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 can be found in the December index volumes of Mathematical Reviews.

1[65F00].— ÅKE BJÖRCK, ROBERT J. PLEMMONS & HANS SCHNEIDER (Editors), *Large Scale Matrix Problems*, Elsevier North-Holland, New York, 1980, 403 pp., $23\frac{1}{2}$ cm. Price $39.95.

This special issue presents 18 papers in numerical linear algebra. The papers are organized into four general categories. The first category—Least squares and applications—contains papers describing new or improved algorithms for solving large sparse linear least-squares problems. Applications include the adjustment of massive amounts of geodetic data and the fitting of multivariate data by tensor spline approximations. The second category—Systems of linear equations and applications—concerns methods for solving systems of linear equations. These involve both iterative and sparse matrix direct techniques as well as combinations of the two. Here the emphasis is on the speed of the algorithms in question. Eigenvalue problems—the third category—describes methods for computing eigenelements of large sparse matrices. These methods involve Raleigh quotient minimization, the Lanczos algorithm, and variations of Arnoldi's method. The fourth and last category —Optimization problems—is concerned with selected problems involving optimization techniques. Linear complementarity problems, entropy maximization problems and applications and new techniques for solving certain classes of quadratic programming problems are discussed.

2[65D00].—ZVI ZIEGLER (Editor), *Approximation Theory and Applications*, Academic Press, New York, 1981, xi + 358 pp., $23\frac{1}{2}$ cm. Price $26.00.

This volume contains 24 papers and a section on open problems presented at a workshop held at the Technion, Haifa, Israel, May 5–June 25, 1980.

3[75–06].—B. HUNT (Editor), *Numerical Methods in Applied Fluid Dynamics*, Academic Press, London, 1980, xviii + 651 pp., $23\frac{1}{2}$ cm. Price $64.50.

This volume is based on the proceedings of the Conference on Numerical Methods in Applied Fluid Dynamics held at the University of Reading, January 4–6, 1978, organized by The Institute of Mathematics and its Applications. There are 19 contributed papers.

4[33A70].— A. P. PRUDNIKOV, YU. A. BRYCHKOV & O. I. MARICHEV, *Integrals and Series of Elementary Functions* (in Russian), Science, Moscow, 1981, 799 pp., 23 cm. Price 4 Rubles, 30 Kopecks.

0025-5718/82/0000-0823/$01.75

This is an impressive collection of formulas. The main part of the volume is divided into six chapters and each chapter is divided into many sections and subsections. Each chapter is quite detailed and, with the aid of the table of contents, location of material is rather easy. Notation is standard and as the table of contents describes mathematically the substance of each subsection, knowledge of Russian is helpful but not essential. Chapter 1 deals with indefinite integrals including types like

$$\int x^p (x+a)^{-q} (x+b)^{-r}\, dx, \quad \int x^p (ax^2+bx+c)^q\, dx,$$
$$\int (a-x)(x-c)(b-x)^{-1}\, dx,$$

etc. Also included are integrals involving exponential, circular and hyperbolic functions. The chapter consumes 269 pages. Chapter 2 begins with some general properties of integrals such as integration by parts, mean value theorem and differentiation under the integral sign. A further example is

$$\int_0^\infty x^{-1}[f(px) - f(qx)]\, dx = [f(0) - f(+\infty)] \ln \frac{q}{p}, \qquad p, q > 0,$$

and provided $f(z)$ is sufficiently smooth for $0 \leq z < \infty$. Following this is a large collection of definite integrals whose integrands are much like those of Chapter 1. The chapter also includes many integrals of Cauchy type. For example,

$$\int_0^\infty (x^2 - y^2)^{-1} \cos bx\, dx, \qquad [b, y > 0]$$

although the designator P.V. which we usually attach before the integral sign is omitted. Chapter 2 consumes 293 pages. Chapter 3 (20 pages) treats definite multiple integrals. Chapter 4 (53 pages) deals with finite sums which can be expressed in closed form. Some typical entries are $\sum_{k=1}^n \varepsilon^k (k+a)^m$, $\varepsilon = \pm 1$ and special cases; $\sum_{k=0}^n \varepsilon^k/(\alpha k + a)(\beta k + b)(\alpha k + c)$ and special cases. There are many series involving binomial coefficients with and without a power of a variable like x^k attached. Most of these sums with $x = 1$ are expressed in terms of binomial coefficients. Numerous summands involve trigonometric functions. Chapter 5 (201 pages) is like Chapter 4 except that the series are infinite. In addition there are doubly infinite series. Finite and infinite products are treated in Chapter 6 (5 pages).

There are two short appendices. The first delineates trigonometric and hyperbolic identities and relations. There is also a section on identities and relations involving the binomial coefficients and a like section for the Pochhammer symbol $(a)_k$. The second deals with properties of the gamma function, its logarithmic derivative, the zeta function, and Bernoulli and Euler polynomials and numbers. There is a rather extensive bibliography of 63 items, though many important references have been omitted. Apart from the appendices, the volume contains sections giving definitions of higher transcendental functions and where they appear in the main part of the text to relate integrals and sums as the case may be.

The printing and binding is very satisfactory. My principal criticism of the text is that no references are specifically given for any of the integrals or sums. This is a valuable addition to an applied worker's bookshelf and is especially a bargain since 1 Ruble = 100 Kopecks = $1.45 approximately.

Y. L. L.

5[65F00].— IAIN S. DUFF (Editor), *Sparse Matrices and Their Uses*, Academic Press, London, 1981, xii + 387 pp., $23\frac{1}{2}$ cm. Price $43.50.

This volume is based on the proceedings of the IMA Numerical Analysis Group Conference, organized by The Institute of Mathematics and its Applications and held at the University of Reading, July 9–11, 1980. There are 13 invited and 8 contributed papers.

6[10A20].— PETER HAGIS, JR., *Every Odd Perfect Number Not Divisible By* 3 *Has At Least Eleven Distinct Prime Factors*, a hand-written manuscript of 46 pages deposited in the UMT file.

This manuscript contains the complete proof of the result stated in its title. The arguments employed are elementary but involve a large number of calculations and searches. These were carried out on the CDC CYBER 174 at the Temple University Computing Center. A sketch of the proof [1] appears elsewhere in this issue.

AUTHOR'S SUMMARY

1. PETER HAGIS, JR., "Sketch of a proof that an odd perfect number relatively prime to 3 has at least eleven prime factors," *Math. Comp.*, v. 40, 1983, pp. 399–404.