DESCRIPTION

A self-contained, elementary introduction to wavelet theory and applications

Exploring the growing relevance of wavelets in the field of mathematics, Wavelet Theory: An Elementary Approach with Applications provides an introduction to the topic, detailing the fundamental concepts and presenting its major impacts in the world beyond academia. Drawing on concepts from calculus and linear algebra, this book helps readers sharpen their mathematical proof writing and reading skills through interesting, real-world applications.

The book begins with a brief introduction to the fundamentals of complex numbers and the space of square-integrable functions. Next, Fourier series and the Fourier transform are presented as tools for understanding wavelet analysis and the study of wavelets in the transform domain. Subsequent chapters provide a comprehensive treatment of various types of wavelets and their related concepts, such as Haar spaces, multiresolution analysis, Daubechies wavelets, and biorthogonal wavelets. In addition, the authors include two chapters that carefully detail the transition from wavelet theory to the discrete wavelet transformations. To illustrate the relevance of wavelet theory in the digital age, the book includes two in-depth sections on current applications: the FBI Wavelet Scalar Quantization Standard and image segmentation.

In order to facilitate mastery of the content, the book features more than 400 exercises that range from theoretical to computational in nature and are structured in a multi-part format in order to assist readers with the correct proof or solution. These problems provide an opportunity for readers to further investigate various applications of wavelets. All problems are compatible with software packages
and computer labs that are available on the book’s related Web site, allowing readers to perform various imaging/audio tasks, explore computer wavelet transformations and their inverses, and visualize the applications discussed throughout the book.

Requiring only a prerequisite knowledge of linear algebra and calculus, Wavelet Theory is an excellent book for courses in mathematics, engineering, and physics at the upper-undergraduate level. It is also a valuable resource for mathematicians, engineers, and scientists who wish to learn about wavelet theory on an elementary level.

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**ABOUT THE AUTHOR**

David K. Ruch, PhD, is Professor in the Department of Mathematical and Computer Sciences at the Metropolitan State College of Denver. He has authored more than twenty journal articles in his areas of research interest, which include wavelets and functional analysis.

Patrick J. Van Fleet, PhD, is Professor of Mathematics and Director of the Center for Applied Mathematics at the University of St. Thomas in St. Paul, Minnesota. He has written numerous journal articles in the areas of wavelets and spline theory. Dr. Van Fleet is the author of *Discrete Wavelet Transformations: An Elementary Approach with Applications*, also published by Wiley.

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**FEATURES**

- Provides comprehensive treatment of the topic using two real-life applications: the FBI Wavelet Scalar Quantization Standard and image segmentation. Both applications are developed in their entirety in the book, and readers will learn how to take a digital fingerprint and perform every step necessary to compress it via the FBI standard.

- Supplemented with a software package called *DiscreteWavelets*, which helps both students and professionals to visualize the applications addressed throughout the book.

- Contains over 200 exercises that vary in type including rote drill, proof completion, and ‘Further Discovery’. Extensive details and examples are provided via the exercises, which help readers to gain a full understanding of the material.
Provides readers with motivation and the needed background to pursue further study in both mathematical theory and applications.

Contains a solid balance of rigor with details and applications.

For additional product details, please visit https://www.wiley.com/en-us