REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS

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

34 [2].—G. GOOS, J. HARTMANIS & K. NICKEL, Editors, *Interval Mathematics,* Lecture Notes in Comput. Sci., Springer-Verlag, Berlin, Heidelberg, New York, 1975, vi + 331 pp., 24 cm. Price $12.90.

This volume is the proceedings of the International Symposium, Karlsruhe, West Germany, May 20–24, 1975. It contains six invited lectures and 26 contributed papers.

J. B.

35 [3].— GILBERT STRANG, *Linear Algebra and Its Applications,* Academic Press, New York, 1976, xi + 374 pp., 24 cm. Price $11.95.

In the preface, Strang says,

"Linear algebra allows and even encourages a very satisfying combination of both elements of mathematics–abstraction and application." The author provides just such a satisfactory treatment of linear algebra. With exceptional clarity, the basic ideas are developed and supplemented by concrete algebraic and geometric illustrative explanations. If this were all that the author provided, then the book would be outstanding. But, he makes the work a masterpiece by skillfully introducing nontrivial applications and weaving them into his delightful presentation. Of course, the author's experience in applying numerical methods to a broad spectrum of fields has tempered his judgement. He not only points out the implications of the theorems, but he explains how to choose the numerical methods that will be most efficient. In a trend setting way, the pseudoinverse and the singular value decomposition of a matrix are carefully developed; the structure of the linear systems that arise in difference methods and in finite element methods are analyzed. The author suggests how the book may be used for four different courses: numerical linear algebra; linear algebra for statistics; linear algebra in economics; basic linear algebra.

Here is a mature work, sprinkled with subtle humor, that will have a profound influence on the teaching of linear algebra.

E. I.

36 [3.05, 3.10, 3.25].—A. BRAMELLER, R. N. ALLAN & Y. M. HAMAN, *Sparsity,* Pitman, London, 1976, 177 pp., 24 cm. Price £ 7.00, $15.90.

This is a nice little book (177 pages) written by electrical engineers for electrical engineers. However, it covers many topics in sparsity–network problems, sparse elimination, sparse linear programming, and sparse nonlinear problems–making an excellent (and readable) introduction to these topics, suitable for anyone wanting to know what sparsity is about.

However, I do find it peculiar that a book with a 1976 publishing date has no reference past 1972 (except for a few to the authors' own work), especially in a field in which so much current work is being produced.

There is only one code presented in the book–and that is a FORTRAN program for calculating the *inverse* of a full matrix! They do state that the inverse of a sparse matrix tends to be full and do not recommend the inversion of sparse matrices. But will engineers never learn that they need not invert full matrices!

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37 [3.25].—G. GOOS, J. HARTMANIS & G. I. MARCHUK, Editors, *Optimization Techniques,* IFIP Technical Conference, Lecture Notes in Comput. Sci., Springer-Verlag, Berlin, Heidelberg, New York, 1975, viii + 507 pp., 24 cm. Price $16.80.

This volume contains papers presented at the IFIP Technical Conference on Optimization Techniques held at Novosibirsk, July 1–7, 1974. There are 17 papers on system modeling and identification, 15 papers on optimal control, 26 papers on mathematical programming and numerical algorithms and 12 papers on the theory of games.

J. B.

38 [5].—BERT HUBBARD, Editor, *Numerical Solutions of Partial Differential Equations,* Academic Press, New York, 1976, ix + 499 pp., 24 cm. Price £ 13.00, $25.00.

This is the proceedings of the Symposium on the Numerical Solution of Partial Differential Equations. III. The following is taken from the preface:

The Symposium on the Numerical Solution of Partial Differential Equations, SYNSPADE 1975, was the third in a series on this topic held on the campus of the University of Maryland, College Park, at 5-year intervals. During the week of 19–24 May 1975, researchers gathered at the Adult Education Center to listen to invited lectures and contributed papers and to discuss with each other the most recent developments in this field. This volume contains the invited addresses in full and a list of the contributed papers.

The emphasis of this symposium was on those difficult problems in partial differential equations exhibiting some type of singular behavior. This is a very broad topic that includes singular behavior of solutions induced by the geometry such as corners or the nature of the differential equation itself. Talks were given on the effects of nonlinearities, such as bifurcation, which occur in problems of nonlinear mechanics. Also discussed were equations of changing type and those with rapidly oscillating coefficients. The point of view of the symposium itself was to give equal weight to discussions of the mathematical models and their relation to experiment, behavior of solutions of the partial differential equations involved, and effective computational methods for their numerical solution.

J. B.

39 [5.10, 5.20, 13.05, 13.15].—J. R. OCKENDON & W. R. HODGKINS, Editors, *Moving Boundary Problems in Heat Flow and Diffusion,* Clarendon Press, Oxford, 1975, x + 300 pp., 24 cm. Price £ 6.00, $19.25.

This volume contains papers and discussions presented at a conference at the University of Oxford, England, on March 25–27, 1974.

The aim of the conference can be stated with the following summary of parts of the preface:

Since moving boundary problems (generalized Stefan problems) occur in many diverse industrial and other situations, and since results in one field were not readily available to researchers in a different field, it was decided to bring together research workers from as many different fields as possible, along with applied mathematicians and numerical analysts.

The organizers have succeeded in fulfilling their aims and have produced an interesting conference report; the papers range from industrial applications to theoretical investigations of analytical and numerical methods. At least for some years into the future, this volume should stand as a most comprehensive survey of various aspects of Stefan problems.

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40 [5.10, 5.20, 13.20].—ROBERT D. RICHTMYER, Editor, *Proceedings of the Fourth International Conference on Numerical Methods in Fluid Dynamics,* Lecture Notes in Physics, Vol. 35, Springer-Verlag, Berlin, Heidelberg, New York, 1975, v + 457 pp., 24 cm. Price \$16.00.

This volume contains papers presented at the Fourth International Conference on Numerical Methods in Fluid Dynamics, at the University of Colorado, USA, on June 24–28, 1974. There are 64 papers ranging from general theory for numerical methods to applications in specific problems.

LARS B. WAHLBIN

41 [5.10.1].— A. CARASSO & A. P. STONE, Editors, *Improperly Posed Boundary Value Problems,* Pitman, London, 1975, iv + 157 pp., 22 cm. Price £ 5.60, \$12.90.

This volume, which is dedicated to Fritz John, represents a substantial portion of the proceedings of a five day regional conference on "Improperly posed problems in partial differential equations" held at the University of New Mexico in May, 1974. The lectures of the reviewer have been published separately as Volume 22 in the Regional Conference Series in Applied Mathematics (S.I.A.M.). The contents of this volume under review are as follows:

1. H. Brezis and J. A. Goldstein: *Liouville theorems for some improperly posed problems.*
2. J. R. Cannon: *A class of inverse problems: The determination of second order elliptic partial differential operators from over-specified boundary data.*
3. J. R. Cannon and R. E. Ewing: *The location of strengths of point sources.*
4. A. Carasso: *The backward beam equation and the numerical computation of dissipative equations backward in time.*
5. J. A. Donaldson: *A uniqueness class for two improperly posed problems arising in mathematical physics.*
6. M. Ghil: *The initialization problem in numerical weather prediction.*
7. H. A. Levine: *Nonexistence of global weak solutions to nonlinear wave equations.*
8. H. D. Meyer: *Half-plane representations and harmonic continuation.*
9. K. Miller: *Efficient numerical methods for backward solution of parabolic problems with variable coefficients.*
10. R. E. Showalter: *Quasi-reversibility of first and second order parabolic evolution equations.*
11. S. Steinberg: *Some unusual ill posed Cauchy problems and their applications.*
12. H. F. Walker: *Well-posedness of certain elliptic problems in unbounded domains.*

The general area of improperly posed problems in partial differential equations is a very active area of research at the present time. This volume should prove quite useful to the applied mathematician or engineer who must cope with such problems, to the novice who wishes to get some idea of what is currently being done in the field and to researchers who are active in certain sub-areas of the broad subject, but wish to know more about other areas of application.

L. P.

42 [9].—THOMAS R. PARKIN & DANIEL SHANKS, *Three Tables Concerning the Parity of the Partition Numbers $p(n)$ for $n < 2040000$*, Aerospace Corporation, Los Angeles, California, 1967, 398 pages of computer output bound in stiff covers and deposited in the UMT file.

Three tables computed for our paper [1] are here deposited in the UMT file. Table 1 (238 pages) extends the octal number $m/2$ of [1, Table 1] to $n = 2039999$ and thereby contains the parity of $p(n)$ to that limit in n.

Table 2 (56 pages) includes Tables 2 and 4 of [1] and lists the octuple counts from 0 to n with

$$n = r \cdot 10^s - 1$$

for $r = 1(1)9$, $s = 1(1)4$ and $r = 1(1)20$, $s = 5$. As described in [1], the k-tuple counts, $k = 2(1)7$, can be determined from these.

Table 3 (104 pages) concerns the equinumerosity of odd and even $p(n)$. It has finer detail than the Table 7 of [1] in that it lists every $n = 1000(1000)2040000$ together with every n where "Odds" = "Evens". It also includes max|Odds-Evens| in each interval here.

D. S.

1. THOMAS R. PARKIN & DANIEL SHANKS, "On the distribution of parity in the partition function," *Math. Comp.*, v. 21, 1967, pp. 466–480.

43 [9].—L. PINZUR, *Tables of Dedekind Sums*, Department of Math., University of Illinois, Urbana, Ill., 1975, 527 computer sheets deposited in the UMT file.

If x is any real number, put

$$((x)) = \begin{cases} 0, & x \text{ an integer}, \\ x - [x] - ½, & \text{otherwise}. \end{cases}$$

The ordinary Dedekind sum is defined for any integer h and any positive integer k by

$$s(h, k) = \sum_{n \bmod k} ((n/k))((nh/k)).$$

It is easily shown [1] that

(a) $s(qh, qk) = s(h, k)$, for all positive integers q,

(b) $s(-h, k) = -s(h, k)$,

(c) $s(h_1, k) = s(h_2, k)$, whenever $h_1 \equiv h_2 \bmod k$.

Hence, for a given positive integer k, it is only necessary to compute $s(h, k)$ for those h such that

$$1 \leqslant h \leqslant k/2, \qquad (h, k) = 1. \tag{1}$$

The value of $s(h, k)$ is a rational number whose denominator (when in lowest terms) divides $6k$ [1]. The table consists of the integers $6k\, s(h, k)$ for $k = 3(1)1000$. The computation was done by repeated use of the following reciprocity relation for the Dedekind sums:

$$s(h, k) + s(k, h) = -\frac{1}{4} + \frac{1}{12}\left(\frac{h}{k} + \frac{k}{h} + \frac{1}{hk}\right).$$

This relation and properties (b) and (c) above reduce the given Dedekind sum to an expression involving a new Dedekind sum with a smaller second variable. This process continues until the second variable equals 1 or 2, at which point it stops since $s(h, 1) = s(h, 2) = 0$ for all positive integers h. For a given integer k, this algorithm takes $O(\log k)$ steps.

The table could have also been computed by storing all previously computed values of $s(h, k)$ and then calling on the reciprocity theorem only once, but this would require an enormous amount of storage. The program used has the desirable feature that individual values of $s(h, k)$ can be computed for large values of k without construction of the entire table up to that point.

AUTHOR'S SUMMARY

1. H. RADEMACHER & E. GROSSWALD, *Dedekind Sums*, Carus Math. Monograph 16, Math. Assoc. Amer., 1972.

EDITORIAL NOTE. The Dedekind sums $s(h, k)$ were previously computed for $k = 2(1)100$ and all h satisfying (1) by R. Dale Shipp (*J. Res. Nat. Bur. Standards Sect. B*, v. 69, 1965, pp. 259–263). $s(h, k)$ was given there as the quotient of two relatively prime integers. It is known that $2k(3, k)s(h, k)$ is an integer, so that the numerator and denominator of $s(h, k)$ in the present table are each divisible by 3 whenever $(k, 3) = 1$. In fact no attempt is made here to present $s(h, k)$ as the quotient of two relatively prime integers. This is not a serious drawback, however, since k is at most 1000.

The table could have been shortened further, since it is known that if $hh' \equiv 1 \bmod k$, then $s(h, k) = s(h', k)$. This would have introduced serious formatting problems, however, since only those h such that $1 \leqslant h, h' \leqslant k/2$ would enter into consideration. It would also have introduced problems for the user.

M. N.