reader who wishes to obtain an overview of research in a particular area. They are seldom adequate for the serious study of new techniques or applications. The present volume is no exception to this rule. The editors, all of the Center for Nonlinear Studies at Los Alamos National Laboratory, have collected 34 papers representing four areas of Nonlinear Problems. The papers were invited for, and in some case contributed to, a conference held at the Center in 1981. The areas are *I*: New Methods and Results in Nonlinear Analysis (11 papers), *II*: Nonlinearity in Field Theories and Low Dimensional Solids (8 papers), *III*: Reaction Diffusion Systems (2 papers), and *IV*: Nonlinear Phenomena in Fluids and Solids (13 papers).

The first and last two areas are probably of most interest to the readers of this journal, and I will therefore concentrate on them.

In the first, the rapidly expanding research area of integrable partial differential equations is represented by the contributions of Flashka/Newell and Sattinger. Finite dimensional Hamiltonians, including problems of the motions of point vortices, integrability and stellar dynamics within a galaxy, are discussed by Palmore, Lewis/Leach, and Newman. A survey of numerical methods for nonlinear equations is provided by Hyman, and papers on optimal control of distributed systems (J.-L. Lions), Variational Problems (P. L. Lions), Limit analysis (Fremond et. al.), Hamilton Jacobi equations (Crandall), and Yang Mills Fields (Singer) complete this rather diverse section. The second section is concerned mainly with problems in the physics of solids and includes several papers on the physical applications of soliton theory. The two excellent papers in Section *III*, by R. Aris and P. C. Fife, deal with models of chemical kinetics and propagating reaction fronts, respectively.

In the final section Gollub and Roux et. al. describe experimental evidence for periodic and chaotic motions in convection and chemical reactions. Bardos, Foias/Temam, Howes, and Mathieu et. al. consider various aspects of the Navier Stokes equations, including the existence of an attracting infinite dimensional manifold in phase space for finite viscosity, boundary layers, and the closure problem in turbulence theory. Patera and Orzag summarize their meticulous and extensive nonlinear stability studies of pipe flow. Two papers on the dynamics of one-dimensional mappings and universal bifurcation structures, by Feigenbaum and Chang et. al., follow. The section concludes with two papers on instability and turbulence in plasmas, by Greene and Pesme/Dubois, and papers on the nonlinear Schrodinger and related equations occurring in nonlinear stability studies (Rose/Dubois and Wang).

As this brief list shows, this is a very diverse collection and the coverage is, consequently, uneven and sometimes cursory. The papers range from Fife's fairly complete review on propagating fronts and Foias and Temam's detailed proof of existence of an "approximative stationary (finite dimensional) manifold" which attracts all solutions of the Navier Stokes equations, to relatively slight notes on special problems. However, as a whole, the editors have collected papers that do provide a good cross section of current research in nonlinear analysis, and which certainly illustrate the diverse applications that the methods of global analysis and bifurcation theory are now finding. The volume is therefore a useful survey and a reasonable starting point for someone wishing to explore a new and exciting field.

In closing this review I would like to mention two further conference proceedings which cover similar ground, with somewhat different emphasis, namely, *Bifurcation Theory and Applications in Scientific Disciplines* (edited by O. Gurel and O. Rössler, *Ann. N. Y. Acad. Sci.*, Vol. 316, 1979) and *Nonlinear Dynamics* (edited by R. H. G. Helleman, *Ann. N. Y. Acad. Sci.*, Vol. 357, 1980). I also draw the reader's attention to the forthcoming Proceedings of the 1982 "Order in Chaos" meeting held at Los Alamos. The latter will appear as an issue of *Physica D*, and also as a volume in the same North Holland Series as the present one.

Finite Element Flow Analysis. Edited by T. Kawai. North-Holland, The Netherlands, 1982. 1096 Pages. Price $95.00.

REVIEWED BY P. M. PINSKY[3]

This book, 1096 pages long, contains the proceedings of the Fourth International Symposium on Finite Element Methods in Flow Problems held at Chuo University, Tokyo, on July 26–29, 1982. The proceedings are dedicated to the memory of Professor Kyuichiro Washizu who was a member of the Japanese Organizing Committee until his death in November 1981. The proceedings of the conference, the fourth in a series which was first held at the University of Wales, Swansea, in 1974, consist of 131 papers and one abstract dealing with recent developments and applications in the finite element method as well as boundary integral techniques, to a wide range of fluid mechanics problems. The contents of the book are divided into 14 chapters, the titles of which illustrate the considerable scope of this conference. These are: General Lecture, Mathematical Analysis, Viscous Flow, Thermal Convection, Polymer Flow, Compressible Flow, Wave, Free Surface Flow, Shallow Water Flow, Seepage Flow, Sediment Transport, Further Application, Boundary Element Method, and Computational Techniques.

Chapter 1 presents four general lectures, the first of which is a paper by K. Washizu in which finite element, boundary element, and modified fluid-in-cell techniques are applied to solve several nonlinear free surface fluid flow problems. The next general lecture by O. C. Zienkiewicz et al., of which only an abstract is printed, presents a survey of the recent development of the finite element method applied to the time-dependent problems of Navier-Stokes and shallow water wave flow. J. T. Oden and O. Jacquotte present an abbreviated paper on the convergence of RIP (reduced integration-penalty) methods for two-dimensional incompressible viscous flows. Chapter 1 is concluded by a survey of numerical procedures for weather prediction in a paper by Y. K. Sasaki and L. P. Chang. The remaining 13 chapters, containing a total of 128 papers, bring together the work of major researchers and contain many notable contributions dealing with new results for subsonic and transonic fluids as well as topics as diverse as geothermal heat storage, thermal analysis in biomechanics, and the circulation of lakes.

Both the variety of problems now capable of solution and the rapid development of new techniques, as exemplified by the contents of these proceedings, clearly demonstrate that the extraordinary rate of progress that this branch of computational fluid mechanics has been experiencing over the last 10 years is continuing in full force. Much of the latest research on the development and application of the finite element method and boundary integral procedures is collected on a worldwide scale in this volume and it is highly recommended as a reference book to libraries of universities as well as research organizations dealing with any aspect of computational fluid mechanics.

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