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EDITORIAL

Modeling and data analytics in manufacturing and supply chain operations

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In past decades, modeling and optimization have played an important role in solving the operational and tactical problems that arise in supply chains, in manufacturing and in services. Successful examples have included supply chain network design, intermodal transportation, and production planning, just to name a few. However, many problems still remain very challenging because of their complicated structure, scale, or stochastic nature. On the other hand, the rapid rise of data analytics has provided exciting new opportunities for the Operations Research and Control communities to re-examine the existing challenges, as well as newly emerging problems that are coming up in supply chains and in manufacturing.

This special issue of the *Flexible Services and Manufacturing* (FSM) Journal aims to include state-of-the-art research that addresses the aforementioned existing challenges and emerging problems through innovative modeling and data analytical methods. Selected papers in the track "Modeling and Data Analytics in Manufacturing and Supply Chain Operations" at the *9th IFAC Conference on Manufacturing Modeling, Management, and Control* (MIM 2019) held in Berlin, Germany, in August, 2019, were invited to submit their extensions to this special issue. The call for papers was open also to researchers who did not attend the MIM 2019 conference. The number of articles received was 25. After a thorough double-blind

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peer review process, following the standards of the FSM journal, five papers were accepted for publication. The problems addressed in these five papers involve supply chains, manufacturing systems, and healthcare. The analytical methods used in these papers include predictive analytics, optimization, simulation, as well as hybrid methods. Two papers focus on supply chain problems, one on information sharing by Dominguez et al. (2021) and one on leasing and selling strategies by Li et al. (2021)). Two papers consider scheduling and dispatching problems in manufacturing, one in flexible manufacturing by Zanchettin (2021) and one on lean manufacturing by Mezzogori et al. (2021). The fifth and last paper, by Guo et al. (2021), considers a scheduling problem in the services industry, namely a medical staff scheduling problem.

1 The papers in the special issue

The first paper by Dominguez et al. (2021) explores the value of information sharing in reducing the bullwhip effect in a four-echelon decentralized supply chain where only some echelons participate in the collaboration. Seven partial information sharing structures are captured using system dynamics models. These models are then evaluated numerically via simulation using design of experiments. Based on the numerical experiments, the impact of the information sharing structures and stochastic lead times are revealed. From a practical vantage point, the managerial recommendations of this paper provide supply chain managers evidence on how to manage different types of information sharing schemes.

The second paper by Li et al. (2021) considers leasing and selling strategies of a monopoly manufacturer of durable goods. In this paper, a model with two differentiated markets is built, and three basic market strategies are examined, including a pure-selling strategy, a pure-leasing strategy, and a hybrid strategy. The authors build optimization models to analyze the profitability of the three strategies and explore how the strategy decision can be influenced by the market structure and product features. They also provide managerial insights on the optimal pricing, quantity strategies and channel selections and operations.

The rise of mass customization in flexible manufacturing systems calls for accurate tracking of highly variable production requests while dealing with system uncertainties in the scheduling process. The third paper by Zanchettin (2021) proposes a closed-loop control approach in balancing the time-varying high-mix production requirements in such systems. The control strategy relies on a forecasting technique that is based on a digital twin of the shop-floor. It makes scheduling and dispatching decisions by accounting for variabilities in the job processing times. The optimal schedule is generated by minimizing production errors, i.e., the discrepancy of the actual production from a reference one. The proposed approach is verified using a hybrid human–robot assembly plant scenario.

The fourth paper, by Mezzogori et al. (2021), considers the workload control in lean production systems with the goal of reducing tardinesses and ensuring on-time deliveries. Existing research often handles this task by making use of sophisticated dispatching rules and complex job-release mechanisms, but it can make

the workload control too complicated for real applications. This paper proposes an alternative workload control method by forecasting the due dates of the jobs. The forecasted due dates are then embedded into a negotiation procedure to determine whether or not the jobs can enter the system; this in order to reduce the percentage of tardy jobs. Simulation experiments on a job-shop scheduling example are conducted to show the effectiveness of this new method.

The last paper considers a personnel scheduling problem in the services industry. It constitutes a challenging and promising attempt to apply OR techniques to optimally obtain the configuration of existing medical staff, so as to alleviate the overcrowding at an Emergency Department in Hong Kong. Guo et al. (2021) address this issue through the integration of simulation optimization with data analytics. In this paper, a data-driven multi-fidelity simulation optimization framework is developed, by adopting simulation as a high-fidelity model and a feed-forward and backward propagation artificial neural network (BPANN) as a low fidelity model. Using the predicted data of patient arrival rates as input, the proposed simulation model has the potential to deal with over-fitting.

2 Concluding remarks

We congratulate the authors for their excellent research, and thank the reviewers for their numerous helpful comments and their timely refereeing. We hope the papers in this special issue will serve as a reference point in the advancement of the research in modeling and data analytics applied to supply chains, manufacturing and service systems.

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