
A Large Neighborhood Search for the Active-Passive Vehicle Routing Problem

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Abstract

The active-passive vehicle routing problem (APVRP) is a variant of the vehicle routing problem in which pickup-and-delivery requests require a joint operation of two types of transport resources, namely, passive and active means of transport. The passive means are used for holding the cargo, representing a single unit that is to be shipped from pickup to delivery locations. The active means haul the passive means and carry them from one location to another. The contribution of our work is twofold. First, we investigate the classical APVRP and provide a fast metaheuristic able to address very large benchmark instances. We design our method such that we realize more opportunities for optimization by allowing the transshipment of passive means among active means during the fulfillment of single pickup-and-delivery requests. Second, we introduce an extended version of the APVRP, where passive means of transport can hold multiple units up to a maximum capacity. This extension is motivated by a real-world problem setting in integrated steel production, concerning the task of intra-facility steel slab routing. We report computational results for the classical APVRP and show that our metaheuristic provides competitive performance on benchmark data sets. As for the extended APVRP, we create new instance sets conforming to the specific problem characteristics. Our contributions are completed by a thorough analysis of the possibilities and limitations of transshipments within the scope of the classical and extended APVRP.

Keywords: Large neighborhood search, Route synchronization, Combined routing, Pickup and Delivery

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