interpolation and extrapolation, splines. The lack of displayed algorithms and formulas and of crisply stated theorems makes the subject matter seem unduly soft and ethereal. This is particularly disappointing in the treatment of minimax approximations, for few subjects in applied mathematics are so inherently elegant. Chapter 4 discusses the solution of equations in a single variable and Chapter 5, numerical quadrature. The discussion of polynomial equations treats only Sturm sequences and polynomial deflation. I have never known anyone (except luckless numerical analysis students) to use these methods. Research scientists hardly ever have to find real zeros; they want complex zeros.

The present book has as many difficulties with *what* as *how*. I often teach courses which are taken at night by people who work in industry, and I always make a point of asking them what problems in numerical analysis they encounter most frequently in their jobs. The problems most commonly mentioned are

1) Solving PDE's;
2) Finding eigenvalues and eigenvectors of partial differential operators;
3) Solving systems of equations (often overdetermined) and inverting matrices (of very large order, say, 100×100);
4) Finding eigenvalues and eigenvectors of matrices (again, very large matrices);
5) Determining all the complex roots of polynomial equations of high degree;
6) Multivariate numerical integration;
7) Solving ODE's, often large systems;
8) Linear and nonlinear programming problems.

Concerning all these vital issues the present book maintains an obstinate silence. And I know the reasons. The material is terribly messy, inherently inelegant, and nearly impossible to organize. It's so much easier to expound lucidly on iteration procedures of higher order, Hermite-Birkhoff interpolation, and specialized quadrature formulas. But the topics itemized above are precisely those required if the instructor is to be faithful to the needs of his students. A conscientious teacher will present at least some of the material. Sadly, this book will be of little help.

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8[65-01, 65Mxx, 65Nxx, 76-01, 76-08, 80-01, 80-08].—DALE A. ANDERSON, JOHN C. TANNEHILL & RICHARD H. PLETCHER, *Computational Fluid Mechanics and Heat Transfer*, Hemisphere Publishing Corp., McGraw-Hill, New York, 1984, xii + 599 pp., 24 cm. Price $39.95.

This is a textbook for advanced undergraduates or first-year graduate students, who have had "at least one basic course in fluid dynamics, one course in ordinary differential equations, and some familiarity with partial differential equations. Of course, some programming experience is also assumed."

At Iowa State University, their engineering students, primarily of aerospace and mechanics, have benefitted from this material during the past ten years. The book deals with finite-difference methods.

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