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A Particle Swarm Optimization and Differential Evolution Algorithms for Job Shop Scheduling Problem

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Abstract—In this paper, we present particle swarm optimization (PSO) and differential evolution (DE) algorithms for the job shop scheduling problem with the makespan criterion. The applications of PSO and DE on combinatorial optimization problems are still considered limited, but the advantages of PSO and DE algorithms such as structural simplicity, accessibility to practical applications, ease of implementation, speed to get the solutions, and robustness are already shown in the literature. However, the major obstacle of successfully applying PSO and DE algorithms to combinatorial optimization problems is due to their continuous nature. To remedy this drawback, the smallest position value (SPV) rule presented in Tasgetiren et al.(2004a, b, c, d) is employed in both algorithms to convert continuous position values to discrete job permutations. In order to improve the solution quality, both algorithms are also hybridized with an efficient local search method based on a variable neighborhood search (VNS) technique. The experimental results based on the well known benchmark instances collected from OR library show that the hybrid PSO algorithm has generated slightly better results than its counterpart, namely, the DE algorithm. It is also shown that the hybrid PSO algorithm is either better or competitive to the state-of-the-art methods in the literature. In addition, to the best of our knowledge, both algorithms are the first reported applications of PSO and DE algorithms for the job shop scheduling problem in the literature.

Keywords—Particle swarm optimization, Differential evolution, Job shop scheduling, Makespan, Variable neighborhood search

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