عنوان مقاله:

A Multi-Level Capacity Approach to the Hub and Spoke Network

محل انتشار:

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خلاصه مقاله:

The existing studies considering the flow-based discount factor in hub and spoke problems assume that increasing the amount of flow passing through each edge of a network continuously decreases the unit flow transportation cost. Although a higher volume of flow allows for using wider links and consequently cheaper transportation, but the unit of flow enjoys more discounts, quite like replacing the current link by a cheaper link type (i.e., increasing the volume of flow without changing the link type would not affects the unit flow transportation cost). Here, we take a new approach, introducing multi-level capacities to design hub and spoke networks, while alternative links with known capacities, installation costs and discount factors are available to be installed on each network edge. The flow transportation cost and link installation cost are calculated according to the type of links installed on the network edges; thus, not only the correct optimum hub location and spoke allocation is determined, but also the appropriate link type to be installed on the network edges are specified. The capacitated multiple allocation p-hub median problem (CMApHMP) using the multi-level capacity approach is then formulated as a mixed-integer linear program (MILP). We also present a new MILP for the hub location problem using a similar approach in order to restrict the amount of flow transmitting through the hubs. Defining diseconomies of scale for each hub type, the model is to present congestion at the hubs and balance the transmitting flow between the hubs. Two new formulations are presented for both the p-hub median and the hub location problems which requiring a flow between two non-hub nodes to be transferred directly, when a direct link between the nodes is available. These models are useful for the general cost structure where the costs are not required to satisfy the triangular inequality. Direct links between non-hub nodes are allowed in all the presented .formulations

کلمات کلیدی:

Hub location; p-hub median; Flow-based discount; Multi-level capacity; Congestion