Chapter 6 considers direct methods for sparse systems, a topic associated with the second author. After a discussion of sparse data structures and the problems of fill and pivoting, various examples, using the code MA28, are given to show that hardware gather-scatter operations are not a cure for the indirect-addressing problem. Attention is then focused on the symmetric problem and the use of graph theory, especially cliques. Next, there is discussion of the frontal method with examples on CRAY machines, followed by the multi-frontal method and elimination trees with examples of parallelism. The chapter ends with a short survey of other approaches to parallelism.

Chapter 7 deals with iterative solution of sparse linear systems, an area associated with the last author. There is a review of primarily conjugate gradient type methods, especially for nonsymmetric systems (least squares formulations, biconjugate gradient, conjugate gradient squared, GMRES, etc.). A key part of any conjugate gradient method is matrix-vector multiplication, and there is an interesting discussion of efficient ways to do this, depending on the sparsity structure and the machine. Another key aspect of CG methods is preconditioning, and various possibilities (ILU, polynomial, approximate inverse, etc.) are reviewed along with their pros and cons on various architectures. The emphasis in this chapter is more on vector than parallel machines, but the last section deals with several parallel issues and examples.

The book ends with a glossary, instructions for obtaining software through NETLIB or from libraries such as NAG, and three other appendices on further hardware information, the BLAS, and operation counts for the BLAS and various decompositions. There is a bibliography of 173 titles.

Although each of the authors is well known for a particular research area, the book is well integrated, and relatively easy to read. Given the rate at which high-performance computer architecture is changing, much of the information in the book may have a relatively short lifetime, but hopefully at least some of the main principles of algorithm development will endure. All in all, the book is an excellent introduction to its subject matter and a welcome contribution to this field.

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10[33-01, 33C50, 41-01, 11-01].—THEODORE J. RIVLIN, *Chebyshev Polynomials: From Approximation Theory to Algebra and Number Theory*, 2nd ed., Wiley, New York, 1990, xiii + 249 pp., $24\frac{1}{2}$ cm. Price \$49.95.

The Chebyshev polynomials are defined by $T_n(x) = \cos n(\arccos x)$. They were introduced by Chebyshev in the mid-nineteenth century, who sought the solution to the following problem: Find the polynomial of degree $n-1$ which best approximates x^n on $[-1, 1]$ in the uniform norm, or, equivalently, minimize the uniform norm of a monic polynomial of degree n on $[-1, 1]$. As is well known, the Chebyshev polynomials have an incredible number of remarkable properties in approximation theory and classical analysis. They are a prototype of orthogonal polynomials on $[-1, 1]$ (the Jacobi polynomials are a generalization of those of Chebyshev), and they provide the solution to an unusual number of extremal problems. They also play an important role in interpolation theory and numerical integration. Less well known are properties of these polynomials which have a basis in modern analysis, especially ergodic theory, as well as in algebra and number theory.

The book under review not only supplies the important results concerning Chebyshev polynomials in these areas, but also contains a basic introduction to approximation and interpolation theory. Written in a lucid style, which illuminates the beautiful topics covered, the author has enhanced his work by the inclusion of over 300 interesting exercises. As a result, the book can easily be used as a text, especially in a seminar, but it also should be read by anyone wishing to learn about this fascinating subject.

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11[41A99].—PAUL NEVAI & ALLAN PINKUS (Editors), *Progress in Approximation Theory*, Academic Press, Boston, 1991, xi + 916 pp., 23 $\frac{1}{2}$ cm. Price $189.00.

This is a collection of 62 research papers that have been submitted to, and accepted by, the *Journal of Approximation Theory* and, with the authors' permission, have been assembled in this volume in order to alleviate the current backlog of the journal. Accordingly, a great variety of topics, both in pure and applied approximation theory, are being addressed, and the ordering of the papers alphabetically with respect to authors only accentuates this diversity. In character, the papers range from a short 3-page note to a substantial 74-page memoir. The printing conforms exactly to that of the journal, except that no received dates are given.

W. G.

12[68Q40, 65Y15, 65Y25, 11-04, 12-04, 13-04, 14-04, 30-04, 33-04].—STEPHEN WOLFRAM, *Mathematica—A System for Doing Mathematics by Computer*, 2nd ed., Addison-Wesley, Redwood City, California, 1991, xxiv + 961 pp., 23 cm. Price $48.50 hardcover, $33.50 paperback.

Mathematica is an interactive computer software system and language intended for solving problems in mathematics. Prominent features are numerical and symbolic mathematical manipulation, elaborate plotting software using the PostScript display technology, and a versatile programming language. While few of the features are entirely novel or "state of the art," the combination of all of these facilities in an accessible package has made it popular.

Any serious user of Mathematica (version 2.0, corresponding to the system described in this publication) will probably wish to have this book close at hand. A purchaser of the software will presumably already own one copy of this manual. It is the principal reference for the commands, and the on-line help