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Wavelets continue to be powerful mathematical tools that can be used to solve problems for which the Fourier (spectral) method does not perform well or cannot handle. This book is for engineers, applied mathematicians, and other scientists who want to learn about using wavelets to analyze, process, and synthesize images and signals. Applications are described in detail and there are step-by-step instructions about how to construct and apply wavelets. The only mathematically rigorous monograph written by a mathematician specifically for nonspecialists, it describes the basic concepts of these mathematical techniques, outlines the procedures for using them, compares the performance of various approaches, and provides information for problem solving, putting the reader at the forefront of current research.

This book is intended to attract the attention of practitioners and researchers in the academia and industry interested in challenging paradigms of wavelets and its application with an emphasis on the recent technological developments. All the chapters are well demonstrated by various researchers around the world covering the field of mathematics and applied engineering. This book highlights the current research in the usage of wavelets in different areas such as biomedical analysis, fringe-pattern analysis, image applications, network data transfer applications, and optical measurement techniques. The entire work available in the book is mainly focusing on researchers who can do quality research in the area of the usage of wavelets in related fields. Each chapter is an independent research, which will definitely motivate the young researchers to ponder on. These 12 chapters available in four sections will be an eye opener for all who are doing systematic research in these fields.

This book traces the prehistory and initial development of wavelet theory, a discipline that has had a profound impact on mathematics, physics, and engineering. Interchanges between these fields during the last fifteen years have led to a number of advances in applications such as image compression, turbulence, machine vision, radar, and earthquake prediction. This book contains the seminal papers that presented the ideas from which wavelet theory evolved, as well as those major papers that developed the theory into its current form. These papers originated in a variety of journals from different disciplines, making it difficult for the researcher to obtain a complete view of wavelet theory and its origins. Additionally, some of the most significant papers have heretofore been available only in French or German. Heil and Walnut bring together these documents in a book that allows researchers a complete view of wavelet theory's origins and development.

A comprehensive, self-contained treatment of Fourier analysis and wavelets—now in a new edition Through expansive coverage and easy-to-follow explanations, A First Course in Wavelets with Fourier Analysis, Second Edition provides a self-contained mathematical treatment of Fourier analysis and wavelets, while uniquely presenting signal analysis applications and problems. Essential and fundamental ideas are presented in an effort to make the book accessible to a broad audience, and, in addition, their applications to signal processing are kept at an elementary level. The book begins with an introduction to vector spaces, inner product spaces, and other preliminary topics in analysis. Subsequent chapters feature: The development of a Fourier series, Fourier transform, and discrete Fourier analysis Improved sections devoted to continuous wavelets and two-dimensional wavelets The analysis of Haar, Shannon, and linear spline wavelets The general theory of multi-resolution analysis Updated MATLAB code and expanded applications to signal processing The construction, smoothness, and computation of Daubechies' wavelets Advanced topics such as wavelets in higher dimensions, decomposition and reconstruction, and wavelet transform Applications to signal processing are provided throughout the book, most involving the filtering and compression of signals from audio or video. Some of these applications are presented first in the context of Fourier analysis and are later explored in the chapters on wavelets. New exercises introduce additional applications, and complete proofs accompany the discussion of each presented theory. Extensive appendices outline more advanced proofs and partial solutions to exercises as well as updated MATLAB routines that supplement the presented examples. A First Course in Wavelets with Fourier Analysis, Second Edition is an excellent book for courses in mathematics and engineering at the upper-undergraduate and graduate levels. It is also a valuable resource for mathematicians, signal processing engineers, and scientists who wish to learn about wavelet theory and Fourier analysis on an elementary level.

Despite their novelty, wavelets have a tremendous impact on a number of modern scientific disciplines, particularly on signal and image analysis. Because of their powerful underlying mathematical theory, they offer exciting opportunities for the design of new multi-resolution processing algorithms and effective pattern recognition systems. This book provides a much-needed overview of current trends in the practical application of wavelet theory. It combines cutting edge research in the rapidly developing wavelet theory with ideas from practical signal and image analysis fields. Subjects dealt with include balanced discussions on wavelet theory and its specific application in diverse fields, ranging from data compression to seismic equipment. In addition, the book offers insights into recent advances in emerging topics such as double density DWT, multiscale Bayesian estimation, symmetry and locality in image representation, and image fusion. Audience: This volume will be of interest to graduate students and researchers whose work involves acoustics, speech, signal and image processing, approximations and expansions, Fourier analysis, and medical imaging.

This third edition overviews the essential contemporary topics of neuroengineering, from basic principles to the state-of-the-art, and is written by leading scholars in the field. The book covers neural bioelectrical measurements and sensors, EEG signal processing, brain-computer interfaces, implantable and transcranial neuromodulation, peripheral neural interfacing, neuroimaging, neural modelling, neural circuits and system identification, retinal bioengineering and prosthetics, and neural tissue engineering. Each chapter is followed by homework questions intended for classroom use. This is an ideal textbook for students at the graduate and advanced undergraduate level as well as academics, biomedical engineers, neuroscientists, neurophysiologists, and industry professionals seeking to learn the latest developments in this emerging field. Advance Praise for Neural Engineering, 3rd Edition: "A comprehensive and timely contribution to the ever growing field of neural engineering. Bin He's edited volume provides chapters that cover both the fundamentals and state-of-the-art developments by the world's leading neural engineers." Dr. Paul Sajda, Department of Biomedical Engineering, Electrical Engineering and Radiology, Columbia University "Neural Engineering, edited by Prof. He, is an outstanding book for students entering into this fast evolving field as well as experienced researchers. Its didactic and comprehensive style, with each chapter authored by leading scientific authorities, provides the ultimate reference for the field." Dr. Dario Farina, Department of Bioengineering, Imperial College London, London, UK "Neural Engineering has come of age. Major advances have made possible prosthesis for the blind, mind control for quadraplegics and direct intervention to control seizures in epilepsy patients. Neural Engineering brings together reviews by leading researchers in this flourishing field. Dr. Terrence Sejnowski, Salk Institute for Biolgical Studies and UC San Diego

This book focuses on the survey technology, post-processing technology, mapping technology and scientific application of the submarine topography and geomorphology in detail. High-resolution submarine geomorphology is a frontier branch of Marine Geology and marine surveying and mapping, which provides a direct basis to study the seabed surface, to understand the tectonic movement and submarine evolution. In the past two decades, high-resolution submarine geomorphology with high-precision multi-beam echo sounding, side-scan sonar and shallow bottom profile as the major techniques, is developing very quickly and is one of the frontiers of international marine science and technology. These high techniques promote the traditional submarine geomorphology to high-resolution and quantitative research. At present, high-resolution submarine geomorphology is widely used in the delimitation of the continental shelf and the international seabed resources survey, marine engineering and marine military applications. In order to facilitate readers to understand how to acquire and apply scientific research based on landform data, it highlights the combination of theory, technology and scientific application. This book is useful as a reference for professional and technical personnel in related fields and also as a textbook for both graduate and undergraduate students as well.

Wavelet Analysis and its Applications, Volume 1: An Introduction to Wavelets provides an introductory treatise on wavelet analysis with an emphasis on spline-wavelets and time-frequency analysis. This book is divided into seven chapters. Chapter 1 presents a brief overview of the subject, including classification of wavelets, integral wavelet transform for time-frequency analysis, multi-resolution analysis highlighting the important properties of splines, and wavelet algorithms for decomposition and reconstruction of functions. The preliminary material on Fourier analysis and signal theory is covered in Chapters 2 and 3. Chapter 4 covers the introductory study of cardinal splines, while Chapter 5 describes a general approach to the analysis and construction of scaling functions and wavelets. Spline-wavelets are deliberated in Chapter 6. The last chapter is devoted to an investigation of orthogonal wavelets and wavelet packets. This volume serves as a textbook for an introductory one-semester course on "wavelet analysis for upper-division undergraduate or beginning graduate mathematics and engineering students.