

Guest Editorial Preface

Special Issue on Efficient and Robust (Meta)Heuristics for Industrial and Service Engineering

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Approximate methods, like tailored heuristics and metaheuristics, are useful to solve a variety of large-scale optimization problems encountered in numerous complex systems such as transportation, logistics, healthcare, cutting and packing, telecommunication, networks, reliability, advertisement, investment, budget allocation, and production management. Efficient local search with its variants and population-based approaches have been and are being proposed for different variations of mono and multi-objective optimization problems.

Because of their wide range of applicability to solve complex systems, a multitude of techniques-based approaches have been considered in the literature. As for the discrete and continuous models related to the complex problems at hand, one can be confronted (i) to their resolution with the state-of-art solvers remains often unsolvable, and (ii) to the non-robustness of special-purpose methods to either the input parameters or additional constraints.

Despite the high performance of computers and knowledge advance, solving most complex systems remains a high challenge. Indeed, according to existing resolution searches of the literature, many papers focused on methods able to cover a wide spectrum of operations research and decision making, overcoming mono and multi-objective practices and academics problems: polynomial approximations, tree search-based techniques, tailored heuristics, meta-heuristics, and several constraint and goal programming-based approaches. Some of these methods try to hybridize the aforementioned techniques, while others take advantages of the parallelization techniques where it relies on the cooperation of several processors to enhance the speedup and/or to improve the quality of the achieved bounds. Often, most specialized methods cannot be easily adapted to non-related problems and so, their usefulness is often challenged while general purpose methods tend to be better adapted to tackle either most complex systems or instances with large-scales.

The current special issue consists of five selected papers, and focuses on efficient and robust general purposes approaches for industrial and service engineering including a variety of complex systems fields.

The first paper authored by Aïder and Skoudarli highlights the importance of the robustness when tackling the single capacitated vehicle routing problem with uncertain demands. The goal of the study is to find a set of routes with the lowest total travel distance and tardiness time, subject to vehicle capacity and time windows constraints. It emphasizes the role of uncertainty whenever dominance relations are considered for handling the epistemic uncertainty in objective functions. Their computation requires using an epistemic multi-objective local search-based approach on benchmark instances generated following a standard generator. The paper tallies some results reached when

the uncertainty is considered where their qualities are compared to those reached by a deterministic version of the method.

The second paper of Frifita, Methlouthi and Dammak proposes to solve a new practical problem related to the technician routing and scheduling problem by applying an efficient hybrid meta-heuristic based upon a variable neighborhood search. Such a problem is inspired from the repair of electronic transactions equipment application where the goal is to minimize both total weighted distance and overtime, and to maximize the requests served. It consists on designing routes of staff to perform requests while considering some tactical constraints and resources. In addition, the problem is solved by applying a hybrid general method: a cooperation between variable neighborhood search, adaptive memory and advanced diversity management procedure are considered.

The third paper contributed by Prajapati and Shah discusses the need to develop simulation methods for the design of Computer-Aided Design (CAD) tools for the automatic design of CMOS analog circuits. The aforementioned automatic design of the analog circuit is inevitable given recent developments in the design of the System On Chip (SOC). For such purpose, a cuckoo search-based meta-heuristic is proposed for tackling the automatic design of Complementary Metal Oxide Semiconductor (CMOS) miller operational transconductance amplifier. Some results are presented and compared to the results reached by previous methods available in the literature.

The fourth paper authored by Kenidra and Ben Mohammed encourages the application of clustering process as a solution tool to identify cancer subtypes based on gene expression and DNA methylation datasets. Because DNA methylation database is a kind of extremely large-scale datasets, the average running time remains a major challenge. The paper proposes a new manner for grouping items related to the datasets, where the clustering procedure-based heuristic is used for enhancing the average running time of the search procedure.

The fifth and last paper authored by Fendri and Chaabane studies micro-grid energy provider in order to make periodically decision on dispatching energy between connected installations. Indeed, interconnecting installations via a micro-grid should allow an equilibrium system between those with lack energy and the others. The paper presents a hybrid petri net-based strategy for the micro-grid energy provider, where the goal is to dispatch energy between connected installations by respecting a periodic threshold fixed to one hour. The proposed approach combines both discrete events (house energy state) and continuous events (energy flow) in order to respond to the decision problem.

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