

Ph.D. course

Metric regularity of set-valued mappings with application to Optimization

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Abstract Regularity properties of mappings lie at the heart of mathematical analysis and its applications. In particular, they pave the way to tangential approximations of solution sets to equations that can be hardly solved explicitly. Such a role is emphasized in modern optimization, where the appearing of side-constraints and/or nonsmoothness of data leads to deal with complicate constraint systems, involving set-valued mappings. These lectures are intended to offer a prolegomenon to the theory grown up in the last decades around the concept of regularity for set-valued mappings and its phenomenology. Key features of this theory are a quantitative character, expressed by metric inequalities, and interconnections with such behaviours as openness and Lipschitz-like properties. Among the topics touched by the lectures are main regularity criteria and applications to the formulation of optimality conditions. Links with the theory of error bounds and transversality are discussed as well.

Main topics Quantitative constraint system analysis • Metric regularity • Aubin property
• Regularity criteria • Optimality conditions in finite-dimensional optimization • Error bounds

Main references J.-P. Aubin, H. Frankowska, *Set-valued Analysis*, Birkhäuser, Boston, 1990.

A.L. Dontchev, R.T. Rockafellar, *Implicit Functions and Solution Mappings*, Springer, New York, 2014.

A.D. Ioffe, *Variational analysis of regular mappings*, Springer, Cham, 2017.

D. Klatte and B. Kummer, *Nonsmooth Equations in Optimization*, Kluwer, Dordrecht, 2002.

B.S. Mordukhovich, *Variational Analysis and Generalized Differentiation I: Basic Theory*, Springer, Berlin, 2006.