Review of *Wavelet Theory and Harmonic Analysis in Applied Sciences,* C.E. D'Atellis and E.M. Fernandez-Berdaguer, Ed.

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Wavelet theory has had a far-reaching influence on mathematics and science as it is done today. Proof of this can be seen in the many books which now appear, not only on the theory of wavelets, but on their applications in almost every area of science which has ever required Fourier analysis. This book is among the many texts, archival works and conference proceedings which have wavelet theory as their theme; it includes both theoretical and applied topics in wavelet analysis.

The advantage of wavelets over standard Fourier techniques is their ability to localize harmonic analysis both within spatial and frequency boundaries. Fourier analysis is capable only of doing the latter. Since the wide acceptance of wavelets in the late 1980s, the advantages of using them in various situations have become apparent and documented in many places. Essentially, one can have the best of both worlds, since the harmonic analysis that wavelets provide can be done location by location, rather than just globally as in Fourier analysis.

This book is a product of a conference held in Buenos Aires, Argentina, at the end of 1995. This conference, the First Latin American Conference on Mathematics in Industry and Medicine, contained presentations both related and unrelated to the topics of this book; the book is a selection of results from the conference. The topics in the book, which form three subsections, are: Theory and Implementation, Applications in Biomedical Sciences, and Applications in Physical Sciences. The papers include wavelet as well as other Fourier techniques in both theory and applications.

In the theoretical section of this book, there are articles on applications of the Monge-Ampere equation to singular integrals, wavelet characterizations of BMO spaces, and modification of spline wavelets to generate an appropriate translation-invariant continuous wavelet transform. There are also articles on a modification of standard wavelet constructions to include bases whose successive scales are not mutually orthogonal, a survey of frames and Riesz bases, and adaptations of Galerkin methods to multiresolution analysis settings.

Applications of wavelet techniques in biology and biomedical engineering have been particularly interesting and fruitful, as can be seen from the many works and articles on this topic which have appeared in this book and elsewhere. There is much at stake here, indeed, both in human and financial terms. The correct analysis by portable electronic devices of biomedical signals using wavelet or other techniques can mean the difference, for example, between the successful detection of an oncoming heart attack by a portable electronic biomedical device, and the failure of such detection and resulting death or injury. Applications of such new technologies to EEG signal analysis can be equally important, given the intense interest in and potential benefits from the ability to predict

oncoming epileptic events from similar portable electronic signal analyzers. For such reasons the applications of wavelet signal analysis to biomedical engineering are now of very large field of interest. There are articles in this book on applications of wavelet transform techniques to the analysis of electrocardiographs and so-called high-resolution electrocardiographs, correlations of cardiac and respiratory rhythms as measured by electronic devices, and epileptic EEG time series.

The final section of this book concerns articles on applications in the physical sciences. These applications include both wavelet and other applied mathematics techniques. A general paper on the analysis of some standard nonlinear models using wavelet techniques in combination with modifications of neural network architectures is included. There is also a paper on the study of higher order asymptotics near corners of domains for the solution of PDE's associated with semiconductor devices. A third paper in this section studies the estimation of dispersion effects for traveling weights in solids, and new methods for estimating such effects. The final paper deals with the mathematics of numerical modeling of Maxwell's equations, as applied to the study of sources of electromagnetic fields within the earth.

This book has the format of a typical conference proceedings, and as such will be useful either to a practitioner who is interested in one of the topics in the book, or who is interested in wavelet theory and applications in general. There are some typographical errors as well as minor language errors in the book, but these will pose no problem in reading the material. Thus this book belongs in libraries as an archival reference, as well as on some private book shelves for those interested in wavelet theory and applications.