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A Hybrid Based Algorithm to Solve the Multi-objective Minimum Spanning Tree Problem

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Abstract : Since it has been shown that the multi-objective minimum spanning tree problem (MOST) is NP-hard even with two criteria, we propose in this study a hybrid NSGA-II algorithm with an exact mutation operator, which is only used with low probability, to find an approximation to the Pareto front of the problem. In a connected graph G, a spanning tree T of G being a connected and cycle-free graph, if k edges of G\T are added to T, we obtain a partial graph H of G inducing a reduced size multi-objective spanning tree problem compared to the initial one. With a weak probability for the mutation operator, an exact method for solving the reduced MOST problem considering the graph H is then used to give birth to several mutated solutions from a spanning tree T. Then, the selection operator of NSGA-II is activated to obtain the Pareto front approximation. Finally, an adaptation of the VNS metaheuristic is called for further improvements on this front. It allows finding good individuals to counterbalance the diversification and the intensification during the optimization search process. Experimental comparison studies with an exact method show promising results and indicate that the proposed algorithm is efficient.

Keywords : minimum spanning tree, multiple objective linear optimization, combinatorial optimization, non-sorting genetic algorithm, variable neighborhood search
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