornadoic Thunderstorms, by Joseph B. Klemp.
 Thermocapillary Instabilities, by Stephen H. Davis.
 Magnetic Fluids, by Ronald E. Rosensweig.
 Von Kármán Swirling Flows, by P. J. Zandbergen and D. Dijkstra.
 Isolated Eddy Models in Geophysics, by G. R. Flierl.
 Recent Developments in Rapid-Distortion Theory, by A. M. Savill.
 Rarefaction Waves in Liquid and Gas-Liquid Media, by S. S. Kutateladze, V. E. Nakoryakov and A. A. Borisov.

Shock Waves and Shock Tubes. Edited by D. BERSHADER and R. HANSON. Stanford University Press, 1986. 922 pp. \$49.50.

This heavy and informative volume of Proceedings of the Fifteenth International Symposium on Shock Waves and Shock Tubes, Berkeley, California, 28 July–2 August 1985, bears witness to the long-standing interest aroused by shock waves and shock tubes. The main feature of this symposium is reflected by the change of title: the words ‘shock waves’, absent during the first nine symposia on shock tubes and then added afterwards, have now been placed in front, stressing the shift from the scientific device to the physical phenomenon for which shock tubes served and still serve as the basic tools of investigation. They are now widely used as diagnostic devices for a variety of phenomena: shock-heated gases, shock-excited spectra, shock-generated chemical kinetics etc., and all these subjects are covered. A second large group of papers is related to the ‘geometry’ of shock waves: to their collision, reflection, diffraction, interaction with obstacles and, finally, to the focusing of shock waves. This last problem is now of special importance because of its application to the fracturing of kidney and gall stones, a subject considered in two plenary lectures. The proceedings also clearly indicate a rise of interest in shocks in multiphase and heterogeneous media (like dusty gases) and also in condensed matter. In contrast the ‘classical’ problems of shock-wave aerodynamics attract at present much less attention in spite of the fact that a large body of problems are still unresolved. It seems already to be a tradition of this series of meetings that there is no sharp division between theoretical and experimental work. Many papers combine experimental findings with either analytical or numerical approaches and even papers collected under the heading ‘Experimental methods’ are not confined only to new techniques of investigation.

Modelling the Flow and Solidification of Metals. Edited by T. J. SMITH. Nijhoff, 1987. 311 pp. Dfl 165.00 or \$79.90 or £55.95.

This book consists of 17 papers. Some report lectures delivered at a Workshop held in Cambridge in late 1985 under the auspices of the Cambridge Wolfson Group for

Studies of Fluid Flow and Mixing in Industrial Processes. Some of the other papers were presented at a meeting in early 1986 on modelling solidification processes, which was organised by the Institute of Metals. The papers cover a wide range. The areas discussed include: the mathematical relevance of weak solutions to the solidification equations; various numerical methods to determine solutions; the influence of complicated geometries on industrial solidification situations; and some of the fluid flow phenomena resulting from solidification. The volume is dedicated to the memory of Arthur Shercliff who was an enthusiastic advocate of the Cambridge Wolfson Group.