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Book reviews

Numerik Symmetrischer Matrizen, by H. Rutishauser, E. Stiefel and H. Schwarz, 1968; 243 pages. (*B. G. Teubner, Stuttgart*)

The text of this book is in German and, as the title suggests, the authors essentially concern themselves with problems in linear algebra whose solution involves a symmetric matrix. The book contains five chapters. The first is introductory and treats topics such as vector and matrix norms, positive-definite quadratic forms, condition number and the Cholesky decomposition. The second deals with iterative methods for the solution of equations with a positive-definite matrix of coefficients and covers the theory of gradient methods and the S.O.R. method, with determination of the optimum acceleration parameters for the special case of block tridiagonal matrices with diagonal blocks. The third chapter discusses the formulation and solution of least squares problems whilst chapter four treats the eigenvalue problem for symmetric matrices. This latter chapter is easily the longest in the book and provides a straightforward account of the methods of Jacobi, Givens and Householder followed by a description of the LR transformation. The special form this transformation takes when applied to tridiagonal matrices leads to a discussion of the QD algorithm and some of its applications. The chapter concludes with an account of the power method and simple treatments of the $A - \lambda B$ eigenvalue problem, where A and B are symmetric with B positive definite. The last chapter is concerned with the discretisation of elliptic boundary-value problems and the solution of the resulting algebraic equations. The reader is here introduced to Young's Property A in connection with the S.O.R. method and to consideration of block overrelaxation and A.D.I. schemes.

The book presents basic material in a clear manner. The methods described are well illustrated by simple numerical examples and ALGOL procedures are included at selected points in the text to provide concrete realisations of some of the algorithms discussed. The authors have obviously simplified their task by restricting their attention to symmetric matrices, yet within the chosen terms of reference they have produced a very useful and readable book which does not 'dress up' its material any more than is necessary for a sound understanding of the theory and methods presented.

E. L. ALBASINY (Teddington)

Computational Methods in Partial Differential Equations, by A. R. Mitchell, 1969; 255 pages. (*John Wiley & Sons Ltd.*, £4·00 (cloth), £2·25 (paper))

The preface to this book, although not the title, makes it clear that the computational procedures to be considered arise entirely from the use of finite-difference methods. Thus, for example, in dealing with hyperbolic equations no account is given of methods based on the use of characteristics, although it is stressed that the reader should become acquainted with their role. The text is aimed at second and third year science and engineering undergraduates and contains a large number of worked examples in addition to exercises for the student.

The book attempts to cover a considerable amount of ground. Thus topics considered are (i) parabolic equations in up to three space dimensions, (ii) two-dimensional elliptic equations together with Laplace's equation in three variables, (iii) first order hyperbolic systems in one and two space dimensions and (iv) second order hyperbolic equations in one, two and three space dimensions. An initial chapter on basic linear algebra and an interesting final chapter on applications in fluid mechanics and elasticity complete the book.

Operator-type methods of deriving formulae are favoured and, for two or more space variables, emphasis is placed on the ability to construct implicit schemes which can be 'split' into computationally simpler forms. In particular the book provides a good introduction to the locally one-dimensional methods developed in recent years by Russian numerical analysts for time-dependent problems, although these are by no means the only splitting schemes considered nor are they especially recommended. The book does indeed frequently detail a large number of possible approaches in various contexts. This can be confusing at times since the relative merits of the proposed schemes are not always clear. As the author himself comments, however, the situation is unlikely to be remedied until more experimental evidence becomes available.

The book is clearly written and deserves to do well. The reviewer noticed a few errors in the text. In particular the stability proof on p. 41 is based on an invalid argument and Table 7 appears to list results for time $t = 2{\cdot}5$ rather than $t = 3$ as stated.

E. L. ALBASINY (Teddington)