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INCORPORATING JUSTIFICATION IN THE PARTICLE SWARM OPTIMIZATION FOR THE RCPSP

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Abstract. *It has been shown that justification is an efficient technique that can be easily incorporated in heuristic algorithms (such as Hartmann's genetic algorithm and simulated annealing) for the resource-constrained project scheduling problem (RCPSP),and can improve the quality of the schedules generated by these algorithms. In this paper, double justification has been incorporated in the Particle Swarm Optimization(PSO) for the RCPSP. The computational results show that the PSO with double justification (DJPSO) is very efficient.*

Keywords: Project scheduling, Resource-constraints, Particle swarm optimization, Justification

1. **Introduction.** The resource-constrained project scheduling problem (RCPSP) involves the non-preemptive scheduling of project activities subject to finish-start precedence constraints and renewable resource constraints in order to minimize the project duration. As a job shop generalization, the RCPSP is NP-hard in the strong sense [1]. Only small-sized problem instances with up to 60 activities can be solved exactly in a satisfactory manner. Therefore, many heuristic solution procedures are applied to handle the RCPSP in which the practical projects under study are larger or more complicated.

Many heuristic approaches (single pass methods, multi-pass methods, sampling procedures) and metaheuristics (Simulated Annealing (SA), Genetic Algorithm (GA), Tabu Search (TS), Particle Swarm Optimization (PSO)) have been proposed for RCPSP. Zhang at el. [2] first proposed the frameworks of the PSO algorithms for the RCPSP according to the two particle representations: the priority-based and permutation-based.

Valls at el. [3] showed that justification, especially double justification, is a simple and quick technique for the RCPSP that can be incorporated in heuristic algorithms (such as Hartmann's GA and SA) and can generate significant improvements in the quality of the schedules. They performed a set of experimental computations to compare the quality of