too freely applied. In variable coefficient and nonlinear cases it is sometimes unclear what are established results and what are conjectures. In the elliptic chapter the author states incorrectly (p. 243) that the formally $O(h)$ Shortley-Weller approximation in the case of a curved boundary detracts from the overall $O(h^2)$ approximation of the five-point approximation. He further hints (p. 235) that higher-order approximation should be used in the case of nonsmooth solutions, although, in general, such methods require at least as much regularity to be competitive.

In conclusion, the reviewer feels that the book could be a useful introduction for the applied scientist with a weak mathematical background. It provides easy reading at the expense of generality, depth and precision. In its emphasis on finite differences, however, it does not properly account for the advances in computational techniques of the last few decades.

V. T.

11[65–01].—G. D. SMITH, *Numerical Solution of Partial Differential Equations, Finite Difference Methods*, 3rd ed., Clarendon Press, Oxford, 1985, xi + 337 pp., 22 cm. Price $19.95.

This book is the third, somewhat modified, edition of a text which first appeared in 1965. It presents the finite difference method in a manner which was standard at that time, with emphasis on formulation of finite difference equations, often motivated by manipulations with Taylor series. It describes the most basic explicit and implicit methods for model parabolic and hyperbolic equations in one space dimension and the usual five-point method for Poisson's equation, together with some common devices for increasing the accuracy. Special attention is paid to time discretization by means of Padé type schemes of equations which are already discretized in the space variable, and to the concept of stiff equations. Stability analysis is carried out for simple model problems in the time-dependent case, using von Neumann's approach, and Gerschgorin's matrix theorem plays a central role in the discussion of the matrix equations. In the elliptic part, the Jacobi, Gauss-Seidel, and SOR iterative procedures for solving the system of difference equations are also considered.

Although some additions have been made in the new edition, the exposition has been only slightly affected by the developments of the last three decades. Thus, the increasing impact of the theory of partial differential equations on the formulation and analysis of numerical methods is essentially ignored or inadequately represented. For instance, application of energy arguments and a discussion of the effect on the error of the regularity of the solution are missing. In the new section on stability for initial value problems the author is somewhat influenced by the Lax-Richtmyer theory, but does not present or apply it properly. Trying to illustrate the Lax equivalence theorem, he describes (p. 72) the existence part of the condition for correctness as: "A solution always exists for initial data that is arbitrarily close to initial data for which no solution exists." In the elliptic part he says (p. 248, unchanged from the first edition): "Although no useful general results concerning the magnitude of the discretization error as a function of the mesh lengths have yet been established, it seems reasonable to assume that this error will usually decrease as the mesh lengths are reduced." In spite of this statement he shows (in the new edition) a basic error estimate for the five-point operator, which he describes as extremely useful. Referring to this estimate, he then comments incorrectly (p. 254): "It also proves that the discretization error is proportional to h^2 so Richardson's 'deferred approach to the limit' method can be used effectively to improve the accuracy of the solution of the difference equations." He remarks (p. 255), somewhat misleadingly, that the requirement of the fourth derivatives of the solution to be bounded "... is not satisfied if, for example, the boundary contains corners with internal angles in excess of 180°."

The list of references for supplementary reading also reveals the author's lack of familiarity with recent developments.

In spite of the dominance today of the finite element method, particularly as concerns elliptic and parabolic problems, the reviewer feels that the finite difference method is still of sufficient importance to justify the publication of a textbook. Unfortunately, however, the present one must be considered severely outmoded.

V. T.

12[65N99].—Carlos A. Brebbia (Editor), *Topics in Boundary Element Research*, Volume I: *Basic Principles and Applications*, Springer-Verlag, New York, Heidelberg, 1984, xiii + 253 pp., $24\frac{1}{2}$ cm. Price $49.50.

This is the first volume in yet another series of publications on the boundary element method edited by Carlos Brebbia. In the Introduction to the Series, it is stated that the series was launched to satisfy an unfilled need, namely that which "exists for a serial publication in which the most recent advances in the method are documented in a more complete form than is usually the case in papers presented at conferences or scientific gatherings". Whether such a need actually existed is debatable in view of the fact that another series "Developments in Boundary Element Methods" edited by P. K. Banerjee et al., with somewhat similar goals, had been started, the first two volumes [1], [2] having been published in 1979 and 1982. Since then two more volumes have appeared [3], [4]. Several of the contributors to the present volume have also contributed to Banerjee's series.

In this volume, there are eleven chapters (three of which are co-authored by the editor) covering such topics as time-dependent problems, fluid mechanics, hydraulics, geomechanics, and plate bending as well as mathematical aspects of the boundary element method. Three chapters are devoted to the latter, the first of which is Chapter 0, entitled "Boundary Integral Formulations" written by the editor and J. J. Connor. This chapter is aptly numbered because there is very little in it of relevance to boundary element methods. Material which is relevant is presented in a more understandable fashion by other authors in later chapters. Much of the discussion in Chapter 0 is devoted to one-dimensional problems, and any mention of boundary integral formulations is through the weighted residual scheme, an approach which does nothing to simplify the derivation of integral equation formulations of boundary value problems, but much to confuse it. Moreover, the weighted residual scheme is an *approximate* method whereas the standard derivation, in which the fundamental solution of the equation in question is combined with a reciprocal theorem, is simply a reformulation of the problem, not an approximation to it. There seems to be nothing that can be accomplished using the weighted residual scheme