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Applications of River Formation Dynamics☆

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Abstract

River Formation Dynamics is a metaheuristic where solutions are constructed by iteratively modifying the values associated to the nodes of a graph. Its gradient orientation provides interesting features such as the fast reinforcement of new shortcuts, the natural avoidance of cycles, and the focused elimination of blind alleys. Since the method was firstly proposed in 2007, several research groups have applied it to a wide variety of application domains, such as telecommunications, software testing, industrial manufacturing processes, or navigation. In this paper we review the main works of the last decade where the River Formation Dynamics metaheuristic has been applied to solve optimization problems.

Keywords: Heuristic methods, Swarm Intelligence, River Formation Dynamics, Applications

1. Introduction

Optimization is a major necessity in Science and Engineering. No matter if we want to reduce the amount of needed resources to perform a task or maximize the output of some process, so often the difficulty of making the right decisions can be rephrased as some kind of optimization problem. Unfortunately, for many optimization problems finding the optimal solution is not feasible in general due to the NP-hardness of the problem. Moreover, this unfeasibility often applies to the task of finding good suboptimal solutions too. Given an approximation algorithm, let its performance ratio be the ratio between the value of optimal solutions and the value of solutions found by the algorithm in the worst case. Some NP-hard optimization problems can be approximated up to any performance ratio ε arbitrarily close to 1 in polynomial time, although the degree of that polynomial grows unboundedly as the required ratio tends to 1 (e.g. 0-1 Knapsack admits a fully polynomial-time approximation scheme, FPTAS [1]), others can be approximated in polynomial time only up to some fix suboptimal performance ratio if P≠NP (e.g. MAX-3CNF cannot be approximated with a ratio higher than

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