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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.

1[65-00, 41-00, 41A05, 41A21, 41A55, 41A65, 65C05, 65H05, 65T20, 73C50, 73V20]—*Handbook of numerical analysis*, Vol. III, P. G. Ciarlet and J. L. Lions (Editors), *Techniques of scientific computing* (Part 1), *Numerical methods for solids* (Part 1), *Solution of equations in* $\mathbb{R}^n$ (Part 2), North-Holland, Amsterdam, 1994, x+778 pp., $24\frac{1}{2}$ cm, $154.25/Dfl. 270.00

This book contains three parts: 1) Techniques of Scientific Computing; 2) Numerical Methods for Solids; 3) Solution of Equations in $\mathbf{R}^n$. Nevertheless, only the second part gets close to "numerical methods for large-scale computation". The aims of the book are rather "constructive methods", which are often the background to numerical methods.

The first part is concerned with three aspects of approximation theory. First, Claude Brezinski provides an interesting historical perspective on interpolation, approximation and numerical quadrature since the year 1611. His main contribution, however, is a survey on Padé approximation, written jointly with van Iseghen. The algebraic theory naturally elucidates the connections with orthogonal polynomials and continued fractions. The convergence theory contains, on the one hand, a complete theory for Stieltjes functions and, on the other hand, only convergence in capacity for the general case. A contribution of Sendov and Andreev includes such varied topics from approximation theory as the Abel-Gontcharov interpolation problem, the fast Fourier transform, the Kolmogorov criterion for uniform linear interpolation, Monte Carlo methods for numerical integration, and finally approximation in the Hausdorff metric.

The second part of the book with the subtitle "Numerical Methods for Nonlinear Three-Dimensional Elasticity" provides a survey on a topic which is rarely found in the literature in such a nice and condensed form. Le Tallec, on 200 pages, addresses people who know how to solve linear elliptic problems (by finite elements) but who may have little experience in elasticity theory. The appropriate setting for treating the nonlinear equations from elasticity by Newton's method in a robust way is a crucial theme. Specifically, algorithms for such problems, which are of general interest, have to cover the treatment of incompressible or almost incompressible materials; the restriction $\det(I + \operatorname{grad} u) = 0$ is genuinely nonlinear. Emphasis is on the augmented Lagrangian method, which is treated in the framework of dualization. The contribution concludes with an excursion into viscoelastic materials.

The last part by Sendov, Andreev and Kjurkchiev concentrates on polynomial equations in one variable. The survey starts with a wrong proof of the fundamental lemma of algebra. Much space is given to estimates of the number of roots in

special subsets of the complex plane, and to bounds on circles which contain all roots. The authors emphasize that the old methods of Bernoulli, Graeffe, Laguerre, and Lehmer-Schur are not only of historical interest. Weierstrass' iteration for the computation of all roots, which has been rediscovered several times, is treated with care. Bounds on the complexity conclude the text.

The most original part of the book is the contribution on solids, and even if the book were restricted to that alone, it would be worth having it.

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2[65-06, 65Nxx]—*Boundary value problems for partial differential equations and applications*, J.-L. Lions and C. Baiocchi (Editors), Research Notes in Applied Mathematics, vol. 23, Masson, Paris, 1993, xii+460 pp., 24 cm, softcover, F 390

This volume contains 44 papers with a total of 71 authors. The papers were all solicited as a tribute to Enrico Magenes on the occasion of his 70th birthday. Given the reputations of the contributing authors and the great esteem in which the honoree is held among workers in Numerical PDEs, it is no surprise that the papers are of high quality. It is likely that quite a number of these papers will be of interest to many readers of *Mathematics of Computation.*

J.H.B.

3[49-02, 70-08, 70Q05]—*Control and estimation in distributed parameter systems*, H. T. Banks (Editor), Frontiers in Applied Mathematics, vol. 11, Society for Industrial and Applied Mathematics, Philadelphia, PA, 1992, xii + 227 pp., 25 cm, softcover, $56.50

This book is volume 11 in the Frontiers in Applied Mathematics series published by SIAM. It consists of five, primarily review, contributions, each between 40 and 54 pages in length and each with extensive bibliographies.

The contributors and their topics, in order, are

1. J.-L. Lions on "Pointwise control for distributed systems",

2. M. C. Delfour and M. P. Polis on "Issues related to stabilization of large flexible structures",

3. J. S. Gibson and A. Adamian on "A comparison of three approximation schemes for optimal control of a large flexible structure",

4. D. L. Russell on "Mathematical models for the elastic beam with frequency proportional damping", and

5. R. F. Curtain on "A synthesis of time and frequency domain methods for the control of infinite-dimensional systems: a system theoretic approach".

For the most part these articles are independent and treat the formulation of, and analytical questions about, specific classes of control problems. Only the third chapter emphasizes computational questions and methodology. The last four chapters each use various beam equations and models as examples for their analysis. The book provides a good snapshot of the state of the art of these topics at the