The 175 page Part I, Fundamentals of finite-difference methods, consists of four chapters. Chapter 1 sketches the history of numerical methods. Chapter 2 describes the classification into elliptic, parabolic, and hyperbolic types for second order equations; discusses characteristics for simple equations and the notion of well-posed problems. Chapter 3 describes several ways to derive difference approximations, and derives several explicit and implicit schemes; how to deal with irregular meshes is described; the notion of stability is explained. Chapter 4 is the longest in Part I and treats the simplest model problems by difference methods. The solution of the difference equation, for a given mesh size, is shown to satisfy a modified differential equation. The amplification matrix, amplitude and phase errors, shock fitting and shock capturing, iterative methods for elliptic problems are all dealt with in Chapter 4.

Part II has 368 pages with the title, Application of finite-difference methods to the equations of fluid mechanics and heat transfer.

Ch. 5–Governing equations of fluid mechanics and heat transfer;
Ch. 6–Numerical methods for inviscid flow equations;
Ch. 7–Numerical methods for boundary-layer type equations;
Ch. 8–Numerical methods for the "parabolized" Navier-Stokes equations;
Ch. 9–Numerical methods for the Navier-Stokes equations;
Ch. 10–Grid generation.

It is in Part II that the real problems and methods for their solution are described. This field is rapidly developing, but it is not yet sufficiently mathematized. The authors present a description of most of the difference methods developed up to the early 1980's. They give advice as to how to select a good method for each physical problem. The method involves introducing appropriate physical variables (both the independent and dependent ones), formulating the system of differential equations, selecting a mesh, choosing a difference scheme and an algorithm for solving the resulting system of equations. They explain the good and bad features of the many methods.

In Appendices A and B, they supply subroutines for solving scalar and block tridiagonal systems of linear equations. Appendix C describes Schneider and Zedan's iterative difference scheme for solving the nonhomogeneous two-dimensional elliptic equation with variable coefficients. They supply a five page list of symbols and abbreviations, a twenty page bibliography of items referred to in the text, and an eight page index. The bibliography does not indicate where each item is cited in the text, even though most of these authors are not listed in the index.

Until the field becomes sufficiently mathematical, this textbook should be valuable both for engineering instruction and reference. The authors state that this work is joint and the toss of a coin was used to order their names.

E. I.

9[35-02, 35Jxx, 35Kxx, 35R35, 65P05].—John Crank, *Free and Moving Boundary Problems*, Clarendon Press, Oxford, 1984, x + 425 pp., 24 cm. Price $64.00.

The stated aim of this book is to provide a broad but reasonably detailed account of the mathematical solution of free and moving boundary problems. Given the scope of the subject, severe restrictions have had to be made: questions of existence and uniqueness are largely ignored; several moving-boundary problems are considered, but only porous flow free-boundary problems are treated in depth; for the most part, only scalar second order elliptic or parabolic equations in two dimensions are studied. Within this self-imposed framework, the author provides an excellent exposition of the problems, their history and formulation, their solution by analytical and numerical methods.

The book alternates between the two types of problem. There are chapters on the formulation of moving-boundary problems, on their analytical solution, and on their numerical solution. Similar chapters on free-boundary problems are interspersed.

Analytical methods for moving-boundary problems are represented by similarity solutions and integral equation formulations, while the solution of free-boundary problems using the hodograph method is treated in considerable detail. All current numerical methods receive attention: front-tracking (including the method of lines due to Meyer); front-fixing (including the isotherm migration method of Crank); the enthalpy method; trial-free-boundaries; and variational inequalities.

Several misprints were noted, none of them serious, but some of which, in formulae, might cause difficulties for readers new to the field. There is an excellent subject index and, as a bonus, an author index. In the list of references, the regrettable custom of not quoting the titles of papers is followed. In parts, the text reads like a lengthy review article with each paragraph devoted to the contributions of a different author, but for the most part the text flows along very smoothly.

In summary, this is a welcome addition to the literature on free and moving boundary problems, the coverage of the latter being particularly good. If supplemented by material on existence and uniqueness theorems, it also deserves serious consideration as a textbook.

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10[65–06, 68–06].—SEYMOUR V. PARTER (Editor), *Large Scale Scientific Computation*, Proceedings of a Conference Conducted by the Mathematics Research Center, The University of Wisconsin, Madison, May 17–19, 1983, Academic Press, Orlando, Fla., 1984, ix + 326 pp., 23½ cm. Price $26.00.

This volume contains twelve papers ranging from mathematical problems to management issues. Questions addressed include: specialized architectural considerations, efficient use of existing "state-of-the-art" computers, software developments, large-scale projects in diverse disciplines, and mathematical approaches to basic algorithmic and computational problems

L. B. W.

11[41–06].—S. P. SINGH, J. W. H. BURRY & B. WATSON (Editors), *Approximation Theory and Spline Functions*, NATO ASI Series C: Mathematical and Physical Sciences, Vol. 136, Reidel, Dordrecht, Holland, 1984, ix + 485 pp., 24½ cm. Price $69.50.