Continuous Time Inventory Routing

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Abstract

We consider the following inventory routing problem. A company supplies a single product to its n retail locations from a single production facility with infinite production capacity over a finite planning horizon T. Each retail location i has a storage capacity Ci and consumes product at a rate of ui per hour. The company deploys a fleet of m vehicles, each with capacity Q, to serve its retail locations, i.e., to deliver product at the retail locations. It is assumed that the delivery of product at a retail location is instantaneous. The vehicles are available at the depot at time zero, can make multiple trips, but have to be back at the depot at time T. The travel time tij as well as the cost of travel cij between two locations i and j (either the depot or a retail location) are known and given. The goal is to minimize the cost of supplying the retail locations, i.e., ensuring that the retail locations do not run out of product at any time during the planning horizon. As product is consumed at retail locations at a constant rate and deliveries can be made at any time during the planning horizon, we refer to this variant of the inventory routing problem as the *continuous time inventory routing problem* (CIRP). We explore mixed integer programming formulations for the exact and heuristic solution of instances of the CIRP.

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