REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS

The numbers in brackets are assigned according to the indexing system printed in Volume 22, Number 101, January 1968, page 212.

20[2.00, 3, 10, 11, 12, 13.05, 13.15, 13.30].—R. SAUER & I. SZABÓ, Editors, *Mathematische Hilfsmittel des Ingenieurs*. III, Authors: T. P. ANGELITCH, G. AUMANN, F. L. BAUER, R. BULIRSCH, H. P. KÜNZI, H. RUTISHAUSER, K. SAMELSON, R. SAUER, J. STOER, Springer-Verlag, Berlin, 1968, xviv + 534 pp., 24 cm. Price $24.50.

This is the third volume of a projected four-volume treatise. Volume I has previously appeared (see Review 3, this Journal, v. 23, 1969, pp. 208–209). To quote from the Editors' Preface, the work as a whole "is designed to acquaint the engineer with the modern state of mathematics as it pertains to theories and methods which are, or promise to become, of significance in engineering. . . . [The work] is more than a compendium of formulas in the customary sense. In each of the disciplines covered, it not only brings the necessary formal apparatus, but also the basic definitions, theorems, and methods, in a presentation which takes account of the physically-geometrically oriented mentality of the engineer. That is, concepts introduced in definitions are interpreted intuitively, whenever possible, and a constant effort is made to motivate the reader for the concepts introduced. The understanding of theorems and methods is facilitated by use of examples and plausibility arguments. Proofs are given only in those cases where they are essential for the understanding of a theorem or a method. Through appropriate references to text books, however, the reader is put in a position to orient himself in each case on pertinent proofs. . . . Although [this work] responds primarily to the needs of engineers, it can profitably be used also by natural scientists, especially physicists and mathematicians."

The present volume contains six chapters, labeled F through K. Chapter F (85 pages), by F. L. Bauer and J. Stoer, is devoted to algebra and presents basic notions and theorems in algebraic structures (semigroups, groups, rings, fields and skew fields), a concise exposition of linear algebra and normed vector spaces, and has also a section on localization theorems for zeros of polynomials and eigenvalues.

Chapter G (146 pages), devoted to geometry, has two parts. Part I, by R. Sauer, deals with selected topics of geometry: affine and projective geometry, conic sections and quadratic surfaces, nomography, spherical trigonometry, vector algebra and vector analysis, differential geometry of curves and surfaces with applications to kinematics, and curvilinear coordinate systems. Part II, by T. P. Angelitch, brings a detailed exposition of tensor calculus, including applications to classical mechanics, heat conduction, electrodynamics, and continuum mechanics.

Chapter H (88 pages), by R. Bulirsch and H. Rutishauser, has interpolation and numerical quadrature as its topic. It contains a comprehensive discussion, frequently supplemented by ALGOL procedures, of polynomial and rational interpolation procedures, interpolation and smoothing by spline functions, and polynomial interpolation in several variables. This is followed by an exposition of selected quadrature schemes, including the Romberg scheme, Newton-Cotes and Gaussian quadrature, and other miscellaneous integration formulas.

Chapter I (127 pages), concerned with the approximation of functions, is again in two parts. Part I, by G. Aumann, outlines the mathematical foundations of approximation theory. Part II, by R. Bulirsch and J. Stoer, addresses itself to the effective computation of functions on digital computers. Among the topics treated are Chebyshev expansion, the use of continued fractions, computation of elliptic functions by Bartky's transformation. Fourier analysis, including the Cooley-Tukey algorithm, and the recursive computation of cylinder functions. A number of ALGOL procedures are included.

Chapter J (51 pages), by H. P. Künzi, treats linear and nonlinear optimization problems. There is a brief outline of the mathematical theory of linear optimization, which is followed by a description of constructive solution algorithms, including Dantzig's simplex method, Gomory's integer programming algorithm, and the author's duoplex algorithm. On nonlinear problems one finds the Kuhn-Tucker theorem for convex problems, and Beale's algorithm for quadratic problems.

The final Chapter K (19 pages), by K. Samelson, starts with an intuitive introduction to the concepts of model, algorithm, and program, and continues to survey the organization of stored program digital computers and problem-oriented programming languages.

The aims set by the editors have been admirably achieved in this volume, and one anxiously looks forward to the appearance of the remaining two volumes.

W. G.

21[2.05].—C. T. Fike, *Computer Evaluation of Mathematical Functions*, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1968, xii + 227 pp., 24 cm. Price $10.50

The title of this volume is somewhat misleading inasmuch as the mathematical functions considered are largely elementary functions, and then only with real arguments. Accordingly, the methods of evaluation are those of polynomial and rational approximation (plus Newton's iteration in the case of the square- and cube-root). Within these restrictions, however, the author has given us an account which is eminently readable, sound in mathematical and computational detail, and rich in illustrative examples and cogent remarks. The treatment is thoroughly up-to-date and well documented by references, not only to the research literature, but also to manufacturer-supplied program libraries. The text can be highly recommended for reference use and for supplementary reading in a numerical analysis course at the junior-senior level.

The territory covered is well delineated by the chapter headings: 1. Error in Function Evaluation Computations; 2. Square-Root and Cube-Root Evaluation; 3. Reducing the Argument Range; 4. Polynomial Evaluation Methods; 5. Minimax Polynomial Approximations; 6. Chebyshev Polynomials and Chebyshev Series; 7. Various Polynomial Approximation Methods; 8. Rational-Function Evaluation Methods; 9. Minimax Rational Approximations; 10. Various Rational Approximation Methods; 11. Asymptotic Expansions. Each chapter is followed by a bibliography and a set of exercises.

W. G.