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.

7[65–01].—CARL-ERIK FRÖBERG, *Numerical Mathematics—Theory and Computer Applications*, The Benjamin/Cummings Publ. Co., Menlo Park, Calif., 1985, xi + 436 pp., 24 cm. Price $37.95.

Originally published in Swedish, in 1962, two subsequent editions were published (in English) by Addison-Wesley under the title "Introduction to Numerical Analysis."

The new title and publisher are the result of a complete revision and restructuring in line with modern teaching trends. The current book covers a very wide range of topics in five distinct parts; Part 1 (Mathematical Introduction, 9 Chapters) Numerical Computation, Vectors and Matrices, Series Expansion, Orthogonal Functions, Linear Operators, Difference Equations, Special Functions, Laplace Transforms, Calculus of Variations; Part 2 (Equations, 4 Chapters) Systems of Linear Equations, Nonlinear Equations and Systems of Equations, Algebraic Eigenvalue Problems, Linear Programming; Part 3 (Approximation, 3 Chapters) Interpolation, Function Representation and Curve Fitting, The Monte Carlo Method; Part 4 (Integration and Summation, 2 Chapters) Numerical Integration, Summation; Part 5 (Differential and Integral Equations, 3 Chapters) Ordinary Differential Equations, Partial Differential Equations, Integral Equations.

Years of opportunity to test and refine this material have led to a presentation which is concise and clear as well as being mercifully free from typographic errors. There are many exercises which seem well thought out and at about the correct level for the text. Most of the sections also have at least one carefully worked out example which can be followed with pencil or pocket calculator. I found reading this text to be a distinctly pleasurable experience. Areas which I had lost track of were nicely refreshed, and in fields near and dear to me the coverage was classical, correct and showed experience in trying to get concepts across. The one single word to describe this book is "smooth." In particular, I liked the introductory chapters and think they will be excellent references for students.

Nevertheless, I must raise the question of who is the intended audience. It is unlikely to be computer science students, whose background and interest in mathematics is generally far too weak. Engineering and physical science students have the correct training. But because the author has elected to cover so many diverse areas, he must be very brief or ignore important subtopics; 2 pages each for Gaussian elimination, splines, overdetermined linear systems, nonlinear minimization, 1 for FFT, and less than 30 for partial differential equations (including parabolic, elliptic

0025-5718/87 $1.00 + $.25 per page

and eigenvalue problems). An earlier reviewer's objection to the lack of discussion of pivoting for linear systems has been corrected by the addition of one paragraph, but that chapter is obviously slanted toward large problems, with more than half the material on iterative and gradient methods, including selection of the optimum SOR parameter. The text reads so smoothly that I fear many students will either miss significant details or will find it very tough going.

Further, all issues of software are omitted. The author explains that "With the availability of large and modern program packages, there is hardly need for such programs in a modern textbook. In fact, this view is shared by many reviewers, and it seems safe to assume that such programs will be run only occasionally. Further, programs that are really good should soon become part of a suitable package." This reader agrees with these statements, but feels that it is an incorrect interpretation to ignore all software issues on the assumption that the students will find out about these on their own somehow. My experience has been that engineering and science curricula emphasize computing more each year, but that these students, and many of their faculty too, are woefully ignorant of the many well-established software packages. It seems sad to teach, for example, about Gaussian elimination and not mention LINPACK, about ODEs without any mention of excellent programs which are available from Hindmarsh or Shampine, about integrals without any mention of adaptive quadrature, or about eigenvalues without mentioning EISPACK.

I believe that the most suitable audience for this book will be professional scientists who would like an extremely well-written introduction or review of the mathematical-numerical techniques which were developed through the mid 1970's. As a course text, the book would benefit from an instructor with real computing experience and insight, who was also willing to expand on some of the overly brief presentations.

DAVID K. KAHANER

National Bureau of Standards
Tech. Bldg., Rm. A151
Washington, D.C. 20234

8[65F05, 65F10, 65F50, 65N05, 65N10, 65N15, 65N30, 65N35].—GARRETT BIRKHOFF & ROBERT E. LYNCH, *Numerical Solution of Elliptic Problems*, SIAM Studies in Applied Mathematics, SIAM, Philadelphia, Pa., 1984, xi + 319 pp., $23\frac{1}{2}$ cm. Price $31.50.

As stated by the authors, "The aim of this monograph is twofold: first to describe a variety of powerful numerical techniques for computing approximate solutions of elliptic boundary value problems and eigenproblems on high speed computers, and second, to explain the reasons why these techniques are effective." An attempt is made "to provide a reasonably well-rounded and up-to-date survey of these methods." The authors succeed in striking a delicate balance between exposition of underlying theory and its application to numerical solution techniques, thereby providing an impressive addition to the literature, which could well become a classic reference on this subject. In a work of this breadth, the depth of treatment is limited. Nevertheless, the crucial theorems are given with reasonable outlines of basic arguments in their proofs and extensive reference to appropriate literature. Current