3. HENRY E. FETTIS & JAMES C. CASLIN, *More Zeros of Bessel Function Cross Products*, Report ARL 68-0209, Aerospace Research Laboratories, Office of Aerospace Research, United States Air Force, Wright-Patterson Air Force Base, Ohio, December 1968, v + 56 pp., 28 cm. (Released to the Clearinghouse, U. S. Department of Commerce, Springfield, Virginia 22151.) See also *Math. Comp.*, v. 23, 1969, p. 884.

14[3.05].—PHILIP J. DAVIS, *Circulant Matrices*, Wiley, New York, 1979, xv + 250 pp. Price $18.95.

A circulant matrix of order n is a square matrix of the form

$$C = \begin{pmatrix} c_1 & c_2 & \cdots\cdots & c_n \\ c_n & c_1 & \cdots\cdots & c_{n-1} \\ \cdot & & & \\ \cdot & & & \\ \cdot & & & \\ c_2 & c_3 & \cdots\cdots & c_1 \end{pmatrix} = \operatorname{circ}(c_1, c_2, \ldots, c_n).$$

This special structure affords an intimate relationship between the study of circulants and Fourier analysis; this relationship provides the backbone for the elegant analysis of circulants presented in this compact, well-organized book by the well-known numerical analyst Philip J. Davis.

Circulant matrices and their generalizations have important applications in physics, image processing, probability and statistics, number theory, geometry, and numerical analysis, e.g. in the numerical solution of periodic boundary value problems. Although the book does not actively pursue any of these applications, it does fulfill the author's avowed purpose of serving as a general reference on circulants, so that the basic facts need not be "rediscovered over and over again" by someone researching a specific application.

Chapter 1 motivates the study of circulants with a geometric example of nested polygons, the vertices of successive polygons being related by a circulant transformation. In fact, those with a taste for geometry will find throughout the book a host of connections between circulant matrix properties and geometrical results (cf. Chapter 4).

Chapter 2 is packed full of useful information on general matrix theory and is intended to provide background for the more specific study of circulants to follow in Chapter 3. In particular, the reader will find an interesting self-contained presentation of material on least squares, the singular value decomposition, and generalized inverses, although computational aspects are not addressed.

In Chapter 3, a central result is the representation of all circulants as polynomials in the special circulant $\pi = \operatorname{circ}(0, 1, 0, \ldots, 0)$, from which many interesting properties of circulants may be obtained. Generalizations of circulants (e.g. skew-circulants, block circulants) appear here and in the fifth chapter. Finally, the study of centralizers in Chapter 6 is used by Davis "to encompass and unify a number of results previously obtained as well as to point us in several new directions."

In order to appreciate the material in the book, the reader should have a reasonable background in matrix theory and some knowledge of abstract algebra. As such, and with the nice selection of problems included, the book can serve as a text for a very interesting secondary excursion into the realm of matrix theory.

S. M. SERBIN

Department of Mathematics
The University of Tennessee
Knoxville, Tennessee 27916

15[3, 3.25].—I. S. DUFF & G. W. STEWART (Editors), *Sparse Matrix Proceedings,* SIAM, Philadelphia, Pa., 1978, xvi + 334 pp., 24 cm. Price $21.50.

The papers in this book were presented at the Symposium on Sparse Matrix Computations held in Knoxville, Tennessee on November 2–3, 1978. Fourteen papers were presented on applications, software, and algorithms. The programming committee has tried to present an up-to-date account of developments in the area of sparse matrix computations.

J. H. B.

16[13.05].—CLAUDE JABLON & JEAN CLAUDE SIMON, *Applications des Modèles Numérique en Physique,* Interdisciplinary System Research 53, Birkhäuser Verlag, Basel, Stuttgart, 1978, 283 pp., 23 cm. Price Fr. 48.—.

This volume is written, in particular with physicists in mind, to explain the rules and help avoid pitfalls in numerical computation. The introduction is unusual in that it includes a discussion of the representation of mathematical models by computer programs from the aspects of linguistics and the theory of computation. The book then explains the basic concepts of numerical computation and goes on to treat numerical methods for a nonlinear equation, interpolation and approximation, and differential equations. The depth of treatment varies considerably and, as is reasonable in a book aimed at physicists, parabolic and elliptic partial differential equations are given relatively much space. The final chapter contains a useful discussion of the role of numerical models in physics and gives some hints on how to structure and document a Fortran program.

This book does not attempt to give a complete coverage of numerical methods, but even so the topics could have been better chosen. The most striking omission is that there is no systematic treatment of numerical methods of linear algebra. For example, eigenvalue problems, which certainly arise very frequently in physical applications, are not at all treated here. I also think that some space should have been devoted to methods for solving minimization problems and systems of nonlinear equations. The hope, expressed by the authors on page 13, that ideas in the (very short) section on solving a single nonlinear equation should enable a reader to tackle systems of nonlinear equations, seems to me to be very optimistic. I would have much preferred a modern treatment on spline approximation to the long section devoted to approximation by sums of translated functions. In the last chapter I missed a comment on the importance of portability.

The fact that descriptions in this book are very much from a user physicist's point of view might attract readers. I liked the introduction and the final chapter best.