A Branch and Bound for Unrelated Parallel-Machine Scheduling Problems with Constrained Resources

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Abstract

When considering machine scheduling problems, it is usually assumed that only available machines are required for the processing of jobs. However, in many practical cases, additional resources such as operators, part holders, or tools, are needed when processing jobs and the amount of these resources are limited. Therefore, one needs to put resource constraints into consideration in order to form feasible job schedules. Parallel machine scheduling problems become more complicated when resource constraints are involved. The goal of this study is to develop effective algorithms that can find optimal solution to the problems with reasonable computation time.

This study applies branch and bound approach on unrelated parallel machine scheduling problem with constrained resources. Sequence-dependent setup time is also considered and the objective is to minimize weighted completion time. Two algorithms are developed. In the first algorithm, the search tree is formed according to the assignment of jobs on machines. The second algorithm, on the other hand, is resource oriented. That is, the branches are formed as resources are assigned to machines. The solutions obtained by applying genetic algorithm are used as the upper bounds in the branch and bound algorithms. A variety of numerical examples are designed with different sizes and resource strength. Numerical experiments are conducted to evaluate the performance of the proposed algorithms.

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