8[41-04, 41A30, 42A38, 65D99, 68U10]—*Adapted wavelet analysis from theory to software*, by Mladen Victor Wickerhauser, A K Peters, Wellesley, MA, 1994, xii + 486 pp., $23\frac{1}{2}$ cm, $59.95

Wavelet analysis is one of the richest subject areas in recent years to be included in the field of computational mathematics. Although there are already several popular monographs in the literature devoted to this subject, the book under review is the first one that goes beyond the mathematical treatment to aid those who write computer programs to analyze real data. It addresses the important properties of the wavelet transform so as to establish the criteria by which the proper analysis tool may be chosen, and it then details the software implementations for computational need. On the other hand, this book is rather self-contained, including even the necessary preliminary materials, such as mathematical analysis in Chapter 1, programming techniques in Chapter 2, and the discrete Fourier transform in Chapter 3. Chapters 4–10 are devoted to the algorithmic approach of wavelet analysis, and the final chapter includes applications to image compression, speech signal segmentation and scrambling, and signal denoising. In addition, an extensive appendix, giving solutions of selected problems in Chapters 2 and 4-9 as well as several tables of filter coefficients, is included.

The presentation of wavelet analysis in Chapters 4-10 is different from those in the existing wavelet books. Since the discrete Fourier transform has already been reviewed in Chapter 3, the subject of localized trigonometric series (or local trigonometric transform) presented in Chapter 4 provides a continuous flow of ideas from global to local analyses. Also, since the main concern of this book is computer implementation, a thorough discussion of quadrature mirror filters in subband coding theory in Chapter 5 is probably the most natural approach for introducing the so-called discrete wavelet transform, DWT (or wavelet series), in Chapter 6. Beyond DWT, but still within the realm of discrete computational analysis, are wavelet packets, their corresponding best-basis algorithm, and multidimensional library trees, discussed in Chapters 7, 8, and 9, respectively. Of course, a chapter on time-frequency analysis must be included in any book on wavelet applications, and this is done in Chapter 10.

Each chapter discusses the technicalities of implementation, giving examples in pseudocode, which is backed up with machine-readable Standard C source code available on a diskette that can be purchased separately. This book, beautifully written by a master of the subject, should be a valuable addition to the personal collections of those who are interested in the subject of wavelet analysis and its applications to data analysis.

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9[42-06, 42C10, 86-06, 86-08]—*Wavelets in geophysics*, Efi Foufoula-Georgiou and Praveen Kumar (Editors), Wavelet Analysis and Its Applications, Vol. 4, Academic Press, San Diego, CA, 1994, xiv + 372 pp., $23\frac{1}{2}$ cm, $59.95

Seismic signals are dispersive, owing to attenuation and dispersion, and therefore, traditional methods that assume stationarity of data are not always useful in spectral analysis. Because of this, the wavelet transform was developed in exploration geophysics in 1982 for the time-frequency analysis of seismic signals. Since then, wavelet transforms have developed into a new branch of mathematics and have been applied to a wide variety of problems, although interestingly their applications in geophysics have been rather limited. Only in the past couple of years have geophysicists started to reevaluate the use of wavelet transforms in their applications. Thus it is very encouraging to find a new publication detailing some recent developments and applications of the use of wavelet transforms in geophysics.

The book under review is of definite interest to all applied researchers in the field. While many geophysicists may be aware of the more fundamental work in the field of wavelet transforms, few real data examples that use the concepts of wavelet theory to solve practical problems in geophysics exist. Of particular value in this book is the introduction written by the editors, which explains the basic ideas of wavelet transform theory by analogy with Fourier transform and windowed Fourier transform methods. This chapter serves as the example from which all the other articles in the volume take advantage. Each of the other articles illustrates a practical example in the analysis of geophysical data using wavelet transforms and reiterates the basic ideas underlying wavelet transforms in general, and then their particular relevance to the problem being addressed. By the time the reader has read the introduction and a couple of the articles (any order is possible) he has already thought of several applications in his own research area where wavelet transforms are likely to be useful. As the reader continues, he is convinced that the problems where wavelets will prove useful are many, and that an explosion of successful practical applications is likely.

As mentioned in the preface, this book is a collection of a series of papers presented at the spring AGU meeting in 1993 from different fields of geophysics: meteorology (atmospheric turbulence), oceanography and marine geophysics, hydrology, and exploration geophysics. The first four chapters show results from the application of wavelet transform based techniques to atmospheric turbulence data with different objectives. The first paper outlines a technique to provide signal decomposition which preserves coherent structures. This technique will certainly find further application in other areas, including exploration geophysics, well log data analysis, ocean bottom scattering, etc. The other three applications in this category are also very interesting and use orthonormal wavelet expansions, piecewise constant Haar decomposition and various properties of wavelet transforms to analyze day-time and night-time turbulence data. The next two papers are based on applications in oceanography such as the analysis of wind-generated ocean waves and bathymetry data. Results from both these applications are quite encouraging and superior compared to standard Fourier transform based tchniques. It is rather amazing when the author S. Little shows how one can detect scarp and faulting in swath-mapped bathymetric data. Another contribution applies the wavelet transform to high-resolution seismic data for time-frequency analysis and obtains attenuation estimates. These were traditionally done by windowed Fourier transforms, and clearly the wavelet transform approach offers significant advantages. Another application is in the characterization of a hydraulic conductivity distribution in which a multi-scale reconstruction method was developed using forward transforms, and then an inverse transform was applied to fill in missing information around sparse data. This technique is also directly applicable to the problem of reservoir characterization performed by petroleum engineers. The last two papers are more general.

One deals with multi-fractal analysis of nonstationary and intermittent geophysical analysis. One area where this will find immediate application is in the stochastic description of sea floor and other geologic structures. Traditional methods based on the assumption of stationarity can be avoided by using wavelet based techniques. The last paper considers noise suppression and signal compression and is the only paper that shows an example from exploration seismology. For the migrated seismic section example, a compression ratio of 20.34 was obtained, which resulted in 93.24% of the original data being discarded. This result is of particular importance for data transmittal and archiving, as a modern seismic surveying for exploration continues to demand an increase in the information required to accurately image subsurface structures in detail.

Thus, this book is very timely; the papers cover a wide range of applications and the results are well presented. We recommend this book without hesitation to any researcher, practitioner or student in geophysics.

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10[41-02, 41A17, 26C05, 26C10, 26Dxx]—*Topics in polynomials: extremal problems, inequalities, zeros*, by G. V. Milovanović, D. S. Mitrinović, and Th. M. Rassias, World Scientific, Singapore, 1994, xiv + 821 pp., $22\frac{1}{2}$ cm, $115.00

This is a remarkable book, offering a cornucopia of results, all connected by their involvement with polynomials. The scope of the volume can be conveyed by citing some statistics: there are 821 pages, 7 chapters, 20 sections, 108 subsections, 95 pages of references (distributed throughout the book), a name index of 16 pages, and a subject index of 19 pages. A brief description of each chapter follows.

Chapter 1 concerns generalities and discusses algebraic polynomials in one or several variables, as well as trigonometric polynomials. The Fejér-Riesz representation of nonnegative trigonometric polynomials is proved, as are representations for nonnegative algebraic polynomials on the real line or the half-line. Orthogonal systems are briefly dealt with, but the authors wisely do not attempt to include that vast subject in their book. Multivariable polynomials of various types are considered, such as symmetric polynomials and homogeneous polynomials. Resultants and discriminants are discussed.

Chapter 2 addresses polynomial inequalities for algebraic and trignonometric polynomials. Here we find inequalities satisfied by the zeros, by the moments, by the coefficients, by derivatives, and so on.

Chapter 3 is on the zeros of polynomials, and includes classical results such as the Gauss-Lucas Theorem and much very recent work (109 pages of text and 15 pages of references).