

An MIPSSTWM-based Emergency Vehicle Routing Approach for Quick Response to Highway Incidents

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Abstract : The risk of highway incidents is commonly recognized as a major concern for transportation authorities due to the hazardous consequences and negative influence. It is crucial to respond to these unpredictable events as soon as possible faced by emergency management decision makers. In this paper, we focus on path planning for emergency vehicles, one of the most significant processes to avoid congestion and reduce rescue time. A Mixed-Integer Linear Programming with Semi-Soft Time Windows Model (MIPSSTWM) is conducted to plan an optimal routing respectively considering the time consumption of arcs and nodes of the urban road network and the highway network, especially in developing countries with an enormous population. Here, the arcs indicate the road segments and the nodes include the intersections of the urban road network and the on-ramp and off-ramp of the highway networks. An attempt in this research has been made to develop a comprehensive and executive strategy for emergency vehicle routing in heavy traffic conditions. The proposed Cuckoo Search (CS) algorithm is designed by imitating obligate brood parasitic behaviors of cuckoos and Lévy Flights (LF) to solve this hard and combinatorial problem. Using a Chinese city as our case study, the numerical results demonstrate the approach we applied in this paper outperforms the previous method without considering the nodes of the road network for a real-world situation. Meanwhile, the accuracy and validity of the CS algorithm also show better performances than the traditional algorithm.

Keywords : emergency vehicle, path planning, cs algorithm, urban traffic management and urban planning

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