Daubechies, Ingrid
Ten lectures on wavelets. (English) Zbl 0776.42018
CBMS-NSF Regional Conference Series in Applied Mathematics. 61. Philadelphia, PA: SIAM, Society for Industrial and Applied Mathematics. xix, 357 p. (1992).

Wavelet theory found many applications during the past decade. This book is one of the few recent books on wavelets. The authoress has made important contributions to the theory of wavelets. The book consists of an introduction, 10 chapters, a bibliography, a subject index and an author index.

In Chapter 1 the authoress explains why the wavelets are of interest. In Chapter 2 the notion and properties of the continuous wavelet transform are studied. In Chapter 3 the discrete wavelet transforms are studied. In Chapter 4 the role of time-frequency density in wavelet transforms is discussed. Necessary conditions for the set $\{\exp\{2\pi imx\}g(x-n)\} := \{g_{mn}(x)\}$ to form a frame are given. The Zak transform is briefly discussed. Orthonormal wavelet bases are constructed. These bases have good localization properties in both time and frequency domains. In Chapter 5 multiresolution analysis is discussed and its connections with subband filtering and QMF filters are described. In Chapter 6 orthonormal bases of compactly supported wavelets are studied. Cohen's theorem is proved. Examples of compactly supported wavelets, generating an orthonormal basis, are given. In Chapter 7 the regularity of the compactly supported wavelets is discussed. In Chapter 8 symmetry and lack of it for compactly supported wavelet bases is discussed. Except the Haar basis, no symmetric or antisymmetric compactly supported real valued wavelet bases exist. Symmetric biorthogonal wavelet bases do exist. In Chapter 9 characterizations of the functional spaces $L^p(\mathbb{R})$, $H^s(\mathbb{R})$ (Sobolev spaces), $C^s(\mathbb{R})$ (Hölder spaces), $0 < s < 1$, are given in terms of the wavelet coefficients of a function belonging to one of these spaces. In Chapter 10 some generalizations and multidimensional wavelets are discussed, wavelets on an interval are studied, and the "splitting trick" is described.

Reviewer: A.G.Ramm (Manhatten)

MSC:

42C40	Nontrigonometric harmonic analysis involving wavelets and other special systems
42-02	Research exposition (monographs, survey articles) pertaining to harmonic analysis on Euclidean spaces
46E35	Sobolev spaces and other spaces of "smooth" functions, embedding theorems, trace theorems

Cited in **37** Reviews
Cited in **2730** Documents

Keywords:

orthonormal wavelet bases; Sobolev spaces; Hölder spaces; wavelet transform; Zak transform; multiresolution analysis; filtering; regularity; symmetry; Haar basis; functional spaces; multidimensional wavelets

Full Text: DOI