Simulation and Optimization of Container Stacking on the Floating Port

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Abstract
When the cargo is dangerous or cannot be handled properly on the land, it will be more convenient to coordinate with the vessels on the floating port. As the floating port is not so stable as the terminal itself, the operations may face a higher risk of failures, resulting in more good damages. While utilizing the flexibility of the floating port, it is also important to reduce the unnecessary operations with the containers, like reshuffling in the container stacking. With the help of simulation and optimization, we can avoid unnecessary reshuffling, improve the efficiency and robustness of container stacking. This may help floating port become more practical in the future terminal.

Keywords: Floating port, container stacking, simulation and optimization
Branch and Price Algorithm for the Integrated Berth Allocation and Yard Assignment Problem in Bulk Cargo Port

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Abstract

Aiming at improving the operational efficiency of the bulk material ports for large iron and steel companies, this paper studied the integrated berth allocation and yard assignment problem to determine the unloading sequence of the bulk material vessels and the storage locations of the bulk materials such as iron ores and coals. The practical considerations such as multiple materials transported by one vessel and the conflicts between operation equipment are explicitly considered. A mixed-integer programming model is proposed with the objective of minimizing the associated logistics costs such as the tardiness penalty costs of vessels and then reformulated as a set partition problem by Danzig-Wolfe decomposition. Accordingly, an exact solution algorithm based on Branch & Price framework is developed to solve the problem. In addition, an improved branching strategy based on the alternative branching on decision variables is employed. Numerical experiments are conducted to validate the performance of the Branch & Price approach.

Keywords: bulk material, berth allocation, yard assignment, Branch & Price
Facility Planning and Operation Strategy for Battery-Powered AGV in Automated Container Terminals

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Abstract

Electric vehicles have attracted much attention and are developing quickly around the world. However, the adoption of battery-powered automatic guided vehicle (B-AGV) is still quite low in container terminals. With the rapid development and application of the electric vehicles, the latest battery technology has guaranteed the carrying capability and durability of B-AGV in heavily-loaded situation. This stimulates many mega container terminals to plan for the deployment of the B-AGV system in the near future, in which the construction of charging stations is crucial to the system’s operation. The decisions of deploying charging stations include the number and location of charging stations, operation strategies of B-AGVs, etc. A good configuration can greatly enhance the productivity of B-AGVs. A simulation approach is presented to configure the facility planning and operation strategy of B-AGVs in the terminal.

Keywords: Automated container terminals; Battery-powered AGVs; Capacity planning; Simulation optimization;
Reliable Cost-Efficient Flows in Stochastic Time-Varying Networks

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Abstract

In the case of freight transport, network flows are an important and well-studied modelling tool. Real-world freight transport networks, however, are inherently stochastic (e.g., regarding travel times) and the available connections in the network usually vary over time. As the reliability of deliveries is becoming a main concern for transport operators, we are motivated to study the computation of reliable, cost-efficient flows in stochastic, time-varying networks. To the best of our knowledge, this problem has not been studied so far.

For the context of hinterland container transport, we define a model to address the problem of determining the value of adaptively routing flow in a capacitated network with stochastic, time-varying arrival times. The goal is to minimize the total costs incurred for reserving capacity on services prior to the execution of the adaptive plan while reaching a given minimum level of reliability.

Our model features a combination of a minimum cost flow formulation, which minimizes booked capacity costs, and of a Markov Decision Process, which maximizes the reliability of the flow via adaptive routing. First, we show how to rewrite the problem into a single MIP; second, we devise a heuristic solution approach which performs a neighborhood search in the space of booked capacities by solving the MDP at each iteration. Our preliminary results show that the marginal amount of additional booked capacity depends both on the level of reliability and the amount of flow. Our next step is to study the structure of this problem.

Keywords: hinterland container transport, reliability, adaptive routing, stochastic time-varying network