Preface: Special Issue on Operations Research Models and Algorithms in Transportation

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Operations research, popularly known as OR, is a scientific research method or mathematical technique for providing decision making aid in the management of large organizations or organized systems. In the real world, transportation, a large organized system, is the movement of humans, animals, and goods from one location to another. The transportation problem is significantly complicated because of its wide range. The modes of transportation include air, land (rail and road), water, cable, pipeline, and space. The field of transportation can also be divided into infrastructure, vehicles, and operations. Hence, transportation is essential for the development of civilizations, and has been an active topic for decades, while operations research is one of its key contents. This special issue examines the current progress, challenges and approaches in transportation through operations research. Thus, the scope of this issue covers high-quality original research focusing on the use of OR techniques (mathematical programming models, algorithms and simulation-based approaches, etc.) to deal with transportation problems.

This issue comprises nine papers by multiple scholars at home and abroad and explores the exploitation of operations research models (ORMs) and algorithms in transportation. The topics in this collection of selected papers encompass a broad area of ORMs and algorithms in transportation, including automatic guided vehicle routing, on-ramp lane arrangement, autonomous vessel scheduling, bus transportation, cross-docking flow shop problem and airline flight transportation, etc. The papers are summarized as follows.

Lu Zhen, Yi-Wei Wu, Si Zhang, Qiu-Ji Sun, and Qi Yue propose a decision framework for port managers to efficiently design the automatic guided vehicle routing. Their decision framework deals with time-varying traffic conditions and makes automatic guided vehicle allocation plans more reasonable within a relatively short computation time. Extensive numerical experiments on a grid graph are conducted to validate

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the efficiency of the proposed decision framework. They also propose an efficient queueing rule in automatic guided vehicle routing scheduling.

Xu Wang, Xiao-Bo Qu, and Pan Li compare the performances of two on-ramp lane arrangements (added lane and zip merging) in terms of travel time and CO₂ emissions to help traffic engineers choose the appropriate on-ramp arrangement based on a given CO₂ emission target. Moreover, they evaluate the relationships between travel time, emissions and different proportions of heavy goods vehicles for the above-mentioned two on-ramp lane managements.

Wei Zhang and Shuai-An Wang investigate a tactical-level schedule decision problem for autonomous vessels. They propose a mixed-integer nonlinear programming model to minimize the total cost of fuel consumption and the delay penalty of an autonomous shipping company. The nonlinear programming model is linearized and further solved effectively by CPLEX. Management insights for commercializing autonomous vessels are drawn based on numerical experiments. The results show that a shipping company may speed up an autonomous vessel with short-distance voyage to avoid delay costs when fuel price is low.

Elbaz Hassane and Elhilali Alaoui Ahmed investigate the waiting time in bus networks. They propose a new model for the scheduling problem in transit networks to reduce the passenger transfer waiting time in correspondence zones. This model gives a new definition to the synchronization among buses to minimize the waiting time in the correspondence zones. The authors apply a multi-agent approach to solve their model and verify the model by numerical experiments.

Bo-Chen Wang, Miao Li, Yi Hu, Lin Huang, and Shu-Min Lin study an emergency warehouse location problem by considering several realistic factors, including different scales of emergency warehouses, damage scenario factors and uncertain relief material demands. They propose a stochastic mixed-integer programming model and design two solution methods (a local branching-based solution method and a particle swarm optimization-based solution method) to solve the problem. Numerical experiments using cases from Yunnan Province (China) are conducted to evaluate the efficiency of the heuristic.

Imen Hamdi and Mohamed Fadhel Tekaya investigate a two-machine cross-docking flow shop scheduling problem to find a feasible schedule that minimizes the makespan. As the problem is strongly NP-hard, a genetic algorithm is applied to solve the considered problems. The high performance of the proposed algorithms is proved through extensive computational experiments using many randomly generated instances.

Bao-Cheng Zhang investigates a congestion pricing problem considering the price discrimination between different origin-destination pairs. This study considers the difference between equilibrium flights in a self-profit maximization scenario and those in a joint profit maximization scenario and regards the flight fare difference between the two scenarios a congestion price. The results show that when the total real flight production of all airlines is less than the equilibrium flights under the joint profit maximization scenario, congestion pricing does not work. Moreover, the optimal congestion price can be determined by proposed mathematical equations.

Yue Li, Rui-Yun Tang, Li-Wen MuRong, and Qian Sun analyze a combined optimization problem of vehicle scheduling and dock door allocation in cross-docking to minimize the completion time of cross-docks. They use the genetic algorithm and

the hybrid particle swarm optimization algorithm to solve small, medium, and large cross-docks. Numerical experiments verify the reliability of the algorithms in terms of the optimal completion time, average completion time, and average solution time. They then introduce the concept of mixed-mode dock door and investigate the influence of the mixed dock door on the vehicle waiting time by comparing the utilization rate of mixed dock doors.

Pu Li, Hong-Jie Lan, and You-Hua Chen propose an optimization model of the distribution route of convenience vegetable stores in cities with transit nodes on the basis of the research on agricultural product distribution. Considering the current traffic jam situation in a specific period in the city, they add the double time constraints of soft time window and hard time window. Hence, they develop a one-stage solution strategy on the basis of the characteristics of their model. Numerical experiments verify the effectiveness and feasibility of the model and the algorithm. The results show that the establishment of a transit can decrease the overall transportation cost when the number of convenience vegetable stores is large. The results also show that with the increase in the number of convenience vegetable stores in cities, the distribution of convenience vegetable stores can be improved by the planning of scientific paths and the increase of transit nodes.

All the papers in this special issue have been peer-reviewed to meet the high standard of the journal. We thank all authors for their significant contributions. Their timely response and careful revisions are highly appreciated. We also thank the anonymous referees for their voluntary work and expert reviews.

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