



Convex Optimization Theory

By Dimitri P. Bertsekas

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An insightful, concise, and rigorous treatment of the basic theory of convex sets and functions in finite dimensions, and the analytical/geometrical foundations of convex optimization and duality theory. Convexity theory is first developed in a simple accessible manner, using easily visualized proofs. Then the focus shifts to a transparent geometrical line of analysis to develop the fundamental duality between descriptions of convex sets and functions in terms of points and in terms of hyperplanes. Finally, convexity theory and abstract duality are applied to problems of constrained optimization, Fenchel and conic duality, and game theory to develop the sharpest possible duality results within a highly visual geometric framework. The book may be used as a text for a theoretical convex optimization course; the author has taught several variants of such a course at MIT and elsewhere over the last ten years. It may also be used as a supplementary source for nonlinear programming classes, and as a theoretical foundation for classes focused on convex optimization models (rather than theory). It is an ideal companion to the books Convex Optimization Algorithms, and Nonlinear Programming by the same author.

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Editorial Review

Review

The textbook, *Convex Optimization Theory* (Athena) by Dimitri Bertsekas, provides a concise, well-organized, and rigorous development of convex analysis and convex optimization theory. Several texts have appeared recently on these subjects ... The text by Bertsekas is by far the most geometrically oriented of these books. It relies on visualization to explain complex concepts at an intuitive level and to guide mathematical proofs. Nearly, all the analysis in the book is geometrically motivated, and the emphasis is on rigorous, polished, and economical arguments, which tend to reinforce the geometric intuition. --Panos Pardalos (*Optimization Methods and Software*, 2010)

This is another useful contribution to convex analysis and optimization by D. P. Bertsekas, a prolific author who is able to put together a rigorous treatment of the subjects and a skillful didactic presentation. Unlike some other books on the same subject (for example the famous book by R. T. Rockafellar ... which does not contain a single figure), the book of Bertsekas abounds in geometrical illustrations of the properties and visual treatments of the problems. ... Some results stem directly from the author's research. Some of the more standard results are not usually found in other conventional textbooks on convexity. --Giorgio Giorgi (*Mathematical Reviews* 2012)

About the Author

Dimitri P. Bertsekas studied engineering at the National Technical University of Athens, Greece, obtained his MS in electrical engineering at the George Washington University, Wash. DC in 1969, and his Ph.D. in system science in 1971 at the Massachusetts Institute of Technology. Bertsekas has held faculty positions with the Engineering-Economic Systems Dept., Stanford University (1971-1974) and the Electrical Engineering Dept. of the University of Illinois, Urbana (1974-1979). Since 1979 he has been teaching at the Electrical Engineering and Computer Science Department of the Massachusetts Institute of Technology (M.I.T.), where he is currently McAfee Professor of Engineering. He consults regularly with private industry and has held editorial positions in several journals. His research at M.I.T. spans several fields, including optimization, control, large-scale computation, and data communication networks, and is closely tied to his teaching and book authoring activities. He has written numerous research papers, and fourteen books, several of which are used as textbooks in MIT classes. Professor Bertsekas was awarded the INFORMS 1997 Prize for Research Excellence in the Interface Between Operations Research and Computer Science for his book "Neuro-Dynamic Programming" (co-authored with John Tsitsiklis), the 2000 Greek National Award for Operations Research, the 2001 ACC John R. Ragazzini Education Award, the 2009 INFORMS Expository Writing Award, the 2014 Bellman Heritage Award, the 2014 Kachiyani Prize, and the 2015 Dantzig Prize. In 2001, he was elected to the United States National Academy of Engineering for "pioneering contributions to fundamental research, practice and education of optimization/control theory, and especially its application to data communication networks."; Dr. Bertsekas' recent books are "Dynamic Programming and Optimal Control: 4th Edition (2012), "Introduction to Probability: 2nd Edition" (2008), "Convex Optimization Theory" (2009), and "Convex Optimization Algorithms" (2015) all published by Athena Scientific.

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