31[65-01, 65R20].—L. M. DELVES & J. L. MOHAMED, *Computational Methods for Integral Equations*, Cambridge University Press, Cambridge, 1985, xii + 376 pp., $23\frac{1}{2}$ cm. Price \$69.50.

This welcome edition consists of one of the most complete elementary expositions of numerical methods for solving one-dimensional integral equations that have been published to date. It covers the classical types of equations: Fredholm, Volterra, first kind, second kind, and third kind. On the theoretical side, one finds discussions of convergence and error of methods confined more frequently to the practical $L^2(a, b)$, $L^\infty(a, b)$, and $C^m(a, b)$ spaces, than in previous texts. Much space is devoted to important discussions of different types of quadrature schemes that may be used for obtaining numerical solutions of integral equations. One finds a discussion of the treatment of singularities, by subtracting them out or by ignoring them. Another novelty of the text is a discussion of the numerical solution of integro-differential equations. There is a refreshingly frequent switching from theoretical to numerical, presumably for purposes of keeping the subject matter interesting to the reader. Finally, one finds many examples, and while most of these do not come from real-life situations, they do illustrate difficulties of the type that one may encounter in real-life problems.

The authors admit a lack of completeness of the text. For example, one does not find a treatment of nonlinear Fredholm equations, of multidimensional Fredholm equations, or of Cauchy singular equations.

The book is recommended for advanced undergraduates or beginning graduate students.

The following is a listing of the chapter-by-chapter layout of the text, along with some brief comments.

Ch. 0: Introduction and preliminaries.

This chapter consists mainly of a discussion of the aim of the book, a listing of other books in the field, and a classification of the different types of integral equations.

Ch. 1: The space $L^2(a, b)$.

Here one finds a complete and self-contained discussion of the theory of $L^2(a, b)$, which is relevant to the contents of the text.

Ch. 2: Numerical quadrature.

Standard classical methods of quadrature and errors of quadrature are discussed here.

Ch. 3: Introduction to the theory of linear integral equations of the second kind.

Here one finds a discussion of the classical theory of Fredholm and Volterra integral equations, in an $L^2(a, b)$ setting. The important Fredholm alternative is not discussed until Ch. 6.

Ch. 4: The Nyström (quadrature) method for Fredholm equations of the second kind.

The Nyström method is very powerful for solving Fredholm equations that have continuous kernels. A complete discussion is given in this chapter of the important Nyström method, along with an error analysis.

Ch. 5: Quadrature methods for Volterra equations of the second kind.

Here one finds a discussion of the implementation of classical numerical methods for solving ordinary differential equations to the numerical solution of one, and systems of Volterra integral equations.

Ch. 6: Eigenvalue problems and the Fredholm alternative.

The discussion of eigenvalues is related to arbitrary Fredholm equations in terms of degenerate systems. No error analysis is given.

Ch. 7: Expansion methods for Fredholm equations of the second kind.

The Galerkin and Ritz-Galerkin methods are discussed for reducing a linear Fredholm integral equation problem to a problem involving a system of linear algebraic equations.

Ch. 8: Numerical techniques for expansion methods.

Explicit methods are discussed for actually carrying out the details of the Galerkin methods of the previous section.

Ch. 9: Analysis of Galerkin method with orthogonal basis.

Truncation and roundoff errors of the Galerkin method with orthogonal basis are discussed.

Ch. 10: Numerical performance of algorithms for Fredholm equations of the second kind.

This chapter compares the time required of different existing computer algorithms for solving Fredholm integral equations.

Ch. 11: Singular integral equations.

The type of singularities discussed are: (i) an infinite, or semi-infinite range of integration in the integral operator; (ii) a discontinuous derivative in the kernel or in the nonhomogeneous term; and (iii) an infinite or nonexisting derivative of some finite order.

Ch. 12: Integral equations of the first kind.

Eigenfunction expansions, regularization, and computational methods are discussed.

Ch. 13: Integro-differential equations.

Several methods are discussed for solving Volterra and Fredholm-type integro-differential equations.

Appendix: Singular expansions.

Explicit formulas are tabulated, for the coefficients in the expansions of the solution in terms of Chebyshev polynomials, for the case when the kernel has various types of special singular forms.

F. S.

32[41-01, 34A40, 34A50].—Richard E. Bellman & Robert S. Roth, *Methods in Approximation—Techniques for Mathematical Modelling*, Reidel, Dordrecht, 1986, xv + 224 pp., 23 cm. Price \$49.00/Dfl. 120.00.

According to the editor of the series in which this book appears, it is a survey of the thoughts of R. Bellman on the how and why of approximation over the past twenty-five years. This seems an accurate enough description, provided that one takes the right definition of the word approximation.