always a brief introduction so that a reader not so familiar with these concepts should not feel lost. In particular, the modern theory of integral equations is nicely outlined. Each section ends with a long list of problems. Their purpose is often to complete details skipped in previous proofs. By this arrangement, the leading ideas become more conspicuous in the main text.

Sinc methods have the potential to become the method of choice for many. The book can therefore be warmly recommended to scientists and engineers. It can also be used for advanced courses in numerical analysis. Even researchers may find the book stimulating since there is still enough room for further developments.

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27[68-02, 68-04, 65G10, 65D10, 65Y10, 65Y15, 68M15, 68Q10].—E. Adams & U. Kulisch (Editors), *Scientific Computing with Automatic Result Verification*, Mathematics in Science and Engineering, Vol. 189, Academic Press, Boston, 1993, x+612 pp., $23\frac{1}{2}$ cm. Price \$59.95.

This text consists of a collection of recent papers on development and application of numerical algorithms with automatic result verification. The majority of the papers represent selected material taken from doctoral theses which were written at the Institute for Applied Mathematics at the University of Karlsruhe. The following three areas are presented:

1. The development of computer languages and programming environments that support automatic result verification in scientific computation;
2. The corresponding software for differentiation or integration problems, or for differential and integral equation problems; and
3. Specific examples of applications in the engineering sciences.

The book has a table of contents, a preface, and a well-written introduction that helps the reader to better understand other parts of the book. It has an excellent bibliography of publications on computations with result verifications, and finally, it also has a helpful index.

The papers are subdivided under three chapter subdivisions.

I. *Language and Programming Support for Verified Scientific Computation.* This chapter consists of papers describing existing languages and programming environments that support result verification: PASCAL-XSC, ACRITH-XSC (a Fortran-like language), and C-XSC (a C + + language), and it also proposes methods for accurate floating-point vector arithmetic.

II. *Enclosure Methods and Algorithms with Automatic Result Verification.* In this chapter, correct algorithmic execution procedures are presented for automatic differentiation, numerical quadrature by extrapolation, numerical integration in two dimensions, numerical solution of linear and nonlinear integral equations, numerical solution of ordinary differential equation initial value problems, and interval arithmetic in staggered correction format.

III. *Applications in Engineering Sciences.* In this chapter one finds various examples of computations with result verification. Included are multiple-precision computations, asymptotic stability computations with applications to control theory, magneto-hydrodynamic flow calculations, computations of discretizations of evolution problems, scattering calculations using the KKR (Koringa, Kohn, and Rostaker) method, and a description of a hardware floating-point unit which extends the standard (scalar) IEEE procedure, for performing vectorized scientific and engineering calculations.

In the reviewer's view, this text is a worthwhile endeavor, especially for the world of parallel and vector computation, for which automatic error control is absolutely essential.

F.S.

28[00A69, 34A55, 45B05, 65R30].—Charles W. Groetsch, *Inverse Problems in the Mathematical Sciences*, Vieweg, Braunschweig/Wiesbaden, 1993, vi+ 152 pp., 23 cm. Price $30.00.

When we study the sciences, we generally learn the mathematical models that predict the outcome of the experiments. The practice of science, however, frequently proceeds in the opposite direction: given the experimental results, what is the mathematical model? At least in the cases where the general form of the model is known, these problems are called inverse problems. Because of their importance in the practice of science, inverse problems deserve a more prominent place in the curriculum. And now, a book on inverse problems has been written that can even be used as an undergraduate text!

As is appropriate for this level, the recent book by Charles Groetsch deals with one-dimensional inverse problems. It begins (Chapter 2) with a wealth of examples, all physically motivated, that involve first-kind integral equations. These linear examples, many of which are explicitly solvable, illustrate the ill-posedness typical of inverse problems, and motivate the discussion of first- and second-kind integral equations at the end of the chapter.

The third chapter gives examples of inverse problems that involve ordinary differential equations. Again, each problem is physically motivated. Many are nonlinear and none have explicit solutions. For approaches to solving them, the reader must wait until Chapter 5. First, however, comes Chapter 4, which summarizes the necessary functional analysis. Undergraduates may find this chapter rather difficult, but more knowledgeable readers will find it a useful compilation of generally familiar material.

The climax of the book is Chapter 5, which explains eight practical techniques that apply to a wide variety of inverse problems. Included are methods for dealing with ill-posedness and for incorporating prior information about the solution.

There are exercises interspersed throughout the text. At the end is a useful annotated bibliography.