

Report on the habilitation thesis of Martin Branda entitled

“Advances in stochastic programming approaches to optimization under uncertainty”

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This habilitation thesis contains ten original research papers of Martin Branda (and co-authors) on stochastic programming theory, methods and applications. The papers deal with chance-constrained programming, sample approximation for mixed-integer stochastic programming problems, and diversification-consistent data envelopment analysis. I'm going to take a sample from this plentiful list.

The first paper, Adam & Branda (2016), examines a relaxed form for nonlinear chance-constrained problems. Optimality conditions are derived, and a close relationship is established between the original and the relaxed problem. Moreover, a special regularization approach is worked out to for a stabilized solution of the relaxed problem. In a successive project, Adam, Branda, Heitsch & Henrion (2018) generalized the approach to joint chance constraints, and solved a difficult gas network design problem.

The third paper, Branda (2013), considers joint probabilistic constrained problems where the random parameters have a discrete finite distribution. An asymptotic equivalence is established to a penalized problem, where the penalty term is formulated as an expectation. Moreover, lower and upper bounds are constructed for the local optimum of the joint constrained problem, based on the local optimum of the penalized problem. These results are extensions of former results of Branda & Dupačová (2012) and of Branda (2012), established for problems whose random parameters have a continuous distribution.

The fifth paper, Branda (2012), deals with sample approximation techniques applied to problems with joint probabilistic constraints on mixed-integer variables, and proves a convergence theorem for the feasible domains. Results of this research were applied to estimating sample sizes to the reliable solution of a stochastic vehicle routing problem.

Papers no. 7 and 8, Branda (2013 and 2015), introduce new models of diversification-consistent data envelopment analysis (DEA). The former paper proposes deviation measures to be used as input levels in DEA. The latter paper adapts DEA models to admit general risk measures as input levels, and general return measures as output levels. One of the models proposed in the latter paper can be applied as a test for SSD-efficiency (SSD stands for second-order stochastic dominance). Moreover, in case of an inefficient benchmark, the optimal solution of the resulting problem is SSD-efficient and strictly dominates the benchmark. An interesting relationship between certain DEA models and SSD was investigated in the former paper Branda & Kopa (2014), and DEA models equivalent to higher-order stochastic dominance were introduced in paper no. 10, Branda & Kopa (2016).

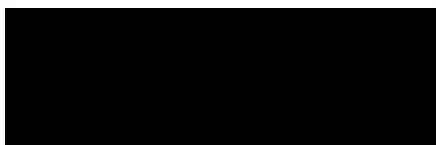
The selected papers contain interesting and original results and demonstrate deep and up-to-date knowledge of the applicant in many related areas, like the theories of nonlinear programming and variational analysis. Most of the proposed procedures have been implemented. Several of them have been successfully applied in the very diverse areas of gas network design, robust portfolio optimization, atmospheric modelling, reliable job scheduling and vehicle routing. (In the job scheduling application, SP methods were compared with heuristic algorithms.) – Summing up, the applicant obtained deep theoretical results, and simultaneously took part in the development meaningful applications. I find this achievement highly commendable.

All ten selected papers were published in leading academic journals. Four of them received at least 10 citations according to the Web of Knowledge. In all, 20 of Martin's papers appear in the Web of Knowledge, their aggregated independent citation number being 155. I think this is a remarkable publication record for a young researcher, even on an international level.

I've been acquainted with Martin for years as we attended several conferences together. He was a member of the organizing committee of last year's Joint Czech-German-Slovak Conference on Mathematical Methods in Economy and Industry (MMEI 2017) that was a successful conference.

I think his high-quality research and development activities completely justify the habilitation and promotion of Martin Branda. Therefore my recommendation for his appointment as associate professor is strongly positive.

Kecskemét, 13 September 2018



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