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Guest editorial

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This issue of *Computational Optimization and Applications* collects a selection of refereed papers that have been presented at the Workshop on *Nonlinear Optimization, Variational Inequalities and Equilibrium Problems* held in Erice, Italy, on July 02–10, 2010 at the "E. Majorana" Centre for Scientific Culture within the "G. Stampacchia" International School of Mathematics. The Workshop was the sixth in a series of Workshops on Nonlinear Optimization held in Erice from 1995 every three years.

In the tradition of these meetings, the purpose of the Workshop was to review and discuss recent advances and promising research trends in Nonlinear Optimization and its applications, with a particular focus on Variational Inequalities and Equilibrium Problems.

The meeting was attended by 62 people from 17 different countries, with 15 invited lectures and 39 contributed talks. Besides the lectures, several formal and informal discussions took place. The result was a wide and deep review of the present research achievements in Nonlinear Optimization and related topics. We wish to express our appreciation to all the participants for their active contribution to the success of the Workshop.

This special issue includes 13 papers selected after a peer revision. They represent a significative review of the recent developments in Nonlinear Optimization, Variational Inequalities and Equilibrium Problems. Both theoretical and numerical aspects are considered.

In particular, the growing interest for derivative-free methods for Nonlinear Optimization is witnessed by two papers: the first one by Powell, where algorithms for unconstrained optimization are considered assuming that the objective function is differentiable but its derivatives are not available. The second one by Liuzzi, Lucidi and

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Rinaldi, where bound constrained mixed-integer optimization problems are considered. The latter nonlinear optimization problems, where both continuous and discrete variables are present and the derivatives of the functions are not available, are arising very frequently in real world applications and this motivates the need of methods for efficiently solving such problems.

Classical bound constrained optimization problems are also considered. In the paper by De Santis, Di Pillo and Lucidi an active set method is proposed for the minimization of a function subject to bound constraints. The method is based on a new estimation of the set of the active and non active variables at a stationary point and a feature of the method is that it maintains the feasibility of the iterates. The paper by Birgin and Gentil faces the problem of assessing the performance of existing solvers for problems with bound constraints. To assess the efficiency and the effectiveness of a new method is of crucial importance and it is not trivial to test and compare different algorithms. This paper gives a fair overview on optimization software for bound constrained optimization.

A new class of optimization problems is considered in the paper by Izmailov and Pogosyan. Indeed, they consider nonlinear optimization problems with vanishing constraints. The latter problems are very difficult to treat since vanishing constraints usually do not satisfy standard constraint qualifications.

The paper by Salzo and Villa considers a general class of penalized nonlinear least squares problems. They propose an extension of the Gauss–Newton method for which they prove local convergence.

New results in conic optimization are given in the paper by Tunçl and Wolkowicz. A conic optimization problem consists in optimizing a linear objective function over the intersection of a convex cone with an affine space. In particular, the paper deals with duality and optimality results and proposes the notion of "minimal representation" of the cone and the constraints. This provides a new framework for solving cone optimization problems which enables to avoid some theoretical and numerical difficulties.

The paper by Simoncini considers the solution of large scale structured linear systems which arise in PDE-constrained optimization problems. The latter problems are computationally very difficult to solve and are based on the solution of linear systems with a particular structure. The paper shows that some PDE–constrained optimization problems involve such systems whose dimension can be significantly reduced by exploiting the structure of the matrices. Moreover, numerical solution of the reduced problem is also considered by using preconditioning techniques.

Optimization problems whose constraints are described by the solution sets of a parametric variational inequality are considered in the paper by Lignola and Morgan. They study the asymptotic behavior of the infimal values whenever a general scheme of perturbation is present.

In the paper by Boukrouche and Tarzia optimal control problems governed by elliptic variational inequalities are considered. The strong convergence of the optimal controls and states associated to this family of optimal control problems is proved.

Equilibrium problems are considered in the paper by Bigi and Passacantando and in the paper by Langenberg. In the first one equilibrium problems with nonlinear convex constraints are reformulated as a global optimization problems by means of

a class of gap functions. Then an algorithm is proposed, its global convergence is proved and it is numerically tested on a particular problem. In the second one, three methods for solving equilibrium-type fixed point problems (considered as a generalization of equilibrium problems) are proposed. They are proximal-like algorithms for which convergence is established.

Finally, the paper by Astorino, Fuduli and Gaudioso deals with a machine learning technique for separating two sets of data by means of a sphere. Both the cases of fixed and moving center are considered. In the first case a solution algorithm is proposed; in the second case the problem is treated as a nonsmooth DC program.

We are indebted to many anonymous referees who took care to review all the papers submitted for publication in this special issue.

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