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MAXIMIZING NETWORK RELIABILITY FOR STOCHASTIC TRANSPORTATION NETWORKS UNDER A BUDGET CONSTRAINT BY USING A GENETIC ALGORITHM

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Abstract. *A transportation network with an origin (supplier) and a destination (customer) is composed of routes and vertices. On each route, there are several carriers to deliver the freight, and each carrier possesses a delivery cost and multiple available capacities with a probability distribution because the capacity may be reserved for various orders. Carrier selection means selecting exactly one carrier to deliver the freight via each route and has significant influence on both customer service and cost. Hence, the transportation network associated with any carrier selection is a stochastic transportation network. Network reliability, the probability that d units of a given commodity are shipped successfully through the transportation network, is a performance index of freight delivery. This paper focuses on finding the optimal carrier selection based on network reliability criterion under a budget constraint. An optimization algorithm integrating a genetic algorithm, minimal paths, and the Recursive Sum of Disjoint Products is proposed to solve such a problem. A practical case of LCD television delivery from China to Germany is presented to illustrate the solution procedure.*
Keywords: Carrier selection, Maximal network reliability, Stochastic transportation network, Recursive sum of disjoint products, Genetic algorithm, Budget

1. **Introduction.** In the modern global marketplace, the outsourcing of freight delivery to external carriers has become a common way to maintain core competitiveness for many global enterprises. As one of the most important logistics activities, freight delivery has significant influence on both customer service and cost. How to select carriers to deliver the freight is therefore a critical issue for global enterprises. Several studies [1-3] have discussed different criteria for carrier selection such as cost, physical facilities and equipment, financial stability, quality of service. Furthermore, Bolduc et al. [4] focused on selecting customers to be served by external carriers and routing a heterogeneous internal fleet to minimize external carrier costs, along with fixed and variable costs of such an internal fleet. Liao and Rittscher [5] developed a multi-objective programming model which considers three decisions: dynamic procurement lot sizing, supplier selection and carrier selection for multiple objectives consisting of the total cost of logistics, the total quality of rejected items, and the total of late deliveries. For the problem of combining carrier selection with freight assignment, Mohammaditbar and Teimoury [3] proposed an integrated three-phased methodology to maximize the total value of freight assignment and minimize transportation and inventory costs. Although carrier selection problems have been widely explored in these literatures, they were primarily concerned with deterministic carrier capacity criterion while the network reliability criterion was never discussed.