E. I.

90[H, P, S, X].—EUGENE L. WACHSPRESS, *Iterative Solution of Elliptic Systems and Applications to the Neutron Diffusion Equations of Reactor Physics*, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1966, xiv + 299 pp., 24 cm. Price $12.95.

This book deals with many aspects of the theory and practice of numerical computations of solutions of the elliptic equations of reactor physics. It also gives some background material on physics, matrix theory, and partial differential equations in general. Following are some comments on the various chapters of the book.

1. *Mathematical Preliminaries* is a survey of elementary matrix theory, the Perron-Frobenius theory of positive matrices, and basic theory for the iterative and direct solution of systems of linear equations. According to the opinion of the reviewer, this chapter, as well as other parts of this book, should have been rewritten before publication. The author could either have worked out a fully self-contained chapter, or limited himself to give references to the well-known book by Varga or some other standard text.

2. *Formulation and Solution of Discrete Boundary Value Problems.* The author describes and discusses various techniques to discretize elliptic differential equations, giving an adequate background for the following chapters. The chapter also contains a short discussion of various types of partial differential equations and the boundary conditions which give rise to well-posed problems. There is also a very

superficial treatment of stability and convergence of difference methods for hyperbolic and parabolic problems, a subject which could as well have been left out completely.

3. *The Group Diffusion Equations of Reactor Physics.* This chapter presents a derivation of these basic equations and some difference approximations to them. Much stress is rightly put on the correspondence between certain laws of physics and properties of the matrices of the discrete problems.

4. *Successive Overrelaxation* gives the standard theory for this iterative method. Also included are methods for the estimation of the optimal parameter and a discussion of the role of eigenvector deficiency.

5. *Residual Polynomials.* The author describes Lanczos' methods, Chebyshev extrapolation, and some combined semi-iterative methods to improve the convergence rate of iterative procedures.

6. *Alternating Direction Implicit Iteration.* The commutative model problem and the selection of optimal parameters are treated in full detail. Available results for general noncommutative problems are surveyed. The author advocates compound iteration techniques for the general case.

7. *The Positive Eigenvector* is a short section on an important aspect of the eigenvalue problem. There is a discussion of several methods and strategies for the determination of the first eigenvalue.

8. *Numerical Studies for the Diffusion Equation* contains results from a series of numerical experiments designed to compare the efficiency of different numerical methods. This is a valuable contribution to the literature. Both practical and theoretical numerical analysts would profit very much from a larger literature on the results of careful numerical experiments.

9. *Variational Techniques for Accelerating Convergence* discusses the periodic application of variational acceleration techniques in linear iterative schemes.

This book undoubtedly contains much interesting material. It can serve as a source for numerical ideas but it should be read with care. The presentation of the material is not very good and part of this book lacks in precision.

Olof Widlund

University of Uppsala
Uppsala, Sweden

91[L].—Henry E. Fettis & James C. Caslin, *Tables of the Modified Bessel Functions $I_0(x)$, $I_1(x)$, $e^{-x}I_0(x)$, and $e^{-x}I_1(x)$*, Aerospace Research Laboratories, Wright-Patterson Air Force Base, Ohio, March 1967, ms. of 223 computer sheets deposited in the UMT file.

These impressive manuscript tables consist of 15S approximations to the modified Bessel functions of the first kind of orders 0 and 1, that is $I_0(x)$ and $I_1(x)$, and their respective products with e^{-x}, for $x = 0(0.001)10$.

These values were computed by double-precision arithmetic on an IBM 7094 system, using a computer program based on the integral representation

$$e^{-x}I_n(x) = \frac{1}{\pi}\int_0^\pi e^{-x(1-\cos\theta)} \cos n\theta d\theta \,.$$