and eigenvalue problems). An earlier reviewer's objection to the lack of discussion of pivoting for linear systems has been corrected by the addition of one paragraph, but that chapter is obviously slanted toward large problems, with more than half the material on iterative and gradient methods, including selection of the optimum SOR parameter. The text reads so smoothly that I fear many students will either miss significant details or will find it very tough going.

Further, all issues of software are omitted. The author explains that "With the availability of large and modern program packages, there is hardly need for such programs in a modern textbook. In fact, this view is shared by many reviewers, and it seems safe to assume that such programs will be run only occasionally. Further, programs that are really good should soon become part of a suitable package." This reader agrees with these statements, but feels that it is an incorrect interpretation to ignore all software issues on the assumption that the students will find out about these on their own somehow. My experience has been that engineering and science curricula emphasize computing more each year, but that these students, and many of their faculty too, are woefully ignorant of the many well-established software packages. It seems sad to teach, for example, about Gaussian elimination and not mention LINPACK, about ODEs without any mention of excellent programs which are available from Hindmarsh or Shampine, about integrals without any mention of adaptive quadrature, or about eigenvalues without mentioning EISPACK.

I believe that the most suitable audience for this book will be professional scientists who would like an extremely well-written introduction or review of the mathematical-numerical techniques which were developed through the mid 1970's. As a course text, the book would benefit from an instructor with real computing experience and insight, who was also willing to expand on some of the overly brief presentations.

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8[65F05, 65F10, 65F50, 65N05, 65N10, 65N15, 65N30, 65N35].—GARRETT BIRKHOFF & ROBERT E. LYNCH, *Numerical Solution of Elliptic Problems*, SIAM Studies in Applied Mathematics, SIAM, Philadelphia, Pa., 1984, xi + 319 pp., $23\frac{1}{2}$ cm. Price $31.50.

As stated by the authors, "The aim of this monograph is twofold: first to describe a variety of powerful numerical techniques for computing approximate solutions of elliptic boundary value problems and eigenproblems on high speed computers, and second, to explain the reasons why these techniques are effective." An attempt is made "to provide a reasonably well-rounded and up-to-date survey of these methods." The authors succeed in striking a delicate balance between exposition of underlying theory and its application to numerical solution techniques, thereby providing an impressive addition to the literature, which could well become a classic reference on this subject. In a work of this breadth, the depth of treatment is limited. Nevertheless, the crucial theorems are given with reasonable outlines of basic arguments in their proofs and extensive reference to appropriate literature. Current research is centered on vector and parallel computation, a field which is still in its infancy. The practitioner would do well to use this monograph as a springboard from which to launch on new methods for the incredible variety of emerging parallel and vector architectures. A summary of the nine chapters follows.

Chapter 1. "Typical Elliptic Problems," in which a description of a variety of physical problems which lead to elliptic systems motivates this treatise.

Chapter 2. "Classical Analysis," wherein a concise overview of the most essential and commonly used classical results are given which serve as a guide to formulation and solution of discrete approximations.

Chapter 3. "Difference Approximations" is a thorough treatment of several differencing techniques with analysis of approximation error and interrelationship of associated properties with solution techniques.

Chapter 4. "Direct and Iterative Methods" and

Chapter 5. "Accelerating Convergence" contain in-depth reviews of many of the most prevalent numerical techniques for solving large elliptic systems. Relative advantages of direct and iterative methods as a function of type of problem are discussed along with methods which utilize a combination of both approaches.

Chapter 6. "Direct Variational Methods" and

Chapter 7. "Finite Element Approximations" deal with variational principles characterizing solution of boundary-value problems, application via patchwork finite element approximation, and error estimation with the aid of classical polynomial approximation theory.

Chapter 8. "Integral Equation Methods," in which there is a concise description of Green's functions, boundary element methods, conformal mapping, capacitance matrix methods and other techniques for solving elliptic equations. Methods discussed here are "quasi-analytic" in that numerical approximations are made in conjunction with extensive analytic reduction.

Chapter 9. "ELLPACK" describes some of the capabilities of the Purdue ELLPACK software package for solving elliptic problems.

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9[65N99, 68-04].—JOHN R. RICE & RONALD F. BOISVERT, *Solving Elliptic Problems Using ELLPACK*, Springer-Verlag, New York, 1985, x + 497 pp., 24 cm. Price $46.50.

While I suspect most readers interested in this book will have some knowledge of the ELLPACK project and its origins, it seems advisable to sketch them because to some such background is necessary to understand this software. The solution of elliptic boundary value problems requires a sequence of operations, i.e., discretization of the domain, discretization of the equations and their boundary conditions, solution of the resulting linear equations, preparation of output. From the early 1970's, researchers in mathematical software have produced many high-quality program packages for individual steps in this sequence. One of the major motivations of the ELLPACK project was to standardize the large-scale testing of such