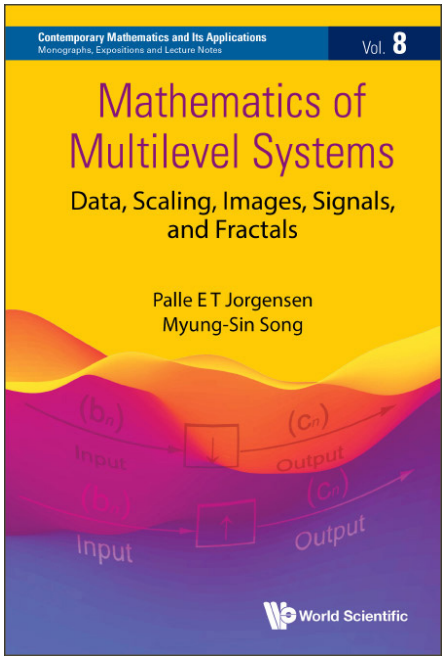
Mathematics of Multilevel Systems

Data, Scaling, Images, Signals, and Fractals



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ABOUT THE BOOK

This book presents the mathematics of wavelet theory and its applications in a broader sense, comprising entropy encoding, lifting scheme, matrix factorization, and fractals. It also encompasses image compression examples using wavelet transform and includes the principal component analysis which is a hot topic on data dimension reduction in machine learning.

Readers will find equal coverage on the following three themes:

- a selection of practical projects and algorithms;
- the theory underpinning the subjects;
- the important interplay between theory and applications.

The book entails a varied choice of diverse interdisciplinary themes. While the topics can be found in various parts of the pure and applied literature, this book fulfills the need for an accessible presentation which cuts across the fields.

As the target audience is wide-ranging, a detailed and systematic discussion of issues involving infinite dimensions and Hilbert space is presented in later chapters on wavelets, transform theory and, entropy encoding and probability. For the problems addressed there, the case of infinite dimension will be more natural, and well-motivated.

READERSHIP

Undergraduate students in wavelet analysis, image compression, and applied mathematics. Master's level wavelet analysis course.

CONTENTS

ABOUT THE AUTHORS

Palle E T Jorgensen is a Professor of Mathematics at the University of Iowa. He has held faculty positions at Stanford University, and at the University of Pennsylvania. Jorgensen's recent distinction involved giving 10 lectures for the Conference Board of the Mathematical Sciences that are published as *Harmonic Analysis: Smooth and Non-smooth* in 2018.

Myung-Sin Song is a Professor of Mathematics at Southern Illinois University Edwardsville. Her dissertation was on connecting wavelet image compression with Cuntz–Krieger Algebra. She worked on functional and harmonic analysis of wavelets, the application of wavelet transform on image processing, using computer programming language, and the connection of the engineering of image processing, using wavelet transform and the mathematics of it. Her more recent work is on fractal analysis and its application in image processing, Karhunen–Loeve transform (principal component analysis) and spectral theory, lifting scheme, sampling theory and quantization, reproducing kernel Hilbert space and dimension reduction using kernel PCA in machine learning.

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