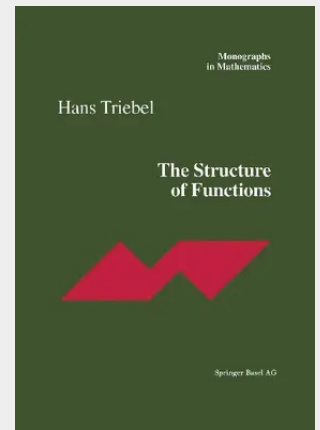


The Structure of Functions

This book deals with the symbiotic relationship between I Quarkonial decompositions of functions, on the one hand, and II Sharp inequalities and embeddings in function spaces, III Fractal elliptic operators, IV Regularity theory for some semi-linear equations, on the other hand. Accordingly, the book has four chapters. In Chapter I we present the Weierstrassian approach to the theory of function spaces, which can be roughly described as follows. Let $\{l_j\}$ be a non-negative Coor function in $\mathbb{R}_n$ with compact support such that $\{l_j(x) - m\} : m \in \mathbb{Z}_n\}$ is a resolution of unity in $\mathbb{R}_n$. Let $\{l_j\} \cdot 3(x) = x \cdot 3 \cdot l_j(x)$ where $x \in \mathbb{R}_n$ and $\{3 \in \mathbb{N}\}$. One may ask under which circumstances functions and distributions f in $\mathbb{R}_n$ admit expansions $00 (0, 1) f(x) = L L L$. $\sim m \cdot l_j \cdot 3(2^j x - m)$, $x \in \mathbb{R}_n$, $n \cdot 3 \in \mathbb{N}$ $j=0 \in \mathbb{Z}$ with the coefficients $\cdot$. $\sim m \in \mathbb{C}$. This resembles, at least formally, the Weierstrassian approach to holomorphic functions (in the complex plane), combined with the wavelet philosophy: translations $x \mapsto x - m$ where $m \in \mathbb{Z}_n$ and dyadic j dilations $x \mapsto 2^j x$ where $j \in \mathbb{N}$ in $\mathbb{R}_n$. Such representations pave the way to constructive definitions of function spaces.

I Decompositions of Functions.- 1 Introduction, heuristics, and preliminaries.- 2 Spaces on $\mathbb{R}_n$: the regular case.- 3 Spaces on $\mathbb{R}_n$: the general case.- 4 An application: the Fubini property.- 5 Spaces on domains: localization and Hardy inequalities.- 6 Spaces on domains. decompositions.- 7 Spaces on manifolds.- 8 Taylor expansions of distributions.- 9 Traces on sets, related function spaces and their decompositions.- II Sharp Inequalities.- 10 Introduction: Outline of methods and results.- 11 Classical inequalities.- 12 Envelopes.- 13 The critical case.- 14 The super-critical case.- 15 The sub-critical case.- 16 Hardy inequalities.- 17 Complements.- III Fractal Elliptic Operators.- 18 Introduction.- 19 Spectral theory for the fractal Laplacian.- 20 The fractal Dirichlet problem.- 21 Spectral theory on manifolds.- 22 Isotropic fractals and related function spaces.- 23 Isotropic fractal drums.- IV Truncations and Semi-linear Equations.- 24 Introduction.- 25 Truncations.- 26 The Q-operator.- 27 Semi-linear equations; the Q-method.- References.- Symbols.



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