Functional Analysis: An Elementary Introduction (Graduate Studies in Mathematics)

By Markus Haase

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This book introduces functional analysis at an elementary level without assuming any background in real analysis, for example on metric spaces or Lebesgue integration. It focuses on concepts and methods relevant in applied contexts such as variational methods on Hilbert spaces, Neumann series, eigenvalue expansions for compact self-adjoint operators, weak differentiation and Sobolev spaces on intervals, and model applications to differential and integral equations. Beyond that, the final chapters on the uniform boundedness theorem, the open mapping theorem and the Hahn-Banach theorem provide a stepping-stone to more advanced texts. The exposition is clear and rigorous, featuring full and detailed proofs. Many examples illustrate the new notions and results. Each chapter concludes with a large collection of exercises, some of which are referred to in the margin of the text, tailor-made in order to guide the student digesting the new material. Optional sections and chapters supplement the mandatory parts and allow for modular teaching spanning from basic to honors track level.

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Review
"Markus Haase's beautiful book lives up to its promise: it provides a well-structured and gentle introduction to the fundamental concepts of functional analysis...The presentation is clear, the applications are insightful, and the large collection of exercises allow us to deepen the study of the presented material. Graduate students, as well as interested undergraduate students can easily profit from this well-written book." -Bela Gabor Pusztai, ACTA Sci. Math.

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