Notice of the Final Oral Examination
for the Degree of Doctor of Philosophy

of

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MSc (Dalian University of Technology, 2016)
BSc (Lanzhou University, 2013)

“Directional constraint qualifications and optimality conditions with application to bilevel programs”

Department of Mathematics and Statistics

Tuesday, July 7, 2020
10:00 A.M.
Remote Defence

Supervisory Committee:
Dr. Jane Ye, Department of Mathematics and Statistics, University of Victoria (Supervisor)
Dr. David Goluskin, Department of Mathematics and Statistics, UVic (Member)
Dr. Yang Shi, Department of Mechanical Engineering, UVic (Outside Member)

External Examiner:
Dr. Tim Hoheisel, Department of Mathematics and Statistics, McGill University

Chair of Oral Examination:
Dr. Helen Kurki, Department of Anthropology, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies
Abstract

The main purpose of this dissertation is to investigate directional constraint qualifications and necessary optimality conditions for nonsmooth set-constrained mathematical programs.

First, we study sufficient conditions for metric subregularity of the set-constrained system. We introduce the directional version of the quasi-/pseudo-normality as a sufficient condition for metric subregularity, which is weaker than the classical quasi/pseudo-normality, respectively. Then we apply our results to complementarity and Karush-Kuhn-Tucker systems.

Secondly, we study directional optimality conditions of bilevel programs. It is well-known that the value function reformulation of bilevel programs provides equivalent single-level optimization problems which are nonsmooth and never satisfy the usual constraint qualifications such as the Mangasarian-Fromovitz constraint qualification (MFCQ). We show that even the first-order sufficient condition for metric subregularity (which is generally weaker than MFCQ) fails at each feasible point of bilevel programs. We introduce the directional Clarke calmness condition and show that under the directional Clarke calmness condition, the directional necessary optimality condition holds. We perform directional sensitivity analysis of the value function and propose the directional quasi-normality as a sufficient condition for the directional Clarke calmness.