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Loading and Unloading Scheduling Problem in a Multiple-Multiple Logistics Network: Modelling and Solving

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Abstract : Most of the supply chain networks have many nodes starting from the suppliers' side up to the customers' side that each node sends/receives the raw materials/products from/to the other nodes. One of the major concerns in this kind of supply chain network is finding the best schedule for loading /unloading the shipments through the whole network by which all the constraints in the source and destination nodes are met and all the shipments are delivered on time. One of the main constraints in this problem is loading/unloading capacity in each source/ destination node at each time slot (e.g., per week/day/hour). Because of the different characteristics of different products/groups of products, the capacity of each node might differ based on each group of products. In most supply chain networks (especially in the Fast-moving consumer goods industry), there are different planners/planning teams working separately in different nodes to determine the loading/unloading timeslots in source/destination nodes to send/receive the shipments. In this paper, a mathematical problem has been proposed to find the best timeslots for loading/unloading the shipments minimizing the overall delays subject to respecting the capacity of loading/unloading of each node, the required delivery date of each shipment (considering the lead-times), and working-days of each node. This model was implemented on python and solved using Python-MIP on a sample data set. Finally, the idea of a heuristic algorithm has been proposed as a way of improving the solution method that helps to implement the model on larger data sets in real business cases, including more nodes and shipments.

Keywords : supply chain management, transportation, multiple-multiple network, timeslots management, mathematical modeling, mixed integer programming
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