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Boris Mordukhovich started his research mathematical career in Minsk, Belarus (at that time it was a part of the Soviet Union) in the late 1960s and early 1970s during his undergraduate study at Belarussian State University. He published a number of papers, which made his name well known to the specialists on optimal control, and in 1973 obtained his PhD (Supervisor – Professor Rafail Gabasov) on the existence theory and necessary optimality conditions in optimal control. After more than 35 years of active research, optimal control still remains one of the main fields of Boris's interest. In the mid 1970s there appeared a new important line in Boris's research, which made his name worldwide famous. He became interested in nonsmooth analysis and optimization. There was a great need in new tools to deal with this type of problems. Many generalized differential constructions were introduced at that time. Among a few of those surviving the test of time are the limiting (or

Mordukhovich) normal cone to sets and subdifferential of nonsmooth functions introduced by Boris in 1976 [Mor76] and his concept of coderivative for set-valued mappings introduced in 1980 [Mor80]. These constructions have become central concepts of modern variational analysis and generalized differentiation.

The Minsk period of Boris's research activity was very fruitful. Besides the topics mentioned above, he obtained a variety of important and well-recognized results published in many papers on optimal control of discrete-time systems and discrete approximations; controllability, observability, and duality of deterministic and stochastic dynamical systems; singular controls and higher-order optimality conditions; control of systems governed by hereditary, functional differential, and partial differential equations; differential inclusions and set-valued analysis, etc. Working for the R&D Institute of Land Reclamation and Water Management, he was strongly involved in real-life applications of mathematics to automatic control and design of groundwater regime engineering systems receiving several patents in this area.

During this period, Boris supervised a number of PhD students at Belarussian State University some of whom became well-established researchers. A large part of Boris's mathematical research during his Soviet period was summarized in his book [Mor88] published in 1988 by Nauka, Moscow, shortly before his immigration to the United States.

Soon after his arrival, Boris was invited to a conference at Montreal organized in February 1989 by Francis Clarke, Terry Rockafellar and Roger Wets, where for the first time he got a possibility to present his theory to the western optimization community. His talk became a real breakthrough, which significantly influenced the philosophy, the arsenal of tools, and the further developments in modern variational analysis. In August 1989, Boris accepted a tenure position at Wayne State University in Detroit, Michigan, joining the internationally well-recognized group of prominent researchers in optimization, control, stochastic analysis, and applications.

Besides his extensive teaching, he started to attend regularly important conferences and intensified his research. In particular, he established complete coderivative characterizations of metric regularity and Lipschitzian properties of set-valued and single-valued mappings that are of crucial importance for nonlinear analysis and optimization [Mor93], developed to perfection his generalized differential calculus in finite-dimensions [Mor94a] and applied it to significant

stability and sensitivity issues in variational analysis [Mor94b], developed the powerful method of discrete approximations and employed it to deriving the strongest necessary optimality conditions of the extended Euler-Lagrange type for constrained nonconvex differential inclusions in terms of his generalized differential constructions [Mor95]. He also succeeded, partially in cooperation with his PhD students, to obtain a full extension of his generalized differential theory to broad infinite-dimensional settings; see, e.g., [MS96]. Simultaneously he demonstrated the usefulness and great potentials of his generalized differential theory and variational techniques by impressive applications to various problems of optimal control and feedback controls governed by ordinary differential and partial differential systems, equilibrium problems and mathematical programs with equilibrium constraints, mechanical systems and economic modeling, etc. These efforts lead eventually to his recent two-volume monograph [Mor06a, Mor06b] published in the most prestigious Grundlehren (Fundamental Principles of Mathematical Sciences) Series by Springer-Verlag. This outstanding work contains not only the results of numerous preceding papers presented in their most general and powerful form, but also a considerable number of striking previously unpublished results. In a short time this book has become an indispensable part of the library of most researchers active in variational analysis, optimization, and their applications.

During his career in the West, Boris delivered numerous invited talks (often keynote and plenary lectures) at various international meetings; he also visited many scientific centers and universities for lecturing and research collaboration. His publication list contains by January 2008 an unbelievable number of 256 items. Along with his extremely active research, he is strongly involved in editorial work being a member of the Editorial Boards as well as Guest Editor of more than 20 high-level international journals.

Besides many distinguished recognitions and awards from Wayne State University, Boris received a number of international honors including Doctor Honoris Causa from the National Sun Yat-sen University in Taiwan and Vasile Goldis University in Romania, Certificate of Appreciation from the International University-Vietnam National University at HoChiMinh City, Honorary Medal of the Union of Czech Mathematicians and Physicists, etc.

Talking about Boris' non-mathematical activities, they are not less remarkable than the mathematical ones. He's an extreme traveller leaving just a few white spots on the globe unvisited, and he likes hiking. On the other hand, everybody who has got the chance to chat with him will enjoy his well-grounded knowledge in literature, history, classical music...

Having a look to the contributors to this special volume, among them good friends and colleagues of Boris, they all share with him their interest in the field of *Variational Analysis and Generalized Differentiation*, which has been influenced and promoted so much by his work. It therefore seems natural to choose this area as a title of the present volume, making deliberate allusion to his recently appeared opus magnum.

January 2008

René Henrion
Alexander Kruger
Jiří Outrata

References

[Mor76] B. S. Mordukhovich, Maximum principle in problems of time optimal control with nonsmooth constraints, J. Appl. Math. Mech. 42 (1976), 960-969.

- [Mor80] B. S. Mordukhovich, Metric approximations and necessary optimality conditions for general classes of extremal problems, *Soviet Math. Dokl.* 22 (1980), 526-530.
- [Mor88] B. S. Mordukhovich, *Approximation Methods in Problems of Optimization and Control*, Nauka, Moscow, 1988.
- [Mor93] B. S. Mordukhovich, Complete characterization of openness, metric regularity, and Lipschitzian properties of multifunctions, *Trans. Amer. Math. Soc.* 340 (1993), 1-35.
- [Mor94a] B. S. Mordukhovich, Generalized differential calculus for nonsmooth and set-valued mappings, *J. Math. Anal. Appl.* 183 (1994), 250-288.
- [Mor94b] B. S. Mordukhovich, Stability theory for parametric generalized equations and variational inequalities via nonsmooth analysis, *Trans. Amer. Math. Soc.* 343 (1994), 609-658.
- [Mor95] B. S. Mordukhovich, Discrete approximations and refined Euler-Lagrange conditions for nonconvex differential inclusions, *SIAM J. Control Optim.* 33 (1995), 882-915.
- [MS96] B. S. Mordukhovich and Y. Shao, Nonsmooth sequential analysis in Asplund spaces, *Trans. Amer. Math. Soc.* 348 (1996), 1235-1280.
- [Mor06a] B. S. Mordukhovich, *Variational Analysis and Generalized Differentiation, I: Basic Theory*, Grundlehren Series (Fundamental Principles of Mathematical Sciences), Vol. 330, Springer, Berlin, 2006.
- [Mor06b] B. S. Mordukhovich, *Variational Analysis and Generalized Differentiation, II: Applications*, Grundlehren Series (Fundamental Principles of Mathematical Sciences), Vol. 331, Springer, Berlin, 2006.