Modeling and solving a multimodal transportation problem with flexible-time and scheduled services

This article studies a transportation problem in a multimodal network with shipment consolidation options. A freight forwarder can use a mix of flexible-time and scheduled transportation services. Time windows are a prominent aspect of the problem. For instance, they are used to model pickup and delivery time slots. The various features of the problem can be described as elements of a digraph and their integration leads to a holistic graph representation. This allows an origin-destination integer multi-commodity flow formulation with nonconvex piecewise linear costs, time windows, and side constraints. Column generation algorithms are designed to compute lower bounds. These column generation algorithms are also embedded within heuristics aimed at finding feasible integer solutions. Computational results with real-life data are presented and show the efficacy of the proposed approach.

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