algorithm." This material is divided into five chapters and is a not quite completed monograph that Rutishauser had been preparing until his untimely death.

E. I.

39[65–01].—LARS ELDÉN & LINDE WITTMEYER-KOCH, *Numerical Analysis: An Introduction*, Academic Press, Boston, 1990, x+347 pp., $23\frac{1}{2}$ cm. Price $39.95.

This book is intended for an introductory course in numerical analysis at the advanced undergraduate level. The student or reader is thus supposed to have prior knowledge in calculus and preferably in linear algebra. The book consists of ten chapters with the headings:

Chapter 1: Introduction.
Chapter 2: Error analysis and computer arithmetic.
Chapter 3: Function evaluation.
Chapter 4: Nonlinear equations.
Chapter 5: Interpolation.
Chapter 6: Differentiation and Richardson extrapolation.
Chapter 7: Numerical integration.
Chapter 8: Systems of linear equations.
Chapter 9: Approximation.
Chapter 10: Differential equations.

The short Chapter 1 is devoted to a discussion of the relationships between mathematical models and corresponding numerical problems.

In Chapter 2 we find a discussion of various sources of errors and derivation of the well-known formulas for error propagation. This topic is dealt with in most textbooks in numerical analysis. But the authors also give an interesting discussion of the IEEE standard for floating-point arithmetic and about pipelined floating-point operations.

Next, Chapter 3 deals with fairly modern topics, such as the CORDIC algorithm for evaluating trigonometric functions. We find here also some useful classical results such as the estimation of the remainder of a truncated alternating series by means of Leibniz's theorem and the integral estimate for truncated positive series.

Chapters 4 and 5 give a useful treatment of classical topics which have many applications.

Chapter 6 presents the important Richardson extrapolation, which should be known by almost everyone working in the area of numerical calculations. Its application to numerical differentiation is treated here, but in subsequent chapters this extrapolation is applied to numerical integration and the treatment of differential equations.

In Chapter 7 we find the classical Romberg scheme for numerical integration. Perhaps the authors could have mentioned in this context that there are situations (e.g., in the integration of periodic functions, or when the interval of integration is infinite) when the trapezoidal rule gives very accurate results which cannot be improved by means of Richardson extrapolation. On the other hand, the authors give an interesting treatment of adaptive quadrature.

Chapter 8 gives a very good introduction to the numerical treatment of linear systems of equations and Gaussian elimination. The cases of general, i.e., nonstructured matrices, positive definite and band matrices are dealt with in detail. Iterative improvement is also discussed. It would perhaps have been worthwhile for the authors to include a short description of the Gauss-Seidel and Jacobi iteration schemes, which now are of interest in the context of the popular multigrid methods. We also find in Chapter 8 a discussion of perturbation, for which the authors introduce vector and matrix norms. The discussion of high-performance computers is also valuable.

In Chapter 9 normed function spaces are introduced in an elementary way, and some classical results on orthogonal polynomials are presented. The reader is also informed that interpolation at the Chebyshev points in general gives a good polynomial approximation.

Chapter 10 is devoted to ordinary differential equations and describes a few important methods for initial value and boundary value problems.

The book is well written. The discussion is clear and easy to follow. The authors present central topics in numerical analysis and the book should be useful for anyone who is interested in numerical calculations.

F.S.

40[65N30, 76D05].—MAX D. GUNZBURGER, *Finite Element Methods for Viscous Incompressible Flows: A Guide to Theory, Practice, and Algorithms*, Computer Science and Scientific Computing, Academic Press, Boston, 1989, xvii +269 pp., $23\frac{1}{2}$ cm. Price $44.50.

The book by Gunzburger will appeal to a broad range of people interested in understanding algorithms for solving the model equations of fluid flow. This could be someone who wants to write new software, someone interested only in using existing software, but wanting to use it more intelligently, or someone looking for research problems in the field. Gunzburger has attempted to present the body of mathematical results currently available on the subject to such people.

The casual reader might comment that the book lacks proofs. This is not an accurate statement, even though the preface says that "no detailed proofs are given." For example, a fairly complete outline of a key issue, "divergence stability," is given (Chapter 2); details are in the papers cited. Even research mathematicians may appreciate this approach—it tells them what is important and where to find out more. However, the approach may make the book inappropriate as a text for a graduate course in mathematics.

There are several books with subject matter related (and complementary) to the book under review. The monographs of Girault and Raviart [2, 3] present