REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS

The numbers in brackets are assigned according to the indexing system printed in Volume 22, Number 101, January 1968, page 212.

28 [2.35, 3, 4].—JAMES M. ORTEGA, *Numerical Analysis, A Second Course*, Academic Press, New York, 1972, xiii + 201 pp., 24 cm. Price $11.00.

This is a concise account of certain topics in numerical analysis which a student is expected to know when he reaches an advanced course yet may not have been introduced to in his first course on the subject.

The book is organized around the notion of *error*. After the concepts of stability and ill-conditioning (important in gauging the effects of all kinds of error) are elucidated in a first part of the book, discretization error, convergence error and rounding error are each studied separately in a few important situations in the last three parts of the book. A review chapter on the Jordan canonical form and on norms for vectors and matrices precedes all.

Stability (or the lack of it) is described as it occurs in the solution of a linear system, in the estimation of eigenvalues and eigenvectors, and in the solution of the initial value problem for a system of linear first-order differential equations or of linear difference equations. In the first instance, the author relies entirely on the condition number of the matrix of the linear system to measure the system's conditioning. The treatment of *a posteriori* error bounds in eigenvalue-eigenvector calculations seems more detailed; it includes a section for the important special case of a symmetric matrix. *Discretization error* is discussed in connection with the numerical solution of the general first-order initial value problem and of the linear second-order boundary value problem by finite difference methods. For the former, "Consistency plus Stability implies Convergence" is proved; the treatment of the latter relies on the maximum principle, else on the diagonal dominance of the coefficient matrix of the finite difference equations. The iterative solution of systems of linear and of nonlinear equations serves to illustrate *convergence error*. Major topics are the analysis of SOR in the linear case and of Newton's method in the nonlinear case. Finally, the backward error analysis for the triangular factorization of a matrix in finite precision arithmetic makes the discussion of *rounding error* concrete.

This is a textbook (of help in the mathematical analysis of some numerical methods) for first year graduate mathematicians and mathematically inclined computer scientists, written very carefully and with much attention to clean and simple proofs, with many interesting and varied exercises, and very carefully proofread.

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