CHARLES K. CHUI, Ed., *Wavelets: A Tutorial in Theory and Applications*, Wavelet Analysis and Its Applications, Vol. 2, Academic Press, 1992, x + 723 pp.

This book is a compilation of 22 solicited contributions on wavelet theory and some of its applications. The editor aims to show the state-of-the-art in this wide field of research while giving an educative tool to the readers. Most of the chapters are written by specialists in this field and the subjects are representative of the various directions of research. The book is divided into seven sections:

1. *Orthogonal Wavelets*: The concept and definition of a multiresolution analysis of $L^2(\mathbb{R})$ given by S. Mallat and Y. Meyer (1985) and the generic construction of orthonormal bases of compactly supported wavelets proposed by I. Daubechies (1988) were the foundations of the theory of orthogonal wavelets. The first three chapters of this book, due to D. Pollen, P. N. Heller, H. L. Resnikoff, R. O. Wells, and G. G. Walter, are devoted to interesting variations on this theme.

2. *Semi-orthogonal and Nonorthogonal Wavelets*: Although orthonormal wavelet bases have been revealed to be a powerful tool in applied mathematics and digital signal processing, their framework is, in many practical situations, much too constraining. This has led to work on the construction of bases of nonorthogonal wavelets. From this study has followed the connection between spline and wavelet theory, which is considered in the first two contributions of this section, due to G. Battle, M. Unser, and A. Aldroubi. The next two contributions are written by A. Cohen and J. C. Feauveau, who, in collaboration with I. Daubechies, gave the complete description of biorthogonal bases of compactly supported wavelets. Their work is the main reference in the theory of nonorthogonal wavelets and the two contributions give a complete review of it.

3. *Wavelet-Like Local Bases*: The third section consists of three examples of the construction of wavelet-like bases, i.e., wavelets which are not deduced from the exact translation and dilation of a unique mother wavelet. Such wavelets are needed when one considers bounded intervals instead of the full real line and, more generally, when the use of Fourier techniques for the construction of wavelets is forbidden. The first contribution of B. Alpert proposes the construction of such bases in order to represent some linear operators by sparse matrices and thus allow the use of fast algorithms from numerical linear algebra. In the second contribution P. Auscher discusses the construction of such bases with preassigned boundary value conditions on the unit interval. In the last contribution of P. Auscher, G. Weiss, and M. V. Wickerhauser a detailed account is given of the local cosine and sine bases of Coifman and Meyer.

4. *Multivariate Scaling Functions and Wavelets*: The fourth section consists of three chapters devoted to the multidimensional case. W. R. Madych describes some elementary properties of multiresolution analysis of $L^2(\mathbb{R}^n)$ in the first chapter. In the second chapter M. A. Berger and Y. Wang propose a study of the scaling dilation equations, and the last chapter, due to J. Stöckler, is devoted to the construction of the wavelets.

5. *Short-Time Fourier and Window-Radon Transforms*: Since the work of Grossmann, Morlet, and Paul (1985) it is known that the continuous wavelet transform is a transform associated to a square-integrable representation of the affine group. Many other groups and associated transforms have been studied. The fifth section gives two reviews of this group theory point of view by H. G. Feichtinger, K. Gröchenig, G. Kaiser, and R. F. Streater.

6. *Theory of Sampling and Interpolation*: The sixth section is devoted to the study of the sampling and interpolatory theory. The first chapter, due to J. J. Benedetto, is a comprehensive review of this subject and the interesting problem of irregular sampling. A Aldroubi and M. Unser exhibit, in the second contribution, the link between multiresolution analysis and

Shannon sampling theory, and between some specific nonorthogonal wavelets and Gabor functions. The last contribution by K. Seip proposes a complete description of sampling and interpolation in the Bargmann–Fock space and in weighted Bergman spaces.

7. *Applications to Numerical Analysis and Signal Processing*: In the seventh section, the reader will find four chapters devoted to various applications of the wavelet techniques. S. Jaffard and Ph. Laurençot have written a very complete survey of the application of wavelets to the analysis of operators and numerical analysis in general, and more particularly to the theoretical and numerical treatment of partial differential equations. An exhaustive list of constructions, specific properties, and open problems is given. R. A. Gopinath and C. S. Burrus present the filter bank theory of frequency decompositions. J. Froment and S. Mallat expose an image coding algorithm that separates the edge from the texture information. The coding precision may be adapted to the properties of the human visual perception. The last contribution, due to M. V. Wickerhauser, discusses the application of wavelet packets (of which he is one of the contributors in collaboration with R. Coifman, Y. Meyer, and S. Quake) to acoustic signal compression.

To conclude, this book gives a good idea of the recent developments in wavelet theory, and the reviewer believes that the editor's ambition to present a tutorial in this field is achieved. Of course, it is not an exhaustive review on wavelet research but the good bibliography will provide the curious reader with the means to find more information. This book is meant to be a complement of C. K. Chui's introductory book on wavelets (see the previous review), and also recommended is the excellent book by I. Daubechies, *Ten Lectures on Wavelets* (Regional Conference Series in Applied Mathematics, Vol. 61, SIAM, 1992) which could not be mentioned in the book under review since it has also appeared in 1992.

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M. B. RUSKAI, G. BEYLKIN, R. COIFMAN, I. DAUBECHIES, S. MALLAT, Y. MEYER, AND L. RAPHAEL, Eds., *Wavelets and Their Applications*, Jones and Bartlett, 1992, xiii + 474 pp.

Wavelet theory became popular in the late eighties, although it has much older roots in fields such as harmonic analysis, quantum mechanics, and signal processing. There is no precise, overall valid, definition of a wavelet function, but the general idea is that wavelets are the translates and dilates of one particular function, which is commonly referred to as the *mother wavelet*. Wavelets can be used efficiently for analyzing and representing general functions. They typically are local both in time and frequency which makes them suited for a wide variety of applications. They are already considered as valuable alternatives to Fourier analysis in many cases.

The idea of this book originated at the NSF/CBMS wavelet conference held at the University of Lowell in 1990. As usual for such conferences, the lectures of the main speaker, in this case Ingrid Daubechies, were published by SIAM. This edited volume contains contributions from other speakers at the conference, as well as from leading researchers in different branches of the field. Mary Beth Ruskai wrote a very informative introduction where she describes the development of the field and points out the connections between the contributions in the book. The rest of the book is then divided into subsections, each containing papers in one area. Each paper can be read separately, but requires some familiarity with the basic ideas of wavelets. Note also that these papers do not follow one general terminology or notation.

The most extensive section is on *signal analysis*. Two papers point out the connection between wavelet filters and subband coding, both in one and two dimensions. There is one paper on wavelet packets, a powerful extension of wavelets which is particularly suited for data compression and time-frequency analysis. One contribution points out the connection between the local maxima of the wavelet transform of an image and its multiscale edges. It