(2) Effort on the part of the user is minimized by casting the program in the form of a compiler with a fixed repertoire of facilities.

(3) Because the AA facilities provide a base of presently available, easily used routines and instructions, programming effort is greatly reduced, and a compiler could be quickly written which was capable of useful analytic processing.

References

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Book Review

Analysis of Numerical Methods, by E. ISAACSON and H. B. KELLER, 1966; 541 pages. (London: *John Wiley and Sons Inc.*, 95s.)

This book sets out to provide an understanding of numerical methods and the reasons for their success or failure. With this aim, selected methods are analysed in some detail with careful consideration given to convergence proofs and to error estimates for truncation and roundoff. The main results are clearly set out in the form of theorems and each section concludes with a number of problems, the results of which have either been used in the text or supplement the information already given.

The book has 9 chapters which cover a fairly conventional range of topics. Chapter 1 contains an introduction to vector and matrix norms, a discussion of rounding errors in floating-point arithmetic, and the requirements for a computing problem to be well-posed. Chapter 2 deals with direct and iterative methods for the solution of linear equations and matrix inversion, and includes Wilkinson's error analysis for Gaussian elimination. Chapter 3 is concerned with the iterative solution of non-linear equations and is largely devoted to a study of the convergence of the iterative scheme $x^{(\nu + 1)} = g(x^{(\nu)})$ for the vector equation $x = g(x)$. The computation of eigenvalues and eigenvectors is the subject of Chapter 4. Here, in the treatment of Givens' method for producing a tridiagonal matrix B, it is stated that once an eigenvalue λ of B has been found the corresponding eigenvector can be obtained simply by applying Gaussian elimination to $(B - \lambda I) x = O$ with neglect of the last r equations if $B - \lambda I$ has rank $n - r$. It should be noted that this is a very dangerous procedure numerically since, even when a very accurate approximation to the true value of λ is used in the equations, the vector x obtained in this way may differ substantially from the desired eigenvector; in fact this is customarily computed using inverse iteration. Chapter 5 presents the basic theory of polynomial approximation, with attention being given to least squares approximation, polynomials of "best" approximation and trigonometric approximation. The basic Weierstrass approximation theorem is proved with the use of Bernstein polynomials. Due to limitations of space, approximations using rational functions are not considered.

Divided differences are introduced in Chapter 6 which covers the topics of interpolation and numerical differentiation. Runge's example to illustrate possible divergence of interpolation polynomials is examined in detail. The Newton-Cotes and Gaussian-type quadrature formulae are considered in Chapter 7 whilst Chapters 8 and 9 are devoted to the numerical solution of ordinary differential equations and to difference methods for partial differential equations. The concepts of consistency, convergence and stability are explained and illustrated but the scope of the book allows only relatively straightforward partial differential equations to be considered. Thus only the Dirichlet problem for the Poisson equation in a rectangle is treated in detail under elliptic equations, together with an analysis of iterative methods for solving the approximating difference equations in this region. The book concludes with a brief bibliography.

The presentation throughout is clear and there appear to be only a few minor misprints. The emphasis is on the mathematics underlying particular numerical procedures and an exhaustive list of methods is not attempted. No illustrative numerical examples are given since it is assumed that these will be supplied by the instructor when using the book for teaching purposes.

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