deeper study, he is referred to appropriate books and journal articles. The subjects treated range from college mathematics through calculus to advanced topics in analysis. Approximate methods are emphasized throughout; their treatment, however, reflects the state of knowledge in the early sixties. (The original work was published in 1963.) A listing of chapter headings and respective authors follows.

1. Arithmetic and algebra (V. Vilhelm), 2. Trigonometric and inverse trigonometric functions. Hyperbolic and inverse hyperbolic functions (V. Vilhelm), 3. Some formulae (V. Vilhelm), 4. Plane curves and constructions (K. Drábek), 5. Plane analytic geometry (M. Zelenka), 6. Solid analytic geometry (F. Kejla), 7. Vector calculus (F. Kejla and K. Rektorys), 8. Tensor calculus (V. Vilhelm), 9. Differential geometry (B. Kepr), 10. Sequences and series of constant terms. Infinite products (K. Rektorys), 11. Differential calculus of functions of a real variable (K. Rektorys), 12. Functions of two or more variables (K. Rektorys), 13. Integral calculus of functions of one variable (K. Rektorys), 14. Integral calculus of functions of two or more variables (K. Rektorys), 15. Sequences and series with variable terms (K. Rektorys), 16. Orthogonal systems. Fourier series. Some special functions (K. Rektorys), 17. Ordinary differential equations (K. Rektorys), 18. Partial differential equations (K. Rektorys), 19. Integral equations (K. Rektorys), 20. Functions of a complex variable (K. Rektorys), 21. Conformal mapping (J. Fuka), 22. Some fundamental concepts from the theory of sets and functional analysis (K. Rektorys), 23. Calculus of variations (F. Nožička), 24. Variational methods for solving boundary value problems of differential equations (M. Prager), 25. Approximate solution of ordinary differential equations (O. Vejvoda and K. Rektorys), 26. Solution of partial differential equations by infinite series (K. Rektorys), 27. Solution of partial differential equations by the finite-difference method (E. Vitásek), 28. Integral transforms (J. Nečas), 29. Approximate solution of Fredholm integral equations (K. Rektorys), 30. Numerical methods in linear algebra (O. Pokorná and K. Korvasová), 31. Numerical solution of algebraic and transcendental equations (M. Fiedler), 32. Nomography and graphical analysis. Interpolation. Differences (V. Pleskot), 33. Probability theory (J. Hájek), 34. Mathematical statistics (J. Hájek), 35. Method of least squares. Fitting curves to empirical data. Elements of the calculus of observations (O. Fischer).

W. G.

15[2, 4, 5, 6, 13.05, 13, 15].—R. Sauer & I. Szabó, *Mathematische Hilfsmittel des Ingenieurs*, Teil II, Springer-Verlag, Berlin, 1969, xx + 684 pp., 24 cm. Price $37.40.

[For reviews of Volumes I and III of this four-volume sequence, see *Math. Comp.*, v. 23, 1969, pp. 208–209 and *Math. Comp.*, v. 24, 1970, pp. 475–476.]

Volume II of this encyclopedic work is devoted to the theory and practical solution of differential equations, and thus takes up a topic which is of vital concern not only to the engineer, but also to the scientist in general. Accordingly, the subject is treated in considerable depth and on the advanced mathematical level which it demands. While the style of presentation is necessarily concise, numerous examples are included throughout for clarification and illustration.

The material is organized into two large sections, D and E, of which the first

(292 pages) is concerned with initial-value problems and the second (377 pages) with boundary and eigenvalue problems. Both sections include ordinary and partial differential equations, as well as systems of such equations.

Section D, written by W. Törnig, begins with a chapter on ordinary differential equations. An outline of the basic existence and uniqueness theory, and an exposition of some elementary integration methods is followed by a more detailed treatment of linear equations, particularly of Fuchs' class, and of systems of such equations, where problems with periodic coefficients are given special attention. There is also a discussion of numerical methods of the one-step and multi-step type. Partial differential equations are taken up in Chapter II, which is devoted to single equations of the first order. Here, one has a complete geometric theory of integration, based on characteristics, which is expounded first for linear and quasilinear equations in two and more variables, and then for general nonlinear equations. Chapter III proceeds to hyperbolic equations and first discusses the characteristic as well as the Cauchy initial value problem for weakly nonlinear and linear second-order equations in two variables. The wave equation and associated initial and initial-boundary value problems are examined next in more detail. This is followed by a discussion of hyperbolic systems of the first order, where the equations of gas dynamics figure prominently among the applications. Numerical methods, particularly the method of characteristics and finite difference methods, are then discussed in considerable detail. Chapter IV gives a similar treatment to parabolic equations. The discussion revolves mainly around the heat and diffusion equation, but includes also the nonlinear equations of boundary layer theory and equations of mixed type. Numerical methods again receive due attention.

Section E has eight chapters, the fourth being authored by L. Collatz, the others by R. Nicolovius. Chapter I deals with boundary-value problems for ordinary differential equations, first with linear problems, and in this connection also with the theory of linear integral equations, and then with nonlinear problems. Much space is allotted to existence and uniqueness results, and to questions of monotonicity and two-sided approximation. Chapter II treats boundary-value problems for partial differential equations, generally in N-space, with special emphasis on the three types of boundary conditions associated with elliptic second-order equations. Among the topics discussed are the concepts of fundamental solutions and Green's function, various uniqueness, existence, and alternative theorems, the maximum principle, and monotonicity properties of partial differential operators. Some of these topics are also discussed in the context of nonlinear equations. A separate chapter is devoted to problems in the theory of the potential and to other problems and equations of mathematical physics, including the reduced wave equation, the problem of minimal surfaces, the Navier-Stokes equations in hydrodynamics, and the equations of elasticity theory. Chapter IV then turns to eigenvalue problems for differential and integral equations. Some general theorems on selfadjoint completely definite problems, concerning in particular the minimum properties of eigenvalues and expansions in eigenfunctions, are followed by inclusion principles for eigenvalues and a presentation of Ritz's method for their approximation. Other approximate methods are also briefly considered, among them the difference method, collocation, perturbation methods, and Weinstein's method of intermediate problems. Variational problems, already touched upon in Chapter IV, receive a systematic treatment in the next chapter, where one finds not only a formulation of the basic problems and methods of the calculus of variations, but also a detailed discussion of how to construct a variational problem from a given boundary-value, eigenvalue, or integral equations problem, and a thorough exposition of direct methods (due to Ritz, Galerkin, Friedrichs, Trefftz, Synge, and others) for solving variational problems. The remaining three chapters are largely method-oriented, but draw frequently upon the problems discussed earlier for illustration. Chapter VI begins with closed-form solutions by means of series (power series, orthogonal and asymptotic expansions), and then illustrates some general principles and approaches toward the numerical treatment of problems. The method of finite differences for differential equations, and the quadrature method for integral equations, of course, hold a central position in the context of this section, and are therefore discussed very thoroughly in Chapter VII. Iteration methods, finally, are the subject of Chapter VIII, which contains general contraction and fixed point theorems as well as a formulation of Newton's method and the method of false position in a Banach space.

W. G.

16[2.05, 2.10, 2.15, 2.20, 2.35, 2.40, 2.55, 3, 4].—CHARLES B. TOMPKINS & WALTER L. WILSON, JR., *Elementary Numerical Analysis*, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1969, xvi + 396 pp., 24 cm. Price $10.50.

The book is directed to a wide audience of beginning students and offers them a sound introduction into the techniques and underlying philosophies of numerical analysis. A commendable effort has been made to motivate all subjects discussed, and to emphasize general principles involved. While the selection of topics is fairly standard, it is an unusual feature of the book that all formulas are displayed in a one-line format not unlike that of present-day computer outputs. Table of contents: 1. Introduction, 2. Taylor's formula: truncation error, 3. Iteration processes: Newton's method, 4. Systems of linear equations, 5. Eigenvalues and eigenvectors, 6. Finite differences, 7. Interpolation, 8. Least squares estimates, 9. Numerical differentiation, 10. Numerical integration, 11. Difference equations, 12. Numerical solution of differential equations.

W. G.

17[2.05, 7].—GÉZA FREUD, *Orthogonale Polynome*, Birkhäuser Verlag, Basel, Switzerland, 1969, 294 pp., 25 cm. Price Sfr. 42.00.

To indicate the general character of this important book and how it relates to earlier monographs on the subject, it is best to quote (in free translation) from the author's preface.

"This book is concerned with the general theory of orthogonal polynomials relative to a nonnegative measure on the real line. For prerequisites, it is assumed that, beyond the usual basic analysis courses, the reader has completed an introductory course in real analysis. Only the last chapter requires some knowledge of complex analysis. I hope to offer something useful to every reader, regardless of whether he