REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS

The numbers in brackets are assigned according to the revised indexing system printed in Volume 28, Number 128, October 1974, pages 1191–1194.

8 [3, 3.25].—JAMES R. BUNCH & DONALD J. ROSE, Editors, *Sparse Matrix Computations,* Academic Press, New York, San Francisco, London, 1976, xi + 453 pp., 24 cm. Price $15.00.

This volume contains the proceedings of a Symposium at Argonne National Laboratory on September 9–11, 1975. Twenty-six papers are presented, collected under the six headings of: I. Design and analysis of elimination algorithms, II. Eigenvalue problems, III. Optimization, least squares and linear programming, IV. Mathematical software, V. Matrix methods for partial difference equations, VI. Applications. The collection gives a comprehensive view of the field at the time.

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9 [3.10, 3.15, 5, 12.05.1].—KLAUS-JÜRGEN BATHE & EDWARD L. WILSON, *Numerical Methods in Finite Element Analysis,* Prentice-Hall, Englewood Cliffs, N. J., 1976, xv + 528 pp., 23.5 cm. Price $28.95.

This book treats most aspects of the formulation and construction of a computer program for linear finite element analysis using a conforming displacement approach. The topics involving choice of shape functions, formulation and numerical evaluation of element matrices, global assembly and solution of the equilibrium equations are given in detail, frequently with computer subroutines as examples.

One special feature which distinguishes this book from many others is the major portion devoted to eigenproblems.

I shall next reproduce a list of contents.

Part I, Matrices and Linear Algebra.
1. Elementary Concepts of Matrices. 2. Matrices and Vector Spaces.

Part II, The Finite Element Method (FEM).
3. Formulation of the FEM. 4. Formulation and Calculation of Isoparametric FE matrices. 5. Variational Formulation of the FEM. 6. Implementation of the FEM (with a full program example).

Part III, Solution of FE Equilibrium Equations.
7. Solution of Equilibrium Equations in Static Analysis. 8. Solution of Equilibrium Equations in Dynamic Analysis. 9. Analysis of Direct Integration Methods. 10. Preliminaries to the Solution of Eigenproblems. 11. Solution Methods for Eigenproblems. 12. Solution of Large Eigenproblems.

The exposition is clear and readable but not concise. Generally true to the title, basic numerical principles are discussed in some detail, and thereafter applied to finite element analysis. Topics not treated at length in the text (like nonconforming methods, assumed stress field and other formulations, bandwidth reducing algorithms) are adequately referenced. Practical hints are given, sometimes without much motivation (e.g., p. 102 for averaging of stresses, p. 165 for recommendation of orders for numerical integration).

The book is mainly intended as a textbook for upper class or graduate courses in engineering. The combined exphasis on basic numerical methods and their use in existing computer codes should serve that purpose well.

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10 [7].—ELDON R. HANSEN, *A Table of Series and Products,* Prentice-Hall, Englewood Cliffs, N. J., 1975, xviii + 523 pp., 28.6 cm. Price $74.00.

Transcendents arise in research in several forms—for instance, integrals, differential equations and series. Given a transcendent in one form, we often desire its other properties, and in particular we would like to know if there exists an equivalent closed or simple form to facilitate its evaluation and to simplify analytic expressions involving the transcendent.

Quite often, we are given a function either analytically or by name (for example, the Bessel function $K_\nu(z)$). Then many compendiums give series expansions in powers of z, both convergent and divergent though asymptotic. However, one can also come upon series by solving a functional equation or by expanding an integrand in series and integrating termwise. With a series in hand, one desires an equivalent simple form or identification of the series as a named function. For such a situation the author states that in his experience extant tables of series were inadequate. Either the tables were limited, or location of material was difficult. To correct these deficiencies, the author decided to develop a comprehensive handbook on the subject, and the volume under review is the fruition of his labors.

Primarily, the present volume is for use where the input is a given series and the output is its sum simply expressed or some equivalent representation. However, the volume can also be used in the reverse sense, as follows. Suppose we are given the error function $\mathrm{erf}(x)$. Then there is provided an "Index of Symbols" which directs one to input entries in the tables where the output is or involves $\mathrm{erf}(x)$. Again, suppose we are given $\cos xy \sec x$; and we desire its expansion in powers of x. Then the desired reference is given by consulting the "Index of Elementary Functions Expanded as a Series or Product".

Collecting data on series is straightforward enough, but organization of the data demands considerable effort. To produce an efficient table, it is imperative that series be given in a standard or canonical form, and that a system be developed so that if a series is in the table, then its location is easily spotted. To guide the user, the author devotes four introductory chapters where topics like references, canonical forms, errors, and ordering of tables are discussed.

We now consider the tables. Each entry is given an equation number and what would ordinarily be called Chapter X, X an integer, with a title, is composed of several sections, and each section contains a number of subsections. Subsection 5.1 has 6 entries (5.1.1–5.1.6). The 27 sections 5.1–5.27 comprise the 'chapter' "Numerical Power Series", but this chapter is given no number. It contains many entries of the form

$$\sum_{k=0}^{n} x^k \left[\prod_{i=1}^{m} (a_i k + b_i) \right]^{-1},$$

n finite or infinite, m ranges from 2 to 11, but $m = 2$ is dominant. The parameters a_i and α_i are always specified. Clearly, such series are related to integrals of the form $\int_0^x t^\gamma (1 + t)^{-1}\, dt$ and the closed expressions involve ln, arc tan, or both. Higher trans-