

Uniform Parallel-Machine Scheduling Problems with Constrained Resources

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ABSTRACT

The previous studies on uniform parallel-machine scheduling problems usually assume that the necessary resources for processes are unconstrained. However, it does not conform to condition that the resources in scheduling problems are usually limited in practice. It is well known that most of the uniform parallel-machine scheduling problems are NP-hard. It costs much time and a large number of resources to solve this kind of problems. Therefore, this research attempts to solve uniform parallel-machine scheduling problems with constrained resources. The objective considered in this research is minimizing the total completion time.

In this research, we propose the branch and bound technique on uniform parallel-machine scheduling problems with constrained resources. The branch and bound technique is proposed with an effective lower bound. The solutions obtained by applying simulated annealing algorithm, is used as the upper bound in the branch and bound technique to acquire the optimal solutions efficiently. In order to meet the requirement of solving problems efficiently in practice, we also propose two heuristics, simulated annealing algorithm with proposed hybrid neighborhood search and genetic algorithm with the improved crossover and mutation rules. Finally, a variety of numerical examples are designed with different sizes and resource strength to evaluate the performance of the proposed algorithms. By the result of our experiments, we can

find that the branch and bound technique provides better solution quality and efficiency on examples of small-sized and medium-sized scale.

Key words : scheduling, uniform parallel-machine, constrained resources, branch and bound technique, simulated annealing, genetic algorithm.