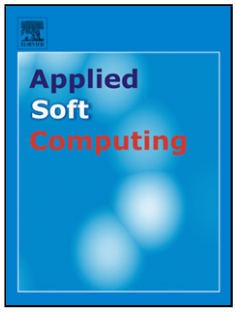

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Hybrid Differential Evolution and Greedy Algorithm (DEGR) for Solving Multi–Skill Resource–Constrained Project Scheduling Problem

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Abstract

Paper presents a hybrid Differential Evolution and Greedy Algorithm (DEGR) applied to solve Multi–Skill Resource–Constrained Project Scheduling Problem. The specialized indirect representation and transformation of solution space from discrete (typical for this problem), to continuous (typical for DE–approaches) are proposed and examined. Furthermore, Taguchi Design of Experiments method has been used to adjust parameters for investigated method to reduce the procedure of experiments. Finally, various initialisation, clone elimination, mutation and crossover operators have been applied there. The results have been compared with the results from other reference methods (HantCO, GRASP and multiStart Greedy) using the benchmark iMOPSE dataset. This comparison shows that DEGR effort is very robust and effective. For 28 instances of iMOPSE dataset DEGR has achieved the best–known solutions.

1. Introduction

Multi–Skill Resource–Constrained Project Scheduling Problem (MS–RCPSP) is one of the widest developed problems in the literature [10, 24]. It comes from its practical nature and the need that arise in real life problems of today's industry i.e. in manufacturing, chemistry, logistics and many other disciplines. Hence, researchers from all around the world struggle to improve existing approaches to solve this kind of problems.

The scheduling problem can be informally defined as a function that assigns jobs to resources to complete the project. However, in real–world applications such simplification is not useful. In the Project Scheduling Problem (PSP) a set of precedence–constrained jobs have to be scheduled so as to minimize a given objective. Furthermore, in extended problem definition, the Resource Constrained Project Scheduling Problem (RCPSP), tasks additionally compete for scarce resources. Such modifications make it possible through a better adaption to apply in manufacturing, production planning, project management, etc. Ultimately MS–RCPSP can be applied to solve many real–world problems. Although PSP is widely described in literature, there is no method that finds an optimal solution and could be applied under every condition. Moreover, as the above problems are NP-hard, there is no optimal solution that could be computed in polynomial time [6]. Hence, researchers try to build methods that find feasible solutions, which are (sub)optimal but can be reached in acceptable time. In such cases soft computing methods are used, mostly heuristics and metaheuristics [15, 24].

Within the metaheuristic group of methods, Genetic Algorithm [18, 30], Tabu Search [47, 48], GRASP [32, 9, 13] Swarm Intelligence Optimization, like Ant Colony Optimisation [29, 27, 31], Bee Colony Optimisation [58] or Particle Swarm Optimisation [57] and Simulated Annealing–based [7, 10] approaches are developed. Those methods can provide good enough solution in acceptable time. Their main drawback, however, is

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