Editorial

International Journal of Transportation

Recent Advances in Metaheuristics for Solving Transportation and Logistics Problems

We are very happy to publish this issue of an International Journal of Transportation by Science and Engineering Research Support soCiety.

This special issue contains 6 articles. Achieving such a high quality of papers would have been impossible without the huge work that was undertaken by the Editorial Board members and External Reviewers. We take this opportunity to thank them for their great support and cooperation.

Metaheuristics has been a topic with intense investigation in past decades because they can be used to solve many practical but difficult problems. Metaheuristics has the capability in searching good solutions quickly in a large space of candidate solutions of the problems even with no good mathematical properties or the NP-hard problems. Transportation and logistics problems, including network design, facility location, freight distribution, demand responsive system, train routing, block-to-train assignment, and vehicle routing problems, can often be solved by metaheuristics efficiently. In this issue, we include six papers focusing on the applications or enhancements of metaheuristics for solving various transportation and logistics problems.

The first article, by Brands and van Berkum, demonstrates a novel application of the non-dominated sorting genetic algorithm for solving the multi-objective multimodal transportation network design problem. The problem considers accessibility, the use of urban space by parking, operating deficit, and climate impact as objectives. The decision variables include park-and-ride locations, train station locations, and train frequency. Using a case in Amsterdam, this article examines the impacts of the randomness of the algorithm and the values of the algorithmic parameter on the optimal solution and objective value obtained. The results show that the randomness affects more on the optimal decision made than optimal decision variable. The results also illustrate that the variations of different parameter setting have a similar impact to the randomness of the algorithm. The proposed model and the results are useful to the planning and management of multimodal transportation networks.

The second article, by Gomes et al., develops a parallel reactive-GRASP approach to solve the dynamic vehicle routing problem for a demand responsive transport system under the low, variable, and unpredictable demand situation. The approach relies on a greedy randomized procedure and a local search to optimize both the operating cost and level of service and obtain a set of efficient solutions. The results of numerical examples indicate that the proposed approach is superior in terms of the reduction in operation cost and improvement in computational efficiency. This approach can be an alternative for designing and managing the demand responsive transportation services.

The third article, by Friedrich and Gumpp, reviews the simplification principles that help reduce the complexity of classical logistics problems. Major logistics problems including facility location, distribution system, lot size, bin packing, and vehicle routing problems are used as examples in the discussion. The role of the metaheuristics in the simplification principles is pointed out. The article indicates that a wide variety of techniques can be used to effectively simplify most complex logistics problems, and more
importantly, solve the problems efficiently. These techniques should be useful to modelers and practitioners to tackle their logistics problems.

The fourth article, by Moniz et al., develops a new genetic algorithm to solve the integrated freight train routing and block-to-train assignment problem. The problem considers the constraints on crew assignment, the number of work events, train weight and length, the number of swaps per block, the number of blocks per train, and the number of trains passing through a link. The genetic algorithm incorporates an algorithm to solve the constrained resource shortest path subproblem. The results indicate that the proposed genetic algorithm can generate a low global cost solution efficiently. This algorithm should be useful for the effective operation and management of freight train networks.

The fifth article, by Baskan, evaluates the performance of three recently developed metaheuristics for solving the optimal link capacity expansion problem, which is a bilevel problem that is difficult to solve. The three metaheuristics are Harmony Search (HS), Artificial Bee Colony (ABC), and Differential Evolution (DE) algorithms. The performance of each algorithm is evaluated based on the comparison with the methods used in the literature using the 18-link network and Sioux Falls network examples. The results of the numerical examples show that the DE algorithm is superior in terms of both the objective function value and computation time. Given its simplicity and robustness, the DE algorithm has the potential for future large-scale applications of transportation network design.

The last article, by Wassan and Nagy, documents a review on Vehicle Routing Problem (VRP) with deliveries and pickup. This article reviews the three classes of VRP known as the VRP with backhauling, the VRP with mixed deliveries and pickups, and the VRP with simultaneous deliveries and pickups. The focus is on the modeling assumptions involved. The advances in metaheuristics for solving VRP are also discussed. This review should fill the knowledge gap and stimulate the improvements in the solution approaches for researchers and in the reverse logistics process for the industry as the article provides concise and clear research directions to the vehicle routing problem with deliveries and pickups.

The six articles published in this special issue provide novel solution approaches, new applications or interesting findings related to using metaheuristics to solve transportation and logistics problems. Various aspects of solution algorithms are addressed in the applications of multimodal transport system, road network design, freight train operation, and demand responsive system, and reverse logistics. It is our hope that this special issue will stimulate initiatives from academics, researchers, and practitioners in the transportation and logistics network optimization.
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Guest Editors of the Special Issue on
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