

FUNCTIONAL ANALYSIS

Functional Analysis delves into the structure of infinite-dimensional spaces, investigating properties through notions like completeness, continuity, and convergence. It explores Banach spaces, where the focus is on complete normed vector spaces, and Hilbert spaces, which extend the concept to include inner products and orthogonality. Linear operators and functionals become central, with bounded linear operators mapping between spaces, often utilized in studying differential equations. Spectral theory further analyzes operators, revealing their eigenvalues and eigenvectors. This field's profound implications span quantum mechanics, where operators represent observables, to engineering, employing Fourier transforms and integral equations for signal processing and system analysis.