responds to criticisms of the approach. There can be difficulties such as instability, stiffness, cancellation, and critical lengths. Some of these are brought out by example, though the reviewer's experience has been that stiffness is a common and serious difficulty which neither author mentions. There are some nice applications of physical interest which are detailed in examples. The Stefan problems and oil reservoir problem in GHM and the Sturm-Liouville problems in MRS particularly appeal to the reviewer.

It will dishearten those writing codes for initial value problems to learn that nearly all the examples in both books were computed using fixed-step, fourth-order Runge-Kutta codes. The techniques being studied are utterly dependent upon the reliable, efficient solution of initial value problems. Because they were obtained from long obsolete codes, the computations reported cannot be used to assess the reliability and effectiveness of the approach nor its efficiency as compared to methods not based on initial value problems. Since this situation is all too common, the reviewer points out there have been three substantial evaluations of codes for the initial value problem published in recent years. There is a high quality, portable code in the text of C. W. Gear (published 1971, reviewed *Math. Comp.*, v. 27, 1973, p. 673) and there are several other codes as good or better which can be easily obtained. With the ready availability of these codes, workers requiring the solution of an initial value problem no longer have any excuse for using codes of lesser quality.

L. F. SHAMPINE

Sandia Laboratories
Albuquerque, New Mexico 87115

53 [5, 13.20].—PATRICK J. ROACHE, *Computational Fluid Dynamics*, Hermosa Publishers, Albuquerque, New Mexico, 1973, vii + 434 pp., 27 cm. Price $12.50.

Chapter headings: 1. Introduction. 2. Incompressible Flow Equation in Rectangular Coordinates. 3. Basic Computational Methods for Incompressible Flow. 4. Compressible Flow Equations in Rectangular Coordinates. 5. Basic Computational Tools for Compressible Flow. 6. Other Mesh Systems, Coordinate Systems, and Equation Systems. 7. Recommendations on Programming, Testing, and Information Processing.

This book is aimed at the person interested in the practical application of its subject. The methods included are described in enormous detail, with emphasis on recipes rather than principles. Practical hints abound, and some of them, in particular in Chapter 7, are quite good.

The book operates, however, within narrow limits. The methods included are simple, with one exception—low order, difference schemes. No substantive discussion is given of spectral methods, finite element or Galerkin methods, higher accuracy methods for compressible flow, or Monte Carlo methods. No proper discussion is given of the effect of boundary conditions on stability. The author suggests that the shortcomings of frozen-coefficient stability analysis can be ascribed to a defect in the definition of stability, and that there do not exist exact analyses of nonlinear problems.

He distinguishes between his field of Computational Fluid Dynamics, and a broader field, Numerical Fluid Dynamics, which is not included in the book, and which presumably contains high accuracy methods as well as the appropriate analysis.

Even the subjects included are treated in an inadequate and slipshod manner. A few examples: the author is enthusiastic about upstream (first order!) differencing, although he quotes, without comment, another author who called it unacceptable. He quotes, approvingly, results obtained with this method at a Reynolds number $R = 10^6$. As his own paper at the end of the book shows, the numerical diffusion in such a scheme is of the order of the mesh size; the contradiction is never resolved.

The discussion of boundary conditions for the pressure in the incompressible (V, p) equations is misleading. The author does indicate some of the disasters which may ensue from the application of his rules, and then merely gives a recipe for keeping the pressure bounded in a specific case, although the general theory is well known. He also states flatly and erroneously that there are no implicit (V, p) formulations available.

Higher order methods for the gas dynamics equations are dismissed because the solutions are not smooth; this would, of course, be a reason for advocating such methods, as an inspection of the Fourier-space characterization of accuracy would reveal. Richardson extrapolation is also dismissed, even for viscous flow.

In summary, this long book is not only inadequate, but also pernicious. It fosters the attitude that accuracy and analysis are the realm of effete "numerical" fluid dynamicists and not useful to practical people. If taken seriously, this book may delay the maturation of its subject.

ALEXANDRE J. CHORIN

Department of Mathematics
University of California
Berkeley, California 94720

54 [8].—CHARLES E. LAND, *Tables of Standard Confidence Limits for Linear Functions of the Normal Mean and Variance*, Department of Statistics, Atomic Bomb Casualty Commission, Hiroshima, Japan 730. Ms. of 6 pp. + 65 computer sheets (reduced) deposited in the UMT file.

The tabulated values of $C(s; \nu, \alpha)$, $C_{-1}(s; \nu, \alpha)$, and $C_{+1}(s; \nu, \alpha)$ represent scaled level α confidence limits for $\mu + \lambda\sigma^2$, for arbitrary nonzero λ, where μ and σ^2 are, respectively, the unknown mean and variance of a normal distribution. These limits correspond to observed values of (Y, S), where $Y \sim N(\mu, \sigma^2/\gamma^2)$, γ is a known positive number, and S^2 is distributed independently as σ^2/ν times a chi-square variate with ν degrees of freedom. For a given observed value (y, s), the level α one-