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Gerhard-Wilhelm Weber, Alexander Kruger, Juan Enrique Martínez-Legaz, Boris Mordukhovich & Leonidas Sakalauskas

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EDITORIAL

Special Issue on recent advances in continuous optimization on the occasion of the 25th European conference on Operational Research (EURO XXV 2012)

This volume of *Optimization* is devoted to the *25th European Conference on Operational Research, EURO XXV 2012* (http://www.euro-2012.lt/), which was held on 8–11 July 2012, in Vilnius, Lithuania. *EURO 2012* attracted 2044 registered participants and 154 accompanying persons from 68 countries of all the continents and from across the OR community in Europe and all over the world, for a four-day meeting of lively exchanges and debates. The delegates from Continuous Optimization and Related Subjects were a large subcommunity in the entire conference with about 250 participants. They met on exchanging their experiences in solving real-world problems, discussing recent advances in optimization theory and applications, reporting on development and implementation of appropriate models and efficient solution methods for continuous optimization problems. The *EURO 2012* conference provided an excellent stage for investigators and practitioners to promote their recent advances in Continuous Optimization to the wider scientific community, for identifying research challenges for their areas, as well as promising research developments in theory, methods and applications, and for promoting interactions with colleagues from related research areas of modern OR and its emerging applications.

EURO 2012 was accompanied by a number of satellite events – scientific workshops which benefited from the local closeness to *EURO 2012* and which, conversely, attracted further participants to join the entire experience of the EURO conference. The *10th Workshop of EWG on Continuous Optimization – EUROPT 2012*, took place on 5–7 July 2012, in Siauliai, Lithuania, (http://www.mii.lt/EUROPT-2012) as a satellite event of *EURO 2012*, which allowed us to overview trends and to gain a common attitude towards latest challenges in continuous optimization, dynamic systems and advanced applications.

On the occasion of *EURO 2012*, the journal *Optimization* invited submissions of papers to a special issue on Continuous Optimization and Related Topics. The papers included recent theoretical and applied contributions in various fields including linear, nonlinear, stochastic, parametric and dynamic programming as well as control theory. Topics were drawn from, but not limited to, the following fields of Continuous Optimization and OR:

- linear programming,
- semi-definite and conic programming,
- semi-infinite programming,
- stochastic programming,

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- global optimization,
- nonsmooth optimization,
- multiobjective optimization,
- optimization in economics,
- optimization in data mining and machine learning,
- continuous optimization for inverse problems,
- continuous optimization in the financial sector.

EURO, the *Programme Committee*, the local organizers from the *Organizing Committee* with its Chair *Professor Leonidas Sakalauskas* and the company *Aim Group Baltic* deserve a special gratitude. We express our thanks also to the Chair of the Program Committee, *Professor Marielle Christiansen*, for having approved and supported this Special issue on the Occasion of *EURO 2012* (http://www.euro-2012.lt/special-issues#Call for Papers – Journal Optimization). Below find some earlier *Optimization* special issues on Continuous Optimization and Related Topics (cf. [1–6]).

As *S.Z. Alparslan Gök* in her article states, uncertainty can be so severe that one can only predict some upper and lower bounds for the outcome of actions, i.e. pay-offs lie in some intervals. Here, cooperative interval games have become an appropriate game theoretic approach. Solution concepts which equip interval allocations with appealing properties offer a natural way to capture uncertainty of coalition values within the players' pay-offs. For cooperative interval games, relations between some set-valued solution concepts using interval pay-offs, called interval core, interval dominance core, square interval dominance core and interval stable sets, are investigated by the author. The interval core turns out to be the unique stable set on the class of convex interval games.

The paper by *Marcel Bogdan* is devoted to the study of weakly efficient solutions to convex variational inequalities in topological vector spaces. The author considers certain stability issues and establishes, in particular, the strong convergence of optimal solutions for a sequence of variational inequality to the corresponding solution of the limiting one. This result can be interpreted as an existence theorem for weakly efficient solutions of variational inequalities under an appropriate cone-lower semicontinuity assumption.

The paper by *Sorin-Mihai Grad* and *Emilia-Loredana Pop* concerns a duality theory for a vector optimization problem described as finding weakly minimal elements, with respect to a convex cone, of a convex set in a separated locally convex space. The main difference between this paper and a vast majority of other publications is that now the authors assume the nonemptiness of quasi-interior of the ordering cone instead of the standard nonempty interiority condition. In this framework, they establish weak, strong and converse duality results in both unconstrained and constrained optimization settings.

In their paper, *Tibor Illés* and *Richárd Molnár-Szipai* deal with maximum flow problems with non-zero lower bounds. Usually the network is transformed into a bigger format with zero lower bounds and then one of the established methods for maximum flow problems modified is used. The authors show that a variant of the monotonic build-up (MBU) simplex algorithm runs in strongly polynomial time on the original network. In MBU algorithm, starting from an arbitrary basis solution the number of infeasible variables decreases monotonically, without letting any feasible variables turn

infeasible. The authors determine a polynomial number of pivots after which the algorithm terminates; that solves the problem without transforming the network.

Tibor Illés and *Adrienn Nagy* provide computational aspects of simplex and MBU simplex algorithms using different anti-cycling pivot rules. Several variations of index selection rules for simplex-type algorithms for linear programming are not only theoretically finite, but also provide significant flexibility in choosing a pivot element. Based on an implementation of the primal simplex and the MBU simplex method, the practical benefit of the flexibility of these anti-cycling pivot rules is evaluated with benchmark LP test sets. Numerical results also disclose the MBU simplex algorithm as a viable alternative to the traditional simplex algorithm.

Olga Kostyukova and *Tatiana Tchemisova* consider a linearly constrained convex Semi-Infinite Programming problem, the set of constraints of which is indexed by a convex polyhedron expressed as the solution set of a linear inequality system. This problem is of its own interest, and the approach used in this paper may also constitute an important step towards solving more general problems having a set of constraints indexed by an arbitrary closed convex set, due to the fact that every closed convex set can be approximated by a convex polyhedron. The authors obtain optimality conditions and show that, unlike other previously known optimality conditions, the new ones can be easily used to test optimality of a given feasible solution.

The article of *Elena Pervukhina*, *Jean-Francois Emmenegger*, *Victoria Golikova* and *Kostiantyn Osipov* refers to the Ukrainian cargo transport system and proposes to forecast indicators of it, taking into consideration macroeconomic indicators. Increased forecast accuracy at a priori information uncertainty is attained through an optimization technique, starting with some Vector Autoregression model of observed multiple time-series, its state space representation and adaptive filtering minimizing forecasting errors. Due to an optimization criterion, they established the Kullback–Leibler information divergence between probability distributions of real values and their estimations. The observations were from 2003 to 2011. A main chance achieved lies in estimating future values of multiple time-series in the presence of structural breaks.

In their article, *Elena Ravve*, *Zeev Volkovich* and *Gerhard-Wilhelm Weber* consider quantitative optimization problems on decomposable discrete systems. They introduce a new kind of labelled decomposable trees, sum-like labelled weighted trees, and propose a method, which allows them to reduce the solution of an optimization problem, defined in a fragment of Weighted Monadic Second-Order Logic, on such a tree to the solution of effectively derived problems, defined in the same logic, on its components with some additional post-processing. The main result of the article may be applied in the wide range of optimization problems such as critical path analysis or project planning, network optimization, generalized assignment problem, routing and scheduling as well as in the modern document languages like XML, image processing and compression, probabilistic systems or speech-to-text processing.

In the paper of *Andrzej Stachurski*, a new form of the updating formula of the Broyden restricted class of methods is presented. It assumes a product form similar to that known for long time for the famous Broyden–Fletcher–Goldfarb– Shanno (BFGS) update. A similar product representation is obtained for the Davidon–Fletcher–Powell (DFP) formula and any member of the Broyden restricted class. For the BFGS update the projection employs a vector of differences of variables, for DFP image of the previous inverse Hessian approximation on the difference of derivatives and the convex

combination of those two vectors if one refers to other members of the Broyden class. Computational results are presented, providing a deeper insight into the structure of variable metric updates. The author hopes for future simplification of the convergence proofs on quasi-Newton methods.

Recently, extensive research has been carried out on the appropriate mathematical treatment of optimization problems governed by diffusion convection partial differential equations. The paper of *Hamdullah Yücel* and *Bülent Karasözen* contributes to this. Standard stabilization techniques, such as the streamline upwind Galerkin method, work well for the single convection dominated equations, but it is complicated to apply them on optimal control problems. Also, it is not straightforward regarding the stabilization methods to decide on one of two basic numerical strategies; they lead to different optimality systems. The recently developed symmetric stabilization methods for continuous finite elements, however, produce the same optimality system.

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Gerhard-Wilhelm Weber
Institute of Applied Mathematics, *Middle East Technical University*

Alexander Kruger
School of Science, Information Technology & Engineering, *University of Ballarat*

Juan Enrique Martínez-Legaz
Departament d'Economia i d'Història Econòmica, *Universitat Autònoma de Barcelona*

Boris Mordukhovich
Department of Mathematics, *Wayne State University*

Leonidas Sakalauskas
Operational Research, *Institute of Mathematics & Informatics*