BOOK REVIEWS

Solution of equations and systems of equations. By A. M. Ostrowski. Academic Press, New York, 1960. 9+202 pp. $6.80.

The book is the outgrowth of a series of lectures given at the American University, Washington, D. C., during the summer of 1952 at the invitation of the National Bureau of Standards. Much of the material contained in the course was unpublished. In preparing the book, the course was completely rewritten and augmented by additional new material.

Of primary concern is the solution of a single equation $f(x)=0$. The following methods are considered: the use of inverse interpolation including the use of a single point, the use of two points (regula falsi), and the use of an arbitrary number of points; the inversion of Taylor series involving the use of two terms (the Newton-Raphson method), and the use of an arbitrary number of terms; and the use of iteration procedures of the form $x_{n+1}=\psi(x_n)$, where $\psi(x)$ is a function such that $x=\psi(x)$ if and only if $f(x)=0$. The use of the function $w=(\alpha x+\beta)/(\gamma x+\delta)$ is also considered, where α, β, γ, δ are determined so that for three values of x, the values of w agree with $f(x)$. In addition, an analogue of the Newton-Raphson method is given for multiple roots. In each case the author gives sufficient conditions for convergence and for monotone convergence, estimates of the rapidity of convergence, and the "efficiency index" which depends on the rapidity of convergence and the amount of work per iteration.

Preparatory to considering the solution of n equations with n unknowns the author develops some of the theory of norms of vectors and matrices and of the convergence and divergence of infinite products of matrices. He then obtains conditions for certain iterative procedures and for given solution vectors of the equation system so that, starting sufficiently close to the solution vector, the vectors obtained will converge to the solution.

There are 11 appendices to which 70 pages are devoted. The following topics are covered: continuity and relative continuity of the roots of algebraic equations as functions of the coefficients; explicit formulas for the nth derivative of the inverse function; an analogue of the regula falsi for two equations in two unknowns; Steffenson's improved iteration rule; the Newton-Raphson algorithm for quadratic polynomials; some modifications and improvement in the Newton-Raphson method; rounding-off in inverse interpolation; accelerating iterations with superlinear convergence; determining the roots of