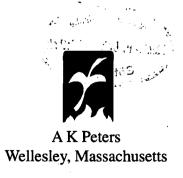
The World According to Wavelets

The Story of a Mathematical Technique in the Making

Second Edition

Barbara Burke Hubbard



Contents

	To the Reader	хi
	Acknowledgments	xvii
PAI	RT I The World According to Wavelets	1
	Prologue	3
I	Fourier Analysis: A Poem Transforms Our World	5
II	Seeking New Tools	21
Ш	A New Language Acquires a Grammar	39
IV	Applications	57
V	Beyond Wavelets	91
PART II Beyond Plain English 11		
	Apologia	113
1	The Fourier Transform	117
2	The Convergence of Fourier Series and the Stability of the Solar System	125
3	Computing Fourier Coefficients with Integrals	137
4	The Fast Fourier Transform	141
		:

viii		Contents
5	The Continuous Wavelet Transform	149
6	Orthogonality and Scalar Products	153
7	Multiresolution	165
8	The Fast Wavelet Transform	183
9	Wavelets in Two Dimensions	193
10	Pyramid Algorithms of Burt and Adelson	199
11	Multiwavelets	201
12	The Heisenberg Uncertainty Principle and Time-Frequency Decompositions	203
13	Probability, Heisenberg, and Quantum Mechanics	209
14	Traveling from One Function Space to Another: Wavelets and Pure Mathematics	223
15	Wavelets and Vision: Another Perspective	231
16	Which Wavelet?	239
17	Different Transforms: A Summary	249
18	Wavelets, Music, and Speech	253
19	The Lifting Scheme	257
20	Best Basis	259
PAI	RT III Appendices	263
A	Mathematical Symbols	265
В	A Review of Some Elementary Trigonometry	267
C	Integrals	271
D	The Fourier Transform: The Different Conventions	275

ntents ix

E	The Sampling Theorem: A Proof	277
F	The Heisenberg Uncertainty Principle: A Proof	281
G	The Fourier Transform of a Periodic Function	285
H	An Example of an Orthonormal Basis and a Proof of Fourier's Result	291
	Further Reading	295
	Wavelet Software and Electronic Resources	299
	References	305
	Index	319