Alabiso, Carlo; Weiss, Ittay
A primer on Hilbert space theory. Linear spaces, topological spaces, metric spaces, normed spaces, and topological groups. 2nd edition. (English) [Zbl 1457.46001]

Publisher's description: This book offers an essential introduction to the theory of Hilbert space, a fundamental tool for non-relativistic quantum mechanics. Linear, topological, metric, and normed spaces are all addressed in detail, in a rigorous but reader-friendly fashion. The rationale for providing an introduction to the theory of Hilbert space, rather than a detailed study of Hilbert space theory itself, lies in the strenuous mathematics demands that even the simplest physical cases entail. Graduate courses in physics rarely offer enough time to cover the theory of Hilbert space and operators, as well as distribution theory, with sufficient mathematical rigor. Accordingly, compromises must be found between full rigor and the practical use of the instruments. Based on one of the authors's lectures on functional analysis for graduate students in physics, the book will equip readers to approach Hilbert space and, subsequently, rigged Hilbert space, with a more practical attitude. It also includes a brief introduction to topological groups, and to other mathematical structures akin to Hilbert space. Exercises and solved problems accompany the main text, offering readers opportunities to deepen their understanding. The topics and their presentation have been chosen with the goal of quickly, yet rigorously and effectively, preparing readers for the intricacies of Hilbert space. Consequently, some topics, e.g., the Lebesgue integral, are treated in a somewhat unorthodox manner. The book is ideally suited for use in upper undergraduate and lower graduate courses, both in Physics and in Mathematics.

See the review of the first edition in [Zbl 1317.46001].

MSC:
46-01 Introductory exposition (textbooks, tutorial papers, etc.) pertaining to functional analysis
46C05 Hilbert and pre-Hilbert spaces: geometry and topology (including spaces with semidefinite inner product)
00A06 Mathematics for nonmathematicians (engineering, social sciences, etc.)
54-01 Introductory exposition (textbooks, tutorial papers, etc.) pertaining to general topology

Keywords:
linear space; topological space; metric space; normed space; topological group; Hilbert space; Riesz representation theorem; Banach’s fixed point theorem; Cauchy problem; unbounded operator; Fredholm equation; dual space; uniformities

Full Text: DOI