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EDITORIAL

Smart operations planning in container terminals: integrating algorithms with our practical knowledge base

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Planning the various operations of a container terminal plays a key role in maintaining and enhancing its efficiency and productivity. In this light, the scope of research on container terminal operations has expanded from manually operated terminals to fully automated ones, from operations planning to real-time decision-making, and from simplified models to realistic albeit complicated modeling efforts. This special issue in your hands consists of papers which show us the gaps between optimization models and real-life container terminal practices, as well as the way in which such gaps can be bridged.

Seven papers are included in this volume; five have already appeared in *Online First*, while the remaining two were selected from among those presented at LOGMS 2019 (the 9th International Conference on Logistics and Maritime Systems 2019), held on 14 and 16 August 2019, in Singapore.

Among the seven papers, five address the *stowage planning problem*. One of the key contributions of this special issue is that it discusses not only theoretical but also practical aspects of stowage planning. From the practical and operational introduction to the problem of stowage planning, we move on to the mathematical formulations and algorithms to solve it. In this way, we hope to have offered powerful and flexible decision tools for stowage planners, of both ships *and* terminals, as well as a useful basis to researchers starting to study this issue. The other two papers address the planning activities for berth/quay cranes and remarshaling operations, which are related to sea-side and land-side operations in container terminals, respectively.

Chou and Fang (2018) introduce the practical procedure of stowage planning in detail. Explanations of various types of stability considerations are provided, together with practical examples that ought to be the key considerations in stowage planning. The paper provides a useful overview of stowage planning.

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Helo et al. (2021) emphasize the importance of the analysis of cargo profiles and cargo systems' compatibility. A set of utilization key performance indicators (KPIs) is proposed to measure how good a cargo system is compared with emerging cargo profiles. The authors show how the *actual* maximum capacity can be increased to close to the *nominal* capacity, through changes in the cargo system.

Ambrosino and Sciomachen (2021) introduce detailed practical constraints to consider during the construction of the stowage plan involving dangerous goods (in containers) and propose a new procedure for stowage planning. The paper also considers the case where alliance members share loading space on the same vessel (vessel sharing agreements).

The other two papers on stowage planning provide mathematical formulations and algorithms. Chao and Lin (2019) propose a mathematical formulation which may be represented as a multicommodity minimum cost network flow problem. Their model can be used for constructing class-based pre-stow plans to determine the preferred blocks corresponding to each container group.

Larsen and Pacino (2020) provide a realistic set of benchmark instances which we consider valuable for the research community in comparing various approaches to the stowage planning problem. A formal description and a mathematical formulation for the single-port stowage planning problem are proposed. An adaptation of the adaptive large neighborhood search heuristic framework is proposed to solve the problem.

Related to the planning of sea-side operations, Cho et al. (2021) address an integrated problem of berth allocation and quay crane assignment. This is attempted while allowing for the reassignment of vessels to other terminals and considering practical working rules of quay crane operators. A filtered beam search (FBS)-based heuristic algorithm is proposed.

Kim et al. (2021) address the planning of hinterland operations in container terminals. The authors propose a method to determine the right time to remarshal outbound containers, as well as the amount of space reservation required considering the handling effort for remarshaling and the efficiency of the loading operation.

Finally, we would like to emphasize that this special issue would not have been possible without the joint contributions and diligent efforts of the authors, paper reviewers, and *MEL* editors who organized the review process. We greatly appreciate all their efforts.

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