

Special issue on: “matheuristics”

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In spite of the progress in information technology and the advance in exact methods for the solution of combinatorial optimization and mixed integer linear programming problems, heuristics remain necessary to obtain high-quality solutions for some computationally hard problems. The availability of powerful commercial software has created new opportunities in the design of heuristics, generating a new class of algorithms that combine classical heuristic and metaheuristic schemes with mixed integer linear programming strategies and software. Although being quite recent, this research direction has already generated a rich body of literature. The heuristics in this class are presented under different names, optimization-based heuristics, heuristics based on mathematical programming, hybrid heuristics, *matheuristics*. We use this latter name to identify all heuristics in the class.

The goal of this special issue has been to collect high-quality papers on matheuristics for the solution of combinatorial optimization and mixed integer linear programming problems. The call for papers has encouraged submission of papers that are surveys or advances in the theory, practice and application of matheuristics.

Three contributions have been accepted. They were peer reviewed according to the high standards of the journal. Our thanks go to highly qualified referees that helped us select these papers. In our view, the selected papers show excellent results that give an overview of the potential applications of matheuristics for the solution of complex combinatorial optimization problems.

“A survey on matheuristics for routing problems” by Claudia Archetti and M. Grazia Speranza presents an overview of the literature on matheuristic algorithms for the

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solution of routing problems. Routing problems are hard combinatorial optimization problems and a huge number of papers is devoted to their study. The recent literature reveals that matheuristics are becoming more and more popular as solution methods for this class of problems. The scope of this survey is to classify the approaches and to highlight the potential benefits that matheuristics offer with respect to classical heuristic schemes, on one side, and the critical issues that they raise, on the other side.

“Optimal selection of contracts and work-shifts in multi-skill call centers” by Roberto Cordone, Pierre Hosteins, Giovanni Righini, Paolo Ravizza and Andrea Piselli deals with the problem of finding the most suitable contracts to be used when hiring the operators of a call center and deciding their optimal working schedule, to optimize the trade-off between the service level provided to the customers and the cost of the personnel. For the solution of this problem, the authors propose a matheuristic which is based on the decomposition of the mathematical programming formulation in sub-problems. An integer solution is derived through a multi-level iterative rounding approach based on the continuous relaxation of each sub-problem. The matheuristic is compared with a greedy randomized adaptive search procedure and tests are performed on real-world and realistic random instances.

“A Lagrangian-ACO Matheuristic for Car Sequencing” by Dhananjay Thiruvady, Andreas Ernst and Mark Wallace studies the problem of scheduling cars on an assembly line. Each car requires a number of options and cars have to be sequenced such that sub-sequences of specific size include a limited number of options. The utilization of options among the sequences must be balanced. For the solution of this problem the authors developed a matheuristic which efficiently combines a Lagrangian heuristic with an ant colony optimization approach. Computational tests show that the matheuristic gives better results than the Lagrangian heuristic and the ant colony approach applied independently.

We are confident that this special issue will become a reference work for researchers who are interested in further investigating the potentiality of matheuristics and their application for the solution of hard combinatorial optimization problems. We hope that the papers presented in this issue will provide insights and inspiration for future work in this field.