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Design-balanced Capacitated Multicommodity Network Design with Heterogeneous Assets

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Management of assets plays an essential role in determination of service plans operated by carriers in the transportation and logistics system. In this paper, we introduce certain issues related to management of heterogeneous assets in the well-known design-balanced capacitated multicommodity network design, where design-balanced requirements are explicitly defined based on heterogeneous assets.

Taking vehicles as an example of heterogeneous assets, we first present an arc-based formulation for the proposed problem and discuss two associated subproblems. We then propose a tabu search based metaheuristic for this problem. Over a wide range of network design instances, we respectively compare our approach with CPLEX with one-hour and ten-hour time limits. Computational results demonstrate that the proposed approach performs very well in terms of solution quality and computing time, especially for large instances.

Key words: service network design; design-balanced constraints; heterogeneous assets; tabu search; heuristic

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1. Introduction

Freight transportation is one of the most important and complex industries in a modern economy. Freight volumes to be transported are increasing, as are expectations of customers in terms of quality of service and cost of providing service (vehicle cost, energy prices, fixed cost, etc.). Thus, reducing transportation costs and satisfying transportation demands are vital tasks for carriers in transportation and logistics systems.

Service network design (SND) formulations are used to model a wide variety of decision problems in the transportation and logistics system. Typically, the SND models address decisions related to planning, selection and eventually, scheduling of services in consolidation-based transportation systems (Pedersen et al. 2009). In SND formulations,

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