This special issue includes a selection of the papers presented at the Conference on High Performance algorithms and Software for Nonlinear Optimization (HPSNO 2004) held in Ischia (Italy) in June 2004, with the addition of some extra contributions. HPSNO 2004 followed the HPSNO95, the HPSNO97 and the HPSNO2002 conferences, whose goal was “putting together recent progress in computer technology with the latest algorithmic developments in the field of numerical optimization”. Since the first HPSNO conference took place, things have considerably changed, and this can be perceived by comparing this special issue to the proceedings of the previous conferences [1–3]. Nowadays, high performance computational environments have become widespread, and are considered standard computational tools, so that the interests of many researchers have been directed towards challenging applications in solving major medical, engineering and financial problems for which effective algorithms, joint with the newly available computational power, represent the critical solving issues.

The papers by Doumpos et al., Georgiev et al., Mittelmann et al. have been clearly inspired by real world applications, and the same holds to some extent for the paper by Frimmanslund et al., which deals with a novel algorithm for unconstrained minimization, exploiting curvature information in order to overcome the drawback due to noisy or non-smoothness in the objective function that often arises in real-world problems. Computational reasons motivate also the paper by Fasano and Roma, which describes the use of an iterative method, based on a planar Conjugate Gradient scheme, to compute negative curvature directions within optimization frameworks. This method is especially suitable for large scale problems since explicit matrix storage is avoided. Numerical linear algebra issues are also behind the papers by Bonettini et al. and by Cafieri et al., both dealing with Interior Point (IP) algorithms, more
specifically with the effective use of iterative solvers within such methods: after the achievement of exciting theoretical results about convergence and complexity issues in the last two decades, several researches on IP methods are nowadays focusing on devising ad hoc factorizations, iterative methods and preconditioning techniques to be used in really effective implementations for large scale problems. Similarly, in his paper Dostal deals with theoretical and implementation issues about the use of the Conjugate Gradient method in a semi-monotonic augmented Lagrangian algorithm for the solution of large convex equality constrained quadratic programming problems. The work of Meziat et al., with much more theoretical flavour, is concerned with a very different topic, being devoted to a new method for solving some nonlinear, non-convex optimal control problems, which actually is of special interest in some problems for design and simulation in science and engineering. One of the most straightforward and direct use of parallel computing in optimization can be found in the general framework of the (meta) heuristic methods, as shown for instance in the paper by Ghiani et al. dealing with a parallelization strategy within a simulated annealing approach for the problem of optimizing a function over a countable set of alternatives.

In conclusion, as the articles in this special issue testify, a large number of researches in the numerical optimization field focuses on computational issues, in order to achieve computational effectiveness in large scale and/or highly nonlinear problems, possibly arising in real world applications, since one of the most striking trends in optimization is the increasing interdisciplinary nature of the field.

We remember that the HPSNO 2004 conference was dedicated to Prof. Panos M. Pardalos for his 50th birthday. His pioneering contributions in the field of global optimization have always been driven from real life applications, with a highly multidisciplinary approach, in which efficient algorithms and advanced computational techniques have been specifically devised and tuned, such as in his recent celebrated works in biomedicine about brain disorders. We are grateful to him for his friendship and support to the HPSNO conferences.

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References