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Cellular particle swarm optimization with a simple adaptive local search strategy for the permutation flow shop scheduling problem

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Permutation flow shop scheduling problem deals with the production planning of a number of jobs processed by a set of machines in the same order. Several metaheuristics have been proposed for minimizing the makespan of this problem. Taking as basis the previous Alternate Two-Phase PSO (ATPPSO) method and the neighborhood concepts of the Cellular PSO algorithm proposed for continuous problems, this paper proposes the improvement of ATPPSO with a simple adaptive local search strategy (called CAPSO-SALS) to enhance its performance. CAPSO-SALS keeps the simplicity of ATPPSO and boosts the local search based on a neighborhood for every solution. Neighbors are produced by interchanges or insertions of jobs which are selected by a linear roulette scheme depending of the makespan of the best personal positions. The performance of CAPSO-SALS is evaluated using the 12 different sets of Taillard's benchmark problems and then is contrasted with the original and another previous enhancement of the ATPPSO algorithm. Finally, CAPSO-SALS is compared as well with other ten classic and state-of-art metaheuristics, obtaining satisfactory results.

Key words: flow shop, particle swarm optimization, local search strategy, hybrid search method, cellular automata, scheduling

1. Introduction

Flow Shop Scheduling Problem (FSSP) has represented a relevant research area for over sixty years due to its simplicity and combinatorial nature [14], which makes the problem a common place to prove new algorithms for discrete optimization. The FSSP can be easily understood and implemented in a computer program to be analyzed. However, since its discrete nature, there is a combinatorial explosion of possible solutions for a linear increment in the number of jobs

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