

**Bauschke, Heinz H.; Combettes, Patrick L.**

**Convex analysis and monotone operator theory in Hilbert spaces.** (English) Zbl 1218.47001  
CMS Books in Mathematics/Ouvrages de Mathématiques de la SMC. Berlin: Springer (ISBN 978-1-4419-9466-0/hbk; 978-1-4419-9467-7/ebook). xvi, 468 p. (2011).

This book is devoted to a review of basic results and applications of convex analysis, monotone operator theory, and the theory of nonexpansive mappings in Hilbert spaces. The choice of the Hilbert space setting enables the authors to cover many interesting applications, while avoiding the technical difficulties related to a general Banach space framework.

The monograph is divided into 29 chapters, entitled as follows: Background (Chapter 1), Hilbert Spaces (Chapter 2), Convex Sets (Chapter 3), Convexity and Nonexpansiveness (Chapter 4), Fejér Monotonicity and Fixed Point Iterations (Chapter 5), Convex Cones and Generalized Interiors (Chapter 6), Support Functions and Polar Sets (Chapter 7), Convex Functions (Chapter 8), Lower Semicontinuous Convex Functions (Chapter 9), Convex Functions: Variants (Chapter 10), Convex Variational Problems (Chapter 11), Infimal Convolution (Chapter 12), Conjugation (Chapter 13), Further Conjugation Results (Chapter 14), Fenchel-Rockafellar Duality (Chapter 15), Subdifferentiability (Chapter 16), Differentiability of Convex Functions (Chapter 17), Further Differentiability Results (Chapter 18), Duality in Convex Optimization (Chapter 19), Monotone Operators (Chapter 20), Finer Properties of Monotone Operators (Chapter 21), Stronger Notions of Monotonicity (Chapter 22), Resolvents of Monotone Operators (Chapter 23), Sums of Monotone Operators (Chapter 24), Zeros of Sums of Monotone Operators (Chapter 25), Fermat's Rule in Convex Optimization (Chapter 26), Proximal Minimization (Chapter 27), Projection Operators (Chapter 28), and Best Approximation Algorithms (Chapter 29).

Each chapter concludes with an exercise section. Bibliographical pointers, a summary of symbols and notation, an index, and a comprehensive reference list are also included. The book is suitable for graduate students and researchers in pure and applied mathematics, engineering and economics.

Reviewer: [Sergiu Aizicovici \(Athens/Ohio\)](#)

**MSC:**

- [47-02](#) Research exposition (monographs, survey articles) pertaining to operator theory
- [47H05](#) Monotone operators and generalizations
- [47H09](#) Contraction-type mappings, nonexpansive mappings,  $A$ -proper mappings, etc.
- [47N10](#) Applications of operator theory in optimization, convex analysis, mathematical programming, economics
- [52A41](#) Convex functions and convex programs in convex geometry
- [46C05](#) Hilbert and pre-Hilbert spaces: geometry and topology (including spaces with semidefinite inner product)
- [90C25](#) Convex programming
- [90C30](#) Nonlinear programming
- [26B25](#) Convexity of real functions of several variables, generalizations
- [41A65](#) Abstract approximation theory (approximation in normed linear spaces and other abstract spaces)

Cited in **1** Review  
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**Keywords:**

[convexity](#); [nonexpansiveness](#); [Hilbert space](#); [monotone operator](#); [optimisation](#)

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