

Electric-Vehicle Traveling Salesman Problem with Battery Swapping

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Abstract

When transporting logistics using electric trucks (eTruck), one of concerns is the limitation of the travel distance due to the limit of battery capacity. This travel distance constraint of an eTruck can be relieved through battery charging, exchange or recovery techniques. Among them, the battery recuperation is a technique of converting the position energy of the eTruck into the electric energy of the battery using the difference of the altitude of the electric truck and the regenerative braking system (RBS). In this study, we study routing problem of eTruck in the presence of a battery swapping station. The difference from previous eTruck routing studies in literature is that battery recuperation technology is taken into account when eTrucks are operated. This problem can be solved by replacing it with asymmetric TSP (ATSP) and we propose such the network as energy TSP graph. The problem of interest can be modeled by using an stochastic dynamic programming (DP). However, since the computational complexity increases rapidly as the number of nodes increases, it is difficult to derive a meaningful solution within polynomial time. Thus, we propose a methodology to derive the good suboptimal solution through heuristic algorithm.

Keywords

Travelling Salesman Problem, Electric vehicles, Battery recuperation, memetic algorithm

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