REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS

The numbers in brackets are assigned according to the American Mathematical Society classification scheme. The 1980 Mathematics Subject Classification (1985 Revision) can be found in the December index volumes of Mathematical Reviews.

5[65–01].—KENDALL E. ATKINSON, *An Introduction to Numerical Analysis*, 2nd ed., Wiley, New York, 1989, xvi+693 pp., 24 cm. Price $55.44.

Although many textbooks have been written on the subject of numerical analysis, this one is outstanding in comparison to others. A knowledge of the contents of this book would provide an excellent preparation for a student who is about to begin his or her graduate studies in numerical analysis. This text not only contains the classical methods which may be found in other books on this subject, but it contains additional refreshing and important topics, as well as new, recently discovered ones. While retaining an air of simplicity, the development and explanations of the methods are carried out with sophisticated mathematical reasoning. The order in which the material is presented is guided by simplicity of presentation, although the chapters are sufficiently independent so that in teaching from this text, one need not always follow the order in which the chapters are presented. Each of the nine chapters of the text contains many simple examples illustrating the material. In addition, each chapter ends with a discussion of the literature on the subject matter of the chapter, along with an ample set of problems to help with the understanding of the methods, as well as a set of references. The appendix at the end of the text contains a discussion of mathematical software, answers to selected exercises, and an index.

Let us next present a chapter-by-chapter summary of the text.

Chapter 1 consists of a discussion of errors, the sources of error, its propagation and analysis. It discusses the computer representation of numbers, the propagation of errors, errors in summation, and stability in numerical analysis.

Chapter 2 involves rootfinding for one or more nonlinear equations. Besides a presentation of the standard elementary methods, one finds here a discussion of Brent's rootfinding algorithm, as well as a brief discussion of unconstrained optimization.

In Chapter 3 one finds the standard material on polynomial and trigonometric interpolation.

Chapter 4 contains a basic introduction to the approximation of functions. Here one finds a discussion of the Weierstrass approximation theorem, Taylor's

theorem, a characterization of minimax polynomial approximation, and least squares methods.

In Chapter 5 we find a discussion of the classical methods of numerical integration, as well as a discussion of the treatment of singular integrals, and numerical differentiation.

Chapter 6 contains the classical methods for solving ordinary differential equation initial and boundary value problems, as well as a discussion of stiff differential equations and the method of lines.

Chapter 7 contains an introduction to linear algebra. This material serves mainly as reference material for Chapters 8 and 9, which cover methods for solving linear equations and the matrix eigenvalue problem.

In Chapter 8 one finds a comprehensive discussion of Gaussian elimination, a discussion of error analysis, the residual correction method, iterative methods, the numerical solution of Poisson's equation, and the conjugate gradient method.

Chapter 9, the final chapter, discusses methods of finding eigenvalues, such as the power method, using orthogonal transformations, Householder matrices, the QR method, inverse iteration, and least squares solution of linear systems.

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6[65Mxx, 65Nxx, 76–08].—ZHU YOU-LAN, ZHONG XI-CHANG, CHEN BING-MU & ZHANG ZUO-MIN, *Difference Methods for Initial-Boundary-Value Problems and Flow Around Bodies*, Springer, Berlin and Science Press, Beijing, 1988, viii+600 pp., $24\frac{1}{2}$ cm. Price $120.00.

Inviscid flow solutions contain shocks and contact discontinuities. These can be handled either by shock capturing or by shock fitting. In the first case, there is some dissipation mechanism such that oscillations are avoided, but the price to be paid is that the discontinuities are smeared out to a certain extent. In the second case, the positions of the discontinuities are kept as separate variables and the solution in between is computed by standard methods for smooth solutions. The authors of this book are well-known specialists on this latter class of methods. The book is a result of their long experience from computation of external flow problems using the Euler equations. In fact, Part II is a 360-page description of these computations.

Part I contains general theory for difference methods. In the first two chapters, initial-boundary value problems are treated for time-dependent equations, and in Chapter 3 the boundary value problem for steady state solutions is discussed. There is plenty of material, but unfortunately, it is not easy to read. The notation is complicated, and there are many subscripts and superscripts everywhere. When trying to interpret a certain estimate, it is sometimes virtually impossible to remember the meaning of all the symbols which occur. On the other hand, if one really gets through, one finds many important results concerning stability.