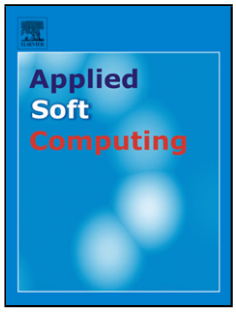

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A Discrete Water Cycle Algorithm for Solving the Symmetric and Asymmetric Traveling Salesman Problem

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Abstract

The Water Cycle Algorithm (WCA) is a nature-inspired meta-heuristic recently contributed to the community in 2012, which finds its motivation in the natural surface runoff phase in water cycle process and on how streams and rivers flow into the sea. This method has been so far successfully applied to many engineering applications, spread over a wide variety of application fields. In this paper an enhanced discrete version of the WCA (coined as DWCA) is proposed for solving the Symmetric and Asymmetric Traveling Salesman Problem. Aimed at proving that the developed approach is a promising approximation method for solving this family of optimization problems, the designed solver has been tested over 33 problem datasets, comparing the obtained outcomes with the ones got by six different algorithmic counterparts from the related literature: Genetic Algorithm, Island-based Genetic Algorithm, Evolutionary Simulated Annealing, Bat Algorithm, Firefly Algorithm and Imperialist Competitive Algorithm. Furthermore, the statistical significance of the performance gaps found in this benchmark is validated based on the results from non-parametric tests, not only in terms of optimality but also in regards to convergence speed. We conclude that the proposed DWCA approach outperforms – with statistical significance – any other optimization technique in the benchmark in terms of both computation metrics.

Keywords: Routing problems, Water Cycle Algorithm, Traveling Salesman Problem, combinatorial optimization

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