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Fundamentals of convex analysis. (English) Zbl 0998.49001
Grundlehren. Text Editions. Berlin: Springer. x, 259 p. (2001).

This book is an abridged version of the book “Convex analysis and minimization algorithms” (shortly CAMA) written in two volumes by the same authors (1993; [Zbl 0795.49001](#) and [Zbl 0795.49002](#)). The authors have extracted from CAMA Chapters III–VI and X, containing the fundamentals of convex analysis, deleting material seemed too advanced for an introduction, or too closely attached to numerical algorithms. Each Chapter is presented as a “lesson” treating a given subject in its entirety, completed by numerous examples and figures. So, this new version becomes a good book for learning and teaching of convex analysis in finite dimensions. The book contains an introduction, five chapters, a bibliographical comment, references and an index. In the following we present the five chapters with their themes.

A. Convex analysis (Chap. III in CAMA), gives the theoretical concepts of convex sets: cone, hull, interiors, separation theorems, extreme point, Farkas-Minkowski lemma, tangent and normal cone.

B. Convex functions (Chap. IV...) presents definitions for convex functions, affine and closed convex functions, punctual operations preserving convexity, first- and second-order differentiation of convex functions.

C. Sublinearity and support functions (Chap. V...) are given by definitions, properties, interpretations in respect to closed convex sets, having numerous examples about norm, polarity, closed convex polyhedra.

D. Subdifferentials of finite convex functions (Chap. VI...) presents the notions of directional derivatives, subdifferential, geometrical aspects, mean-value theorems, chain rules with subdifferentials, monotonicity properties, implications in optimization.

E. Conjugacy in convex analysis (Chap. X...) presents the convex conjugate and biconjugate of a function, with definitions, interpretations and properties, some of them using the subdifferential. Calculus rules on the conjugacy operation are given, too.

Reviewer: [Stefan Mititelu \(București\)](#)

MSC:

- [49-01](#) Introductory exposition (textbooks, tutorial papers, etc.) pertaining to calculus of variations and optimal control
- [49J52](#) Nonsmooth analysis
- [90C25](#) Convex programming
- [52A41](#) Convex functions and convex programs in convex geometry
- [65K10](#) Numerical optimization and variational techniques
- [26B25](#) Convexity of real functions of several variables, generalizations

Cited in 1 Review Cited in 226 Documents

Keywords:

[nonsmooth analysis](#); [convex analysis](#); [convex sets](#); [convex functions](#)