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Book reviews

Aram V. Arutyunov and Valeri Obukhovskii; Convex and set-valued analysis. Selected topics, De Gruyter Graduate, De Gruyter, Berlin 2017, viii+201 p., ISBN: 978-3-11-046028-5/pbk; 978-3-11-046030-8/ebook.

The book, consisting of two relatively independent parts, is based on courses taught by the first author at the Moscow State University and by the second one at the Voronezh University. A preliminary Russian version, written by the first author, was published in 2014 with Fizmatlit Editors, Moscow, but the present book contains many additions and extensions.

The first part of the book is devoted to convex analysis - convex sets, separation of convex sets, convex functions, continuity and differentiability properties of convex functions, the Young-Fenchel conjugate, convex cones. Although, for more clarity and accessibility, the presentation is done, in general, in the finite dimensional Euclidean case, some topics are treated in a more general context - the separation of convex sets in a normed space, the existence of some positive functionals on normed spaces ordered by closed convex cones, and the Young-Fenchel conjugate in a Hilbert space.

The second part is devoted to set-valued analysis. After a detailed introduction to Hausdorff metric and its essential properties, one passes to the study of continuity (upper and lower) of set-valued maps. Measurable set-valued maps and measurable selections, with applications to set-valued superposition operators (satisfying a Carathéodori-type condition), are included as well. An important part of the book is devoted to fixed point and coincidence point theorems for set-valued maps (mainly), with applications to differential inclusions. Several nice results of the authors, involving metric regularity and covering maps theory, are presented. A proof of the Brouwer fixed point theorem based on the degree theory for single-valued maps is given, while the degree theory for set-valued maps is applied to fixed point results for this kind of maps.

Numerous examples and exercises complete the main text. The prerequisites are minimal: basic topology, some linear algebra and rudiments of functional analysis.

Written by two experts in these areas and based on their teaching experience, the book contains a clear and accessible introduction to convex and set-valued analysis. It can be used for courses on these topics or for self-study.

Adrian Petruşel

Vidyadhar S. Mandrekar; Weak convergence of stochastic processes. With applications to statistical limit theorems, De Gruyter Graduate, De Gruyter, Berlin 2016, vi+141 p., ISBN: 978-3-11-047542-5/pbk; 978-3-11-047631-6/ebook).

The book is devoted to a detailed study of weak convergence in probability theory with applications to Brownian motion, inference in statistics and convergence in martingale theory.

As the first chapter contains only the Introduction, the effective presentation starts in Ch. 2, *Weak convergence in metric spaces*, with the introduction of cylindrical measures as a tool for the study of Brownian motion. Sections 2.10 and 2.11 of this chapter are concerned with the weak convergence of probability measures on complete separable metric spaces (Polish spaces) - Portmanteau Theorem, tightness and Prokhorov's compactness criterium. It is worth to mention that extensions of these results to non-separable metric spaces are given in Ch. 6, *Empirical processes*, where, with a suitable definition of the weak convergence of nets of random variables, one obtains analogs of the results from the separable case - Portmanteau Theorem, tightness, asymptotic tightness and compactness.

Ch. 3, *Weak convergence on* $C[0,1]$ *and* $D[0,1]$, is dealing with the distributional counterpart of weak convergence. The techniques developed in Sections 2.10 and 2.11 are applied to the space $C[0,1]$, one introduces the Skorokhod topology and the Skorokhod metric on the spaces $D[0,T]$ and $D[0,\infty)$ of functions having only discontinuities of the first kind. Compact sets in $C[0,1]$ and $D[0,1]$ are characterized - Arzela-Ascoli in the first case and in terms of tightness in the second one. The chapter ends with Aldous' tightness criterium, characterizing compactness in terms of stopping times.

Chapters 4. *Central limit theorem for semi-martingales and applications*, and 5. *Central limit theorems for dependent variables, are devoted to applications*, as, e.g., statistical limit theorems for censored data that arise in clinical trials.

Written by an expert in probability theory and stochastic processes, the book succeeds to present, in a relatively small number of pages, some fundamental results on weak convergence in probability theory and stochastic process and applications.

Hannelore Lisei