

DISSERTATION DEFENSE

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Transportation Scheduling Methods

This thesis consists of two algorithms for solving two combinatorial transportation problems and a model for optimizing a robust transportation schedule.

The first algorithm solves a problem of operating multiple cranes used in a factory to transport equipment and materials. The cranes are physically constrained from crossing paths in the longitudinal direction because they are mounted on the same overhead track. Since there is too much work for a single crane to complete in the time available, multiple cranes must be employed to perform the work while carefully coordinating their movements. The objective is to complete the set of required tasks on the cranes as quickly as possible. This research was motivated by a real-world case in which crane interference was causing production delays at a copper-smelting plant in Germany.

The second algorithm is a logic-based Benders decomposition method for a common routing and delivery problem. Our problem model contains a set of feasible routes and a set of required deliveries. Each route has a cost and capacity, and each delivery has a size and a subset of the routes on which it can be shipped. The objective is to find the minimum-cost set of routes which can ship all of the deliveries. We study the case in which some of the deliveries may be split into multiple shipments, whereas others must be shipped entirely by a single route. This research was motivated by a case at the United States Post Office in which departure times needed to be carefully selected for a set of routes carrying high-priority time-sensitive packages.

Lastly is a model for optimizing transportation costs at an assembly plant with many suppliers and a high uncertainty of demand. The B/S/H/ appliance factory in New Bern, NC employs thousands of trucks from third-party carriers every year to move parts and materials from vendors across North America. In order to maintain flexibility in its purchasing decisions from each vendor, each purchase is shipped individually from the vendor to the factory. We will explore a model for designing a robust shipping schedule that takes advantage of correlations and economies of scale by pooling freight from multiple vendors into single shipments while still maintaining an acceptable amount of demand flexibility.