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Vehicle Routing Problem with Mixed Fleet of Conventional and Heterogenous Electric Vehicles and Time Dependent Charging Costs

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Abstract : In this paper, we consider a new real-life Heterogenous Electric Vehicle Routing Problem with Time Dependant Charging Costs and a Mixed Fleet (HEVRP-TDMF), in which a set of geographically scattered customers have to be served by a mixed fleet of vehicles composed of a heterogenous fleet of Electric Vehicles (EVs), having different battery capacities and operating costs, and Conventional Vehicles (CVs). We include the possibility of charging EVs in the available charging stations during the routes in order to serve all customers. Each charging station offers charging service with a known technology of chargers and time-dependent charging costs. Charging stations are also subject to operating time windows constraints. EVs are not necessarily compatible with all available charging technologies and a partial charging is allowed. Intermittent charging at the depot is also allowed provided that constraints related to the electricity grid are satisfied. The objective is to minimize the number of employed vehicles and then minimize the total travel and charging costs. In this study, we present a Mixed Integer Programming Model and develop a Charging Routing Heuristic and a Local Search Heuristic based on the Inject-Eject routine with three different insertion strategies. All heuristics are tested on real data instances.

Keywords : charging problem, electric vehicle, heuristics, local search, optimization, routing problem
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