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REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS

The numbers in brackets are assigned according to the American Mathematical Society classification scheme. The 1991 Mathematics Subject Classification can be found in the annual subject index of *Mathematical Reviews* starting with the December 1990 issue.

5[65-02]—*Acta numerica 1995*, A. Iserles (Managing Editor), Cambridge University Press, Cambridge, 1995, 491 pp., $25\frac{1}{2}$ cm, $59.95

This is the 1995 issue of the annually published series Acta Numerica, which was started in 1992, but which does not appear to have been reviewed earlier in Math. Comp. The managing editor of the series is Professor A. Iserles of the University of Cambridge, England, who at his side has an editorial board of about 10 leading numerical analysts. The ambition, as expressed in the preface to the -92 volume, is to '...counteract the information explosion by presenting selected and important developments in numerical mathematics and scientific computation on an annual basis', and this is done by inviting authors on the basis of their contributions to the area and their excellence in presentation to write survey papers on relevant topics. In my opinion this is a very worthwhile purpose, and the present volume contains a convincing selection of such surveys. I could imagine that it may become increasingly difficult to find suitable topics and expositors as the years progress.

The present volume contains 7 articles and begins with a very well written presentation by P. T. Boggs and J. W. Tolle of *Sequential Quadratic Programming*, which is a class of iterative methods for solving nonlinearly constrained optimization problems employing quadratic subproblems. The authors first introduce the basic method, under the appropriate assumptions, and then discuss local and global convergence relating the algorithms to Newton's method. Several problems regarding implementation are also touched upon.

In *A Taste of Padé Approximation*, C. Brezinski provides an introduction to Padé approximation and related topics, with emphasis on questions relevant to numerical analysis and applications. Algebraic properties, including the relation with orthogonal polynomials and recursive computation, convergence theory, some generalizations, and applications, e.g., to A-acceptable approximations of ordinary differential equations are presented in separate sections.

Introduction to Adaptive Methods for Differential Equations, by K. Eriksson, D. Estep, P. Hansbo, and C. Johnson, is an enthusiastic account of Johnson's program for the design, analysis, and implementation of computational methods for differential equations, based on Galerkin finite element techniques and adaptivity. The framework is proposed to be accessible enough to be suitable for integration into basic calculus courses, thus fulfilling what the authors refer to as Leibniz's vision.

The paper *Exact and Approximate Controllability for Distributed Parameter Systems*, by R. Glowinski and J. L. Lions, is the second part of what amounts to a monograph on control of evolutionary partial differential equations, the first part of which appeared in Acta Numerica 1994. With its over 170 pages, or more than a third of the present volume, it is by far the longest paper and exceeds perhaps the ideal length of a survey paper for this series. After the groundwork laid in the -94 volume on control of linear diffusion equations, the authors continue in a systematic way to cover boundary control, control of Stokes systems and nonlinear diffusion equations, and control of wave equations and coupled systems. The different sections begin with theoretical considerations and continues with discretization with respect to both time and space, iterative techniques, and finally the results of a large number of numerical experiments.

Numerical Solution of Free Boundary Value Problems, by T. Y. Hou, is concerned with recent advances in developing efficient and stable numerical methods for problems with propagation of free surfaces, such as water waves, boundaries between immisible fluids, vortex sheets, Hele-Shaw cells, thin film growth, crystal growth and solidification. The paper first discusses locally well-posed problems using the boundary integral method, with application to water waves, and in a second part such methods are applied to ill-posed problems of fluid interfaces, mentioning in particular vortex sheets and associated singularity formation. In further sections the stabilizing effect of boundary tension is considered, as well as problems for which the boundary integral method is not suited.

Particle Methods for the Bolzmann Equation, by H. Neunzert and J. Struckmeier, discusses in a rather informal way numerical simulation of rarified gas flows by particle methods. After a section on collision integrals, particle methods are introduced first for the spatially homogeneous and then for the inhomogeneous Bolzmann equation. Practical aspects, relating to collision pair selection, stochastic methods, use of singular limits, domain decomposition, and use of parallelism are touched upon and some numerical results presented.

The New qd Algorithms, by Beresford N. Parlett, presents recent work, in which the author has been involved, concerning methods for computing eigenvalues and eigenvectors of tridiagonal matrices. The new algorithms discussed are based on factoring such tridiagonal matrices into bidiagonal ones and on Rutishauser's LR algorithm.

The numerical mathematics community will look forward to the 1996 volume of Acta Numerica with anticipation.

VIDAR THOMÉE

6[65-01, 65M06, 65N06]—*Numerical solution of partial differential equations*, by K. W. Morton and D. F. Mayers, Cambridge University Press, Cambridge, 1994, 227 pp., $22\frac{1}{2}$ cm, hardcover, \$54.95, paperback, \$22.95

This is a book that grew out of undergraduate courses at Oxford. The emphasis is on traditional finite difference theory and the use of stability (and consequent emphasis on truncation errors). Stability is considered in L_∞ for parabolic and elliptic problems (using maximum-principles) and in L_2 (von Neumann-Fourier analysis) for hyperbolic and parabolic problems.

The presentation, naturally given in model situations for a course of this nature, is very clear and precise with mention (and most often some analysis) of key practical issues such as curved boundaries.

I believe that, in a first course of this nature, the Lax Equivalence Theorem should come with warning labels: "Do not thoughtlessly discard unstable methods."