differential equations, which results in guaranteed inclusions, possibly under perturbations like in satellite computations.

A good number of papers deal with techniques which make implementations of automatic differentiation more efficient, special attention being given to concurrent architectures. Language aspects are also considered, and a group of papers describes particular aspects of particular software products. Another group of papers comments on the advantages which the authors have been able to derive from the use of automatic differentiation in their particular application areas, which range from weather prediction to distributed dynamical systems.

Altogether, this volume offers the opportunity to the computational scientist for a first, or in-depth, encounter with automatic differentiation, an experience which he is well advised to seek.

H. J. S.

6[41-06, 65Dxx].—E. W. Cheney, C. K. Chui & L. L. Schumaker (Editors), *Approximation Theory* VII, Academic Press, Boston, xx+249 pp., $23\frac{1}{2}$ cm. Price $59.95.

During the last ten or fifteen years, *Approximation Theory* as a research subject has undergone remarkable changes and has turned up a variety of interesting new facets. Practical applications as well as theoretical questions, partly emerging from other mathematical subjects, have motivated new types of problems, which to a large extent have replaced classical issues like Jackson and Bernstein theorems. While this makes the field perhaps less coherent, it does enhance its pivotal position as a link between several different areas.

These trends are clearly reflected in this book. The Texas Symposium on Approximation Theory has long become a central and traditional event. This seventh volume of its proceedings has broken with tradition in that this time it only contains the contributions by the invited speakers. I am tempted to say, though, that the book is a good example of "less is more". In fact, all the articles are survey-type articles. They are all well, and some even exceptionally well, written. While they still address classical subjects like approximation by algebraic polynomials or rational functions, they emphasize important connections with potential theory, consider not only classical accuracy questions but also issues of shape preservation, and deal with algorithmic aspects such as recursive interpolation processes. The reader will learn of important principles for studying approximation orders and cardinal interpolation for shift-invariant spaces. This latter setting is also inherent in several contributions to the theory of wavelets and its applications, for instance, to signal processing. One important issue in this context is data compression, which is also the central theme of knot removal techniques for spline curves and surfaces motivated by applications in Computer Aided Geometric Design. Last but not least, the question of denseness of systems of ridge functions or sigmoidal functions is discussed and related to the theory of neural networks.

So the ideas and principles discussed in these articles, combined with the many references to the original papers, make this volume a valuable source of information on several recent interesting developments in approximation theory and beyond.

The authors and their titles are as follows:

Carl de Boor, Approximation order without quasi-interpolants
Charles K. Chui, Wavelets and signal analysis
Albert Cohen, Wavelet bases, approximation theory, and subdivision schemes
Bo Gao, Donald J. Newman, and Vasil Popov, Approximation with convex rational functions
Martin Gutknecht, Block structure and recursiveness in rational interpolation
Kurt Jetter, Multivariate approximation from the cardinal interpolation point of view
Will Light, Ridge functions, sigmoidal functions, and neural networks
Tom Lyche, Knot removal for spline curves and surfaces
Vilmos Totik, Approximation by algebraic polynomials

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7[65-01, 65Mxx, 65Nxx].—WILLIAM F. AMES, *Numerical Methods for Partial Differential Equations*, 3rd ed., Computer Science and Scientific Computation, Academic Press, Boston, 1992, xvi+451 pp., $23\frac{1}{2}$ cm. Price $59.95.

This is a third and significantly updated edition of a well-known textbook which first appeared in 1969, with a second edition in 1977. Of the six chapters of the second edition, the last one, "Weighted residuals and finite elements", has been disassembled and its contents, to quote the author, "... merged with the material on finite differences", so that "... they now constitute equal partners". Further, "Additional material has been added in the areas of boundary elements, spectral methods, the method of lines, and invariant methods."

The book covers a large number of topics of interest for applications in science and engineering, and contains about 300 problems and 650 references. The presentation is more descriptive than analytic, and thus introduces and discusses concepts and gives many recipes for numerical approaches but provides little in terms of theory and proofs.

In spite of the author's claim for equal partnership between finite differences and finite elements, the text is still strongly founded in the finite difference ideology of the time of its first edition, and many important new points of view and developments are omitted such as, e.g., the variational approach to boundary value problems, and domain decomposition and multigrid methods. The first sentence of the introduction, "Numerical calculation is commonplace today in fields where it was virtually unknown before 1950" is taken over from an earlier time and gives an antiquated impression, and the author's claim in the preface that "the references have been brought up to date" is not quite justified: among the 134 references in the chapter on "Elliptic Equations", 95 are from before 1969 and only 19 from the 1970s and 20 from 1980 and later.

In summary, in the opinion of the reviewer, the updating of this classical