Global planning in a multi-terminal and multi-modal maritime container port

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Abstract

In the world-wide transport network, container ports act as intermodal interfaces, where containers are transferred between mother vessels, feeder vessels, river barges, trains and trucks. Nearby container ports are competing for traffic. Different factors have been identified as contributing positively to the attractiveness of a port, among which the operational efficiency of its terminals, and its connections to hinterland. New critical questions arise from the increase of vessel sizes, the contention of service roads, the urge for massified, cleaner transport modes. Container terminal operations have received considerable attention in the literature in recent years. Most of the studies focus on one isolated problem that occurs in one terminal, e.g. berth planning, quay crane scheduling, storage space allocation, etc. Only a few studies consider globally the flow of containers through several terminals in a port. However, a better partitioning of the workload between terminals, and the use of specialized terminals or platforms to help massifying the flows, may significantly improve the enlarged port competitiveness. This presentation proposes a multi-periodic tactical model to handle vessels, barges, trains, trucks and their containers over several cooperating terminals. The primary objective is to minimize weighted turnaround time. The problem is formulated as a mixed-integer linear program. Apart from direct solving by a MIP solver, we propose a new heuristic to solve MILPs made of several subproblems weakly linked together by constraints, called restrict-and-fix. Numerical experiments are conducted on realistic generated instances with up to three terminals. Results show the effectiveness of the approach.

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