


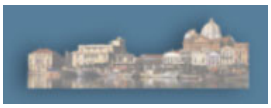


Editorial

Special Issue
"Challenges of Continuous Optimization
in Theory and Applications"
of *EJOR,*
European Journal of Operational Research

on the Occasion of

EUROPT Workshop
"Challenges of Continuous Optimization
in Theory and Applications",
Rhodes, Greece, July 2-3, 2004

Prepared and Supported by

EUROPT (EURO Working Group on Continuous Optimization)
http://www.iam.metu.edu.tr/EUROPT/,
University of the Aegean
http://www.aegean.gr/,
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On July 2-3, 2004, the *fourth annual Workshop* of *EURO Working Group on Continuous Optimization* (EUROPT) took place at Rhodos City, Greece, on the subject *"Challenges of Continuous Optimization in Theory and Applications"* (cf. http://www.iam.metu.edu.tr/contopt04/index.html). Likewise the previous annual meetings of EUROPT, this workshop was held and became celebrated in close timely neighbourhood and interaction with EURO XX Conference, Rhodes, Greece, July 4-7, 2004 (see http://www.euro-rhodes2004.org/). *Workshop on Challenges of Continuous Optimization in Theory and Applications* has been sponsored by *The Association of European Operational Research Societies* (EURO), *Gesellschaft für Operations Research e.V.* which is *German Operations Research Society* (GOR), and organized by EUROPT, by IAM (METU) and University of the Aegean. Together with its various contributions to EURO XX by sessions organized, a semi-plenary held, many session talks given and new EURO events initiated, *Workshop on Challenges of Continuous Optimization in Theory and Applications* became a worthwhile contribution to European collaboration on OR, surrounded by Greece long tradition in hospitality, its rich old culture, and with a happy looking forward to the future always among old and new friends who met.

Workshop on Challenges of Continuous Optimization in Theory and Applications aimed to bring together researchers from smooth and nonsmooth optimization, and from related fields of discrete optimization, operations research, economy and technology. It intended to be a forum for the exchange of recent scientific developments and for the discussion of new trends. The **scope** of the conference includes all aspects of smooth, nonsmooth and discrete optimization, from fundamental research to numerical methods and applications. The workshop's rich **topics** ranged from linear and nonlinear programming, semidefinite and semi-infinite optimization, complementarity problems, derivative-free, global and stochastic

optimization and nondifferentiable analysis to optimal control, optimization of technological, bio- and social systems and financial optimization.

The organizing committee of ESI XXII was composed of *Evgenios Avgerinos* (University of the Aegean, Greece), *Nikos Ampazis* (University of the Aegean, Greece), *Mirjam Dür* (Darmstadt University of Technology, Germany), *Azize Hayfavi* (METU, Ankara, Turkey), *Kathrin Klamroth* (Friedrich-Alexander University of Erlangen-Nuremberg, Germany), *Dimitrios Konstandinidis* (University of the Aegean, Greece) and *Gerhard-Wilhelm Weber* (METU, Ankara, Turkey).

Workshop on Challenges of Continuous Optimization in Theory and Applications was high-lighted by the participation of six invited speakers: *Miguel Goberna* (University of Alicante, Spain), *Kathrin Klamroth* (Friedrich-Alexander University of Erlangen-Nuremberg, Germany), *Marco A. López* (University of Alicante, Spain), *Arkadi Nemirovski* (Israel Institute of Technology, Haifa, Israel), *Moshe Sniedovich* (University of Melbourne, Australia) and *Theodore Trafalis* (University of Oklahoma, Norman, USA).

The total number of workshop participants turned out be ***33***, they travelled to Rhodes from **15** different countries: Australia, Brazil, Canada, Israel, Germany, Greece, Hungary, Lithuania, Mexico, The Netherlands, Norway, Portugal, Spain, Turkey and the USA.

This present EJOR special issue is already the fifth one of EUROPT, our working group which was founded in Budapest, Hungary, in 2000. Proceeding the first workshop held there, the second one held in Rotterdam, The Netherlands, in 2001, the third one celebrated in Istanbul, Turkey, in 2003, and EURO Summer School "Optimization and Data Mining" organized by us in Ankara, Turkey, 2004, four *EJOR special issues* were prepared and published already. Today, we are glad to announce this fifth EJOR special issue finalized.

For the refereeing process *sixtysix referees* served by their careful work; each paper was in average by three, sometimes even more, specialists from all over the world evaluated. As the result of their devotion, rigor, their very constructive and fruitful part, *thirteen* of the submitted papers fulfill the high standards of EJOR and display the recent contributions advances to *"challenges of continuous optimization"* by a variety in state-of-the-art research and vision. As the guest editors, we cordially thank the participating referees for their engaged efforts, for their positive encouragement and support of the authors whenever needed.

The work by M.A. Goberna, S. Gómez, F. Guerra and M.I. Todorov, *Sensitivity analysis in linear semi-infinite programming: perturbing cost and right-hand side coefficients*, is a valuable contribution to continuous optimization in the "semi-infinite" presence of infinitely many inequality constaints. The authors analyze the effect on the optimal value of a linear program imposed by a kind of perturbations which more frequently arise in practical applications. Moreover, they give formulae representing the exact value of a perturbed problem as a linear function of the perturbation.

B. Polyak in his contribution *Newton's method and its use in optimization* is devoted to a basic tool in numerical analysis and numerous applications, including OR and data mining. Newton's method's history, its main ideas, convergence results, modifications and its global behaviour are explained. The author focuses on applications of the method for various classes of optimization problems. Some extensions, e.g., to nonsmooth problems and Smale's results, are discussed and some others, for example, the method to achieve global convergence, are closer elaborated.

The paper of T. Illes and M. Nagy, *A Mizuno-Todd-Ye type predictor-corrector algorithm for sufficient linear complementarity problems*, analyzes a version of that famous predictor-corrector interior point algorithm for some linear complementarity problem (LCP). It assumes the existence of a strictly positive feasible solution and uses a proximity measure to derive an iteration complexity result for this algorithm. Furthermore, by the way of updating the centrality parameter and by the analysis being easier than before, this paper improves the previously done works.

The motivation of S.-A. Gustafson's contribution, *Some continuous programming problems in numerical analysis*, is lying , e.g., in design and implementation of computational schemes. Here, error bounds for the input data based and calculated results have to be minimized. The author describes rules of optimal quadrature and gives an application to the evaluation of the sums of power series. He uses linear and semi-infinite programming. Moreover, optimal convergence and related complexity issues are also in the scope of this paper, which arrives at qualitative results for the computational efforts.

In their work *Sufficient conditions for total ill-posedness in linear semi-infinite optimization*, M.J. Cancovas, M.A. López, J. Parra and F.J. Toledo discuss a central condition from the theory of inverse problems: total ill-posed. A linear, possibly semi-infinite programming problem is called so if it possesses the highest unstability in the sense that arbitrarily small perturbations may cause consistent and inconsistent problems, as well as both bounded and unbounded problems and solvable and unsolvable problems. This well exemplified paper presents sufficient conditions for this critical property in terms of the coefficients.

M. Ali's study *Differential evolution with preferential crossover* studies the mutation operation of the differential evolution algorithm, especially, the effect of the scaling parameter of the differential vector in mutation. The author derives the density function of points generated by mutation, proposes a "preferential crossover rule" reducing drawbacks of the scaling parameter. A motivation and numerical experience are provided. This work's modifications, the "preferential" one and a variable scaling parameter introduced, lead to a considerable reduction of the computational effort needed and can serve in global optimization.

The paper of J. Gebert, N. Radde and G.-W. Weber, called *Modeling gene regulatory networks with piecewise linear differential equations*, is located in the field of computational biology. It analyzes large amounts of data prepared by microarray chips. For this a model implying the most relevant regulating interactions in a cell is built by the least squares method. The authors investigate which dynamical behaviour the system is able to show. An important aspect included is lying in instantaneous changes of the dynamics at thresholds, and the relation to gene regulatory networks is explained, too.

E.N. Gryazina's work *The geometry and number of the root invariant regions for linear systems* considers the stability domain are a feasible set for numerous optimization problems. To describe the stability domain in the parameter space for linear parameter-dependent systems, a D-decomposition technique is targeted. For robust stability and low-order controllers design, this is very simple and efficient. The author's paper studies the open decomposition problem of the parameter space into root invariant regions. She estimates the number of these regions and gives examples, where this number is attained.

V. Bartkuté and L. Sakalauskas in their paper *Simultaneous perturbation stochastic approximation of nonsmooth functions* develop a "SPSA" approximation method by the operators of perturbation with the Lipschitz density function. Herewith, one can approximate the objective function by twice differentiable functions, represent their gradients by volume integrals, and for a wide class of perturbation densities SPSA algorithms can be created. A convergence theory is provided and the applicability of SPSA exemplified by the mean absolute pricing error for the calibration of the Heston stochastic volatility model.

In their contribution *An algorithm for local continuous optimization of traffic signals*, J.Q. Ying, H. Lu and J. Shi deal with the problem of optimizing traffic signals by taking into account their interaction with the drivers' route choice. The authors' approach is based on a stochastic user equilibrium model for a general network with link interferences. The proposed solution procedure relies on a sensitivity analysis where the sensitivity equations can be solved efficiently. In this paper, numerical results for controlling the green phase of a traffic network with two intersections are provided.

By *Challenges of continuous global optimization in molecular structure prediction*, a modern application is given to (bio) chemistry by G. Beliakov and K.F. Lim. For determining the properties and reactivity of molecules, bio- and macromolecules, the molecular geometry is a major factor. Computation of stable conformations can be done by locating minima on the potential energy surface being, however, shallow, often. The authors point out computational challenges on the geometry of oligopeptides, addresses by an efficient algorithm for calculating the lower bounds and an extended cutting angle method, combined with local optimization.

D. Lozuvanu and S.W. Pickl in *Algorithms for dynamic c-games on k-layered and k-expanded networks* investigate a multi-objective control problem of time-discrete systems with given starting and final states and the dynamics controlled by finitely many actors. Each of them aims at minimizing his own integral-time cost of the system's transitions by an admissible trajectory. Nash equilibria conditions are derived and algorithms for solving dynamic games in positional form proposed. The existence theorem for Nash equilibria is related to the introduction of an auxiliary dynamic *c*-game. Stationary and non-stationary cases are described and a complexity analysis provided.

T. Tchemisova analyzes optimality conditions for nonlinear problems. In her paper *Rigidity of abnormal extrema in nonlinear programming problems with equality and inequality constraints*, she focuses on the

situation where no constraint qualification is assumed. In this setting, the Lagrange multiplier corresponding to the objective function can vanish, and the extremum is called abnormal. The author develops a second order sufficient optimality condition which guarantees that the abnormal extremum is isolated in the feasible set, i.e., the extremum is rigid.

We share the conviction that each of these papers fulfills the high EJOR standards by content and style, and serves to represent both modern OR as an excellent host of continuous optimization as one of the important and core areas of OR in theory, methods and applications. In editing this Special Issue / Feature Cluster of EJOR, it is our hope that the readers will appreciate the efforts of EURO being a European initiative for advanced studies, and of EJOR being a unique journal for scientific communication and excellence.

Ankara, November 20, 2005

Guest Editors:

Mirjam Dür,
Darmstadt University of Technology, Germany
Bülent Karasözen,
Middle East Technical University, Ankara, Turkey
Tamás Terlaky (EUROPT deputy at EJOR),
McMaster University, Hamilton, Canada
Gerhard-Wilhelm Weber,
Middle East Technical University, Ankara, Turkey,

Editor:

Jacques Teghem,
Faculté Polytechnique de Mons, Belgium.