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EDITORIAL

Guest editors' preface to the special issue devoted to the 2nd International Conference "Numerical Computations: Theory and Algorithms", June 19–25, 2016, Pizzo Calabro, Italy

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This special issue of the *Journal of Global Optimization* contains twelve high-quality research papers devoted to different aspects of global optimization such as theory, numerical methods and real-life applications. The papers included in this special issue are based on the presentations carefully selected by the guest editors among the talks delivered at the 2nd International Conference "Numerical Computations: Theory and Algorithms (NUMTA)" held in June 19–25, 2016 in Pizzo Calabro, Italy (the first NUMTA conference took place in Falerna, Italy in 2013). The NUMTA 2016 has been organized by the University of Calabria, Rende (CS), Italy, in cooperation with the Society for Industrial and Applied Mathematics, USA. The guest editors actively participated in the organization of the conference: the Program Committee of the NUMTA 2016 was chaired by Yaroslav D. Sergeyev, in their turn, Renato De Leone and Anatoly Zhigljavsky took part in the Program Committee.

The goal of the NUMTA 2016 was creation of a multidisciplinary round table for an open discussion on numerical modeling nature by using traditional and emerging computational paradigms. Participants of this conference discussed several aspects of numerical computations and modeling from foundations of mathematics and computer science to advanced numerical techniques. A large part of presentations has been dedicated to optimization. Selected papers presented at the conference in the field of numerical analysis and respective applications have been published in the special issue of the international journal *Applied Mathematics and Computation*, Volume 318 (2018). In its turn, the present special issue contains articles dealing with global optimization. Let us give a brief description of the papers included in this special issue.

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- The paper [1] is dedicated to a Lipschitz global optimization problem using the well-known DIRECT algorithm and the diagonal partitioning strategy. One of the main advantages of the diagonal partitioning scheme is that the objective function is evaluated at two points at each hyper-rectangle and, therefore, more comprehensive information about the objective function is considered with respect to the central sampling strategy used in most DIRECT-type algorithms. In this paper, the authors introduce a new DIRECT-type algorithm using a bisection instead of a trisection which is typical for diagonal-based and DIRECT-type algorithms. The authors show that their algorithm provides very promising numerical results compared to its direct competitors.
- In the article [2], the authors consider solving a set of global optimization problems in parallel. It is shown that the algorithm they propose provides a uniform convergence to the set of solutions for all problems treated simultaneously. The current accuracy for each particular solution is estimated and results of numerical studies based on solving several hundred multidimensional global optimization problems are provided.
- A proximal bundle method for the numerical minimization of a non-smooth DC function is introduced in [3]. The authors build two piecewise-affine approximations of the component functions, grouping the corresponding information in two separate bundles. In the bundle of the first component, only information related to points close to the current iterate are maintained, while the second bundle only refers to a global model of the corresponding component function. The authors then combine the two convex piecewise-affine approximations and generate a DC piecewise-affine model, which can also be seen as the pointwise maximum of several concave piecewise-affine functions. Convergence issues of the resulting proximal bundle method are studied and a supporting evidence based on computational results is provided.
- The rate of convergence of general global random search algorithms is studied in [4]. The authors show that if the dimension of the feasible domain is large then it is impossible to give any guarantee that the global minimizer is found by a general global random search algorithm with a reasonable accuracy. They then study precision of statistical estimates of the global minimum in the case of large dimensions and show that these estimates also suffer the curse of dimensionality. Finally, they demonstrate that the use of quasi-random points in place of the random ones does not give any visible advantage in large dimensions.
- A new method for solving multicriterial optimization problems is proposed in [5]. It is supposed that the optimality criteria may be multiextremal and calculations of the criteria may be time-consuming. The authors reduce multicriterial problems to global optimization ones through minimax convolution of partial criteria and apply Peano curves to decrease the dimensionality of the resulting problem. To efficiently find the set of Pareto-optimal solutions they propose to reuse the search information obtained in the course of previous iterations. Results of computational experiments are provided.
- The authors of [6] consider a class of bilevel linear mixed-integer programs (BMIPs), where the follower's optimization problem is a linear program. In their study they suppose that the follower may be willing to give up a portion of his/her optimal objective function value in order to inflict more damage to the leader. To handle such adversarial settings the authors consider a modeling approach referred to as α-pessimistic BMIPs. The proposed method naturally encompasses as its special classes pessimistic BMIPs and max–min/min–max problems. The authors extend this modeling approach by considering strong–weak bilevel programs, where the leader is not certain if the follower is collaborative or adversarial, and thus attempts to make a decision by taking into account both cases via a convex combination of the corresponding objective function values. A number of interesting theoretical results regarding the proposed models are provided and illustrated by numerical examples.

- A global optimization algorithm working with simplexes used to subdivide the search region is proposed in [7]. The main idea consists of applying a bicriteria selection of a simplex for the bi-section at each iteration. The first criterion is the minimum of estimated Lipschitz lower bound over the considered simplex. The second criterion is the diameter of the simplex. Results of an experimental testing of the proposed algorithm are included. They show quite a promising behavior of the introduced method in comparison with its competitors.
- The paper [8] proposes a method for solving systems of nonlinear inequalities with predefined accuracy based on non-uniform covering concept adopted for global optimization. The method generates inner and outer approximations of the solution set. The authors describe three possible numerical implementations of the method and study the generated approximations of the regions of interest both theoretically and experimentally.
- The article [9] investigates a single machine serial-batching scheduling problem considering release times, setup time, and group scheduling, with the combined effects of deterioration and truncated job-dependent learning. The objective of the studied problem is to minimize the makespan. The authors analyze a special case where all groups have the same arrival time, and propose the optimal structural properties on jobs sequencing, jobs batching, batches sequencing, and groups sequencing. They develop a hybrid VNS–ASHLO algorithm incorporating variable neighbourhood search (VNS) and adaptive simplified human learning optimization (ASHLO) algorithms to solve the general case of the problem considered. Computational experiments on randomly generated instances of different scales show effectiveness and efficiency of the proposed algorithm.
- The convergence rate of a rectangular partition based algorithm is considered in [10]. A hyper-rectangle for the subdivision is selected at each step according to a criterion rooted in the statistical models based theory of global optimization; only the objective function values are used to compute the criterion of selection. The convergence rate is analyzed assuming that the objective are twice continuously differentiable and defined on the unit cube in d-dimensional Euclidean space. An asymptotic bound on the convergence rate is established and results of numerical experiments are included.
- Global optimization problems where the objective function is non-differentiable, satisfies the Lipschitz condition with an unknown Lipschitz constant, and is given as a "black-box", are studied in [11]. A derivative-free deterministic method reducing the dimensionality of the problem by using space-filling curves and working simultaneously with all possible estimates of Lipschitz and Hölder constants is proposed. A smart adaptive balancing of local and global information collected during the search is performed at each iteration. Convergence conditions for the new method are established. Results of numerical experiments on 1000 randomly generated test functions show an excellent performance of the new method w.r.t. the popular method DIRECT and some other competitors.
- In the paper [12], the authors consider the pump scheduling optimization problem in a Water Distribution Network with both ON/OFF and variable speed pumps. The well-known EPANET simulator is used to compute the energy cost associated to a pump schedule and to verify that hydraulic constraints are not violated and the demand is met. Two Bayesian Optimization approaches are proposed in the paper, where the surrogate model is based on a Gaussian Process and a Random Forest, respectively. Both approaches are tested with different acquisition functions on a set of test functions, a benchmark Water Distribution Network from the literature and a large-scale real-life Water Distribution Network in Milan, Italy.

After this brief description of the contents of the special issue the guest editors have a pleasant duty to thank all the individuals and institutions who helped them in making this special issue published. First of all, the guest editors on behalf of the Program and Organizing Committees of the NUMTA 2016 thank the sponsors and partners of the Conference for their generous support. Without their help this event would not happen:

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