Hopf points in certain two- and three-parameter problems are presented by B. DeDier, D. Roose, and P. VanRompay. C. Kaas-Petersen examines the Gray-Scott model of isothermal autocatalytic processes when the standard symmetry is broken by unequal boundary conditions and events with higher codimension occur.

Finally, the fourth group of papers concerns parameter-dependent time-dependent systems. The computation of heteroclinic orbits connecting two saddle points is discussed by E. J. Doedel and M. J. Friedman, and E. Lindtner, A. Steindl, and H. Troger study the loss of stability of the basic periodic motion of a robot.

The results in this volume certainly provide an interesting contribution to this very active area.

W. C. RHEINBOLDT

Department of Mathematics and Statistics
University of Pittsburgh
Pittsburgh, Pennsylvania 15260

7[65-01, 65D07, 65L60, 65N30].—P. M. PRENTER, *Splines and Variational Methods*, Wiley Classics Edition, Wiley, New York, 1989, xi + 323 pp., 23 cm. Price: Softcover $24.95.

This is a reprint of a book first published in 1975 and now elevated to the status of a "classic", in good company with other books in the Wiley Classics Library such as Courant-Hilbert, Curtis-Reiner and Dunford-Schwartz. It is intended as an introduction to the subject of its title, aimed at first-year graduate students in engineering and mathematics. To quote from the Preface: "... to introduce them gradually to the mathematician's way of thinking ... "; "... a book on the subject that could be read by ordinary mortals ... ". Basic concepts of one-dimensional and multivariate polynomial and piecewise polynomial interpolation are covered and then finite element and collocation methods for differential equations. Concepts, e.g., from elementary functional analysis, are introduced as needed.

The book is much in the spirit of Strang and Fix's influential 1973 book [3], although it does not try to cover the then research frontier as [3] did. Prenter's book includes more of "classical" approximation theory.

It is a very pleasant and well-written book. However, some parts of it have not aged well in the decade and a half since its publication, and it cannot now be used as a textbook. I proceed to give two examples of why.

First, although there is a "guest" reference to Bramble and Hilbert 1970 on p. 271, the Bramble-Hilbert lemma is not stated or used. Consequently, error estimates for multivariate approximation are restricted to the maximum (Tchebycheff) norm, although they are later applied to energy and L_2 estimates. Excessive, in many applications fatal, smoothness demands result. Also, as was common before the Bramble-Hilbert lemma, the estimates in approximation theory are slugged out on a tedious case by case basis (which sometimes may give more explicit constants than use of the Bramble-Hilbert lemma). As the author remarks, p. 127: "Waning sadism forbids us to go further", which can be taken as a nice comment on the effort-, ink-, and tree-saving role of the Bramble-Hilbert lemma. (That role was duly appreciated at the time, e.g., in [3, p. 146].)

Secondly, in the analysis of the finite element method in one space dimension, the author derives maximum norm error estimates that are off by one full order of accuracy, pp. 215 and 221–222. The case on pp. 221–222 was actually solved by Wheeler [4] in 1973, while the general case, including that on p. 215, came later [1].

Finally, reprinting good books is an idea that deserves strong applause from the mathematical community. In numerical analysis, will Richtmyer and Morton's 1967 book [2] be next?

L. B. W.

1. J. Douglas, Jr., T. Dupont, and L. B. Wahlbin, *Optimal L_∞ error estimates for Galerkin approximations to solutions of two-point boundary value problems*, Math. Comp. **29** (1975), 475–483.

2. R. D. Richtmyer and K. W. Morton, *Difference methods for initial-value problems*, 2nd ed. Interscience, New York, 1967.

3. G. Strang and G. J. Fix, *An analysis of the finite element method*, Prentice-Hall, Englewood Cliffs, N.J., 1973.

4. M. F. Wheeler, *An optimal L_∞ error estimate for Galerkin approximations to solutions of two-point boundary value problems*, SIAM J. Numer. Anal. **10** (1973), 914–917.

8[41-02, 41A29, 41A50, 41A52, 41A65, 65D15].—ALLAN M. PINKUS, *On L^1-approximation*, Cambridge Tracts in Mathematics, Vol. 93, Cambridge Univ. Press, Cambridge, 1989, x + 239 pp., $23\frac{1}{2}$ cm. Price $44.50.

We welcome this book as the first comprehensive monograph on approximation in the mean. It merits much praise for being all that such a work should be: it takes a global viewpoint and proceeds systematically and efficiently through the entire subject. All the classical results are here—often in generalized form and with improved proofs. Fully half the book is devoted to the progress made in the last ten years. The author has played a leading role in all this recent activity and is uniquely qualified to be its chronicler and interpreter.

Mean approximation (or L^1-approximation) is the problem of minimizing the expression $\int |f - u|$ by choosing u from some given class of functions. Here, f is a function to be approximated, and the integral is over a fixed measure space. A typical example occurs when f is a continuous function on a closed and bounded interval of the real line, and u is chosen from the family of cubic spline functions with a prescribed set of knots. In this case the integral could be the usual Lebesgue or Riemann integral on the interval, but much more general measures are admitted in the theory.