20[2.00].—J. STOER & R. BULIRSCH, *Introduction to Numerical Analysis*, Translated by R. Bartels, W. Gautschi, and C. Witzgall, Springer-Verlag, New York, 1980, ix + 609 pp., 24 cm. Price $24.00.

This textbook, which has been translated from a German edition, is a gold mine for anyone looking for facts concerning a large variety of methods in numerical mathematics. It is modern, not only with respect to analysis but also in selection of methods. For example, there are good surveys of the fast Fourier transform, spline functions, the simplex method, minimization methods, stiff differential equations, and the finite element method; several of these subjects are not generally covered in similar literature. On the other hand, partial differential equations as well as integral equations are missing for reasons which are explained but perhaps not too convincingly.

Looking at details, one can express criticism in some respects. Much effort and space is devoted to interpolation in spite of the fact that with general access to computers few people would nowadays perform this kind of calculation. The main interest is actually concentrated on the use of interpolation as a theoretical tool in connection with, e.g., numerical differentiation and integration. To cite one specific example, no one would perform polynomial interpolation on the function $y = \cot x$ for small x (p. 72). If such an interpolation has to be done, the auxiliary function $z = x \cot x$ should be used instead. It gives even better accuracy than rational interpolation (whose supremacy is supposed to be illustrated).

In several places clumsy notations are irritating; as an example, the theorem on page 69 could be mentioned. Quite often "recursive" notations would give a much better overview and even better insight. Far too often, readability is an underestimated quality with textbooks.

The exercises are numerous and as a rule very good and illustrative, most of them original. No answers are given; if supplied, they would add considerably to the value of the book, especially for students who study this course on their own. An appealing feature is the large number of references at the end of each chapter.

As is understood from the review above, this textbook represents an excellent modern and welcome addition to the literature in numerical mathematics.

CARL-ERIK FRÖBERG

University of Lund
Lund, Sweden

21[6.35].—JOHANN SCHRÖDER, *Operator Inequalities*, Academic Press, New York, 1980, xvi + 367 pp., $23\frac{1}{2}$ cm. Price $39.50.

The subject of this book, operator inequalities, is one which has wide application to various branches of analysis. The author sets up the abstract framework in the first chapter, where he introduces the notions of ordered linear spaces and positive linear operators. There he also states the fixed point theorems and the iterative procedures he will need in the sequel. In the subsequent chapters he extends the abstract ideas and presents a number of applications.

For example, in Chapter II, he introduces the notions of inverse positive linear operators and connected sets of operators. There he applies these ideas to the theory of M and Z matrices and gives some numerical applications. He also applies these ideas to linear second order ordinary differential inequalities and places the maximum principle in this framework. Other applications are made to oscillation theory and eigenvalue problems for second order o.d.e.s.

In Chapter III, the concept of inverse monotone operators is introduced. Here the emphasis is directed toward the study of two joint boundary value problems for *nonlinear* second order o.d.e.s. Chapter IV is concerned with an estimation theory for linear and nonlinear operators, the principal applications being to functional differential equations and nonlinear functions on finite-dimensional spaces. Chapter V deals with vector valued differential operators and systems of ordinary differential equations.

This book has several pleasant features. The inclusion of problems at various points in the text not only helps the reader toward understanding but also makes the book suitable for use in a special topics graduate course. There are also very informative notes at the end of each chapter which refer to a bibliography of approximately three hundred and fifty items. The English, while stilted in places, is otherwise fine.

There are only two criticisms to be made of the book. First, there is no discussion of operator inequalities of the form

$$\|du/dt - A(u)\| \leqslant \varphi(t)\|u(t)\|,$$

where $\| \ \|$ is a Banach space norm and $A(u)$ is a linear operator. Secondly, as the author readily confesses, there are no applications to partial differential equations. (The first criticism may partially be included in this one as well.) The author gives sizes constraint as the reason for this latter omission. This is reasonable considering the length (348 pages) of the book. However, some mention could have been made at various points in the text as to which ideas are used in partial differential equations, especially in elliptic theory (maximum principle, Schauder estimates, comparison functions etc.) (although some of this is done in the chapter notes).

All in all this is a well written book that can be read by upper-level graduate students. It does contain a wealth of material of interest to numerical analysts as well as people in ordinary differential equations. It is worthy of a sequel dwelling on applications to partial differential equations.

HOWARD A. LEVINE

Department of Mathematics
Iowa State University
Ames, Iowa 50011