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[65N30, 65N50, 65F10].—STEPHEN F. MCCORMICK, *Multilevel Adaptive Methods for Partial Differential Equations*, Frontiers in Applied Mathematics, Vol. 6, SIAM, Philadelphia, PA, 1989, ix + 162 pp., 23 cm. Price: Softcover $24.50.

This book provides an introduction to a class of multilevel methods for solving discretized partial differential equations. The discretization method used is the finite volume method (also known as box method). A brief introduction of this method is given in Chapter 2. Chapter 3 describes some basic concepts of the standard multigrid method. The major topic of the book, presented in Chapter 4, is how the multigrid method is used on a special locally refined grid. Ideas and techniques of the so-called FAC (fast adaptive composite grid) algorithms are discussed together with some preliminary theoretical analysis. The AFAC method, a parallelized version of FAC, is studied in Chapter 5.

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2[35J85, 73C50, 73E99, 73F99, 73K05, 65N30].—ROLAND GLOWINSKI & PATRICK LE TALLEC, *Augmented Lagrangian and Operator-Splitting Methods in Nonlinear Mechanics*, SIAM Studies in Appl. Math., Vol. 9, SIAM, Philadelphia, PA, 1989, x + 295 pp., $23\frac{1}{2}$ cm. Price $44.50.

Many of the most interesting problems of nonlinear mechanics involve constraints, either present because of the physics of the problems, or introduced artificially to provide a formulation convenient for computation. These include problems of incompressibility in nonlinear elasticity, unilateral constraints in contact problems, or general problems in elasticity, plasticity and elasto-viscoplasticity. In 1983 a popular collection of contributed papers appeared on the subject of augmented Lagrangian methods, edited by Michel Fortin and Roland Glowinski, which showed that these methods provided an attractive general approach to broad classes of constrained problems in nonlinear mechanics. The present book, written by two researchers who have contributed extensively to

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this subject, describes an impressive collection of applications of variants of augmented Lagrangian methods in nonlinear mechanics.

The book begins with a review of fundamental concepts of continuum mechanics including basic concepts of Sobolev spaces, existence theorems, and the characterization of solutions to weak or variational formulations of nonlinear initial and boundary value problems. Some of the basic equations of quasi-static viscoplasticity, elasto-viscoplasticity, and finite elasticity are given in a second chapter. Then the augmented Lagrangian methods for the solution of variational problems are presented and discussed in considerable depth in Chapter 3. The remaining chapters concern specific algorithms applying the augmented Lagrangian methods to various problem classes.

Chapter 4 is particularly interesting as it applies these methods to viscoplasticity and elasto-viscoplasticity problems with small strains. Limit load analysis is covered in Chapter 5 and two-dimensional flow of incompressible viscoplastic fluids is covered in Chapter 6. Chapter 7 is devoted to problems of finite elastic deformation. Emphasis is given to finite element discretizations and iterative solution methods based on augmented Lagrangian formulations. Included in this chapter are also some problems of contact. In Chapter 8, the final chapter in this work, large-displacement behavior of flexible rods is discussed. This work includes the solutions of dynamical problems.

The book is well written, laid out in a readable style, and the major algorithms are set out in a tabular-box format in the text. The book provides, at the same time, an excellent introduction and a text to augmented Lagrangian methods as well as a reference to researchers and engineers looking for powerful numerical methods to treat nonlinear problems in mechanics. This book is an important contribution to the field.

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3[65N38, 65R20, 65L10, 45E10].—MICHAEL A. GOLBERG (Editor), *Numerical Solution of Integral Equations*, Mathematical Concepts and Methods in Science and Engineering, Vol. 42, Plenum Press, New York, 1990, xiii + 417 pp., $23\frac{1}{2}$ cm. Price $75.00.

This book consists of eight interesting survey papers on current topics in the numerical treatment of integral equations. Combined, these papers cover a vast area. All of them are well organized, clearly written and easy to follow. If a theorem is given without a proof, a suitable reference is supplied for the interested reader. Each paper contains a long reference list which is very useful for further study. I note with satisfaction that the book has an index, something which cannot always be taken for granted in collections of this type.

The following list of chapter headings gives an indication of the contents of this volume:

1. K. E. Atkinson: A survey of boundary integral equation methods for the numerical solution of Laplace's equation in three dimensions.
2. I. H. Sloan: Superconvergence.