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★**Wavelets through a looking glass. (English. English summary)**

The world of the spectrum.

Applied and Numerical Harmonic Analysis.
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In the last few years, a plethora of books on wavelets have appeared. Most have been variations on the same themes which were covered in some detail by Daubechies in 1992 and by Meyer in 1990. So I was expecting more of the same in this book. But it's different, a lot different. One difference is its point of view which derives more from mathematical physics than from signal processing. This enables the authors to take a fresh look at the subject and develop a new intuition for many topics. It particular, they make more extensive use of spectral theory than is usual in the subject.

The book also has a number of unusual aspects in its organization. Each of the six chapters begins with a relatively intuitive vignette which is written in a more leisurely style than other parts of the book. These sections give the book much of its flavor; they are entitled respectively: "Overture: why wavelets", "The dangers of navigating the landscape of wavelets", "The world of the spectrum", "A slanted matrix from dynamics", "The fine structure of correlation", and "The other side of wavelets". Each gives an introduction to the topics in the chapter and explains why they are discussed and where they come from.

There are connections with many other areas of mathematics and physics not usually associated with wavelet theory. For example the introductory chapter includes some aspects of quantum computing and their reinterpretation in more traditional wavelet terms. The second chapter connects homotopy theory to wavelets by studying which wavelets may be continuously transformed into others in an appropriate topology. Next is a chapter entitled "Can you hear the shape of a wavelet?" which asks (and answers) whether you can recover the mother wavelet from the spectrum of the transfer operator. Chapter four again deals with the transfer operator and its spectrum. An infinite-dimensional version of Perron-Frobenius theory from linear algebra is exploited here. In chapter five the fixed point properties of the transfer operator are emphasized. In the final chapter entitled "Orthogonalization and isospectral approximation", more general non-orthogonal wavelets are considered. For biorthogonal wavelets an associated orthogonal wavelet with the same spectral properties (of the transfer operator) is found. Since much of the analysis in the book is based on this spectrum, the more general wavelets may also be attacked by the same methods.

The end of each chapter has a large selection of problems in which much of the standard theory can be worked out by the reader. There is also a glossary of useful terms at the end of Chapter 1 where many of the terms (e.g., transfer operator) are clearly defined both from a mathematical and an applications point of view.

Most of the book is clearly a research monograph of interest primarily to researchers who wish to pursue the subject and who already are familiar with some aspects. The authors have apparently used the book as a text in a graduate course; however, it would probably serve best as a second course after the students have absorbed some of the basics. *Gilbert Walter* (1-WIM)