25[65-01, 65M05, 65M10, 65M15, 65N05, 65N10, 65N15, 65N20].—JOHN C. STRIKWERDA, *Finite Difference Schemes and Partial Differential Equations*, Cole Mathematics Series, Wadsworth & Brooks, Pacific Grove, California, 1989, xii + 386 pp., $24\frac{1}{2}$ cm. Price \$47.95.

According to the author's preface, this book is intended as an introductory graduate text on finite difference methods for students in applied mathematics, engineering and the sciences. The purpose is both to present basic material which is useful in scientific computing and to convey a theoretical understanding of the methods, assuming no mathematical background beyond advanced calculus. The contents are proposed to suffice for two one-semester courses, an introductory one, and a somewhat more advanced one.

The book starts out with five chapters essentially on finite difference methods for first-order scalar hyperbolic equations in one space dimension, with constant coefficients, where standard concepts such as convergence, consistency and stability as well as dissipation and dispersion are defined, exemplified and analyzed. The next three chapters, Chapters 6–8, deal with parabolic equations, systems of equations in higher dimensions, and second-order hyperbolic equations. The following three contain somewhat more advanced material: Chapter 9 discusses well-posedness and stability in L_2, including a nice proof of an extended version of the Kreiss stability theorem (which, incidentally, is then never applied!). Chapter 10 is on the Lax equivalence theorem and on convergence analysis and the dependence of convergence rates on the regularity of the solutions and data, and Chapter 11 reviews the Gustafsson-Kreiss-Sundström stability theory for discrete boundary conditions. Of the final three chapters, Chapter 12 contains a rudimentary treatment of finite difference methods for elliptic problems and Chapters 13 and 14 give elements of iterative methods for solving the resulting linear systems of equations.

The selection of the material naturally reflects the interest of the author, and this has given it an emphasis on methods for hyperbolic equations, which are studied in the style of the school of H. O. Kreiss. The treatment is almost entirely based on the use of Fourier transforms and assumes that the equations and difference schemes have constant coefficients. The main tool is Parseval's relation, and the results are expressed in terms of L_2-type estimates, so that, in particular, well-posedness and stability are always considered to be with respect to the L_2 norm. Even the Lax-Richtmyer equivalence theorem is given in this framework and has thereby lost some of its elegance and generality. (The reviewer feels the author's extremely respectful comments on this result somewhat overstate its importance.) Since the author wants to keep the presentation accessible to students with limited mathematical knowledge, many interesting things have had to be omitted, and some are presented without proofs, such as most of the Gustafsson-Kreiss-Sundström theory.

The book is thus quite limited in its scope. No discussion of variable-coefficient problems is included beyond a few remarks to the effect that the constant-coefficient results are of importance also for such cases, and nonlinear problems are not mentioned. Also, the section on elliptic problems is shorter and more sketchy than would be indicated by the importance of such problems. Here more attention is paid to the iterative solution of the resulting system of linear algebraic equations than the finite difference equations themselves, but even so, there is no mention of modern fast methods such as fast Fourier transform methods or multigrid methods.

One could question the usefulness, for the intended purpose, of a text with the composition of the present book at a time when a large fraction of the computations in engineering and science are done by finite elements, and when also those that are carried out by finite differences relate to problems with variable coefficients, nonlinearities, and complicated geometries. It appears to the reviewer that it is not natural to expect students of the type to which the book is directed to take two consecutive courses on this rather restricted part of the numerical PDE area.

Although the approach of the presentation is novel in some instances, most of the material dates back 15–20 years (more care could have been taken to give a correct historical account). The text contains a lot of nice mathematics, and for someone who was involved in finite differences at the time, it brings back nice memories. The presentation is clear and well organized, and although the reviewer feels that the selection of material is nonoptimal for the purposes stated, and not quite up to date, the book offers a good way of learning what it covers.

V. T.

26[73-02, 65-02, 73K30, 73M05, 65N30, 45L10].—T. A. Cruse, *Boundary Element Analysis in Computational Fracture Mechanics*, Mechanics: Computational Mechanics, Vol. 1, Kluwer Academic Publishers, Dordrecht, 1988, xiii + 162 pp., $24\frac{1}{2}$ cm. Price \$67.00/Dfl.125.00.

This book presents a collection and review of the author's fundamental contributions to the boundary element method with special emphasis on fracture mechanics. This specific point of view is the fascination of this book as well as its limitation. It is well written and self-contained. From fracture mechanics as well as from boundary integral methods, only those aspects are selected which are of principal importance for computational boundary element methods and which stem from the original work of the author. Hence, the topics are restricted to static fracture mechanics and to classical stationary plasticity. Dynamical aspects and dynamic viscoplasticity are not dealt with. As the author emphasizes, this is not a reference book but an interesting monograph which can serve as an introduction to the field as well as a source of interesting details for the specialist. The mathematical analysis is classical; neither modern