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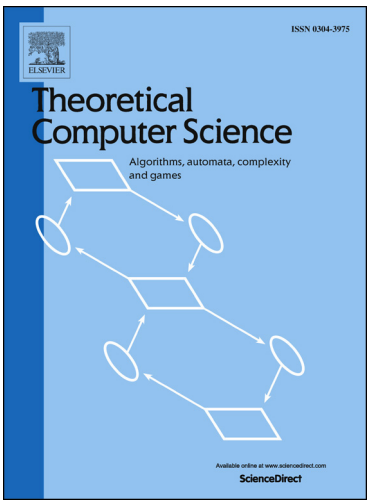

Identical parallel machine scheduling with time-dependent processing times

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Identical parallel machine scheduling with time-dependent processing times

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Abstract

This paper introduces an exact algorithm which minimizes the total completion time for A two parallel machine problem with time dependent deterioration effect ($2|r_j = t_0, p_j = b_j \times t_j|C_{max}$). By deterioration effect, we mean that the processing time of a job is defined by an increasing function of its starting time. The proposed algorithm combines a lexicographic search and a list scheduling rule based on a largest deteriorating rate first strategy to provide the optimal solution.

This algorithm is extended to solve the general version of this problem ($P|r_j = t_0, p_j = b_j \times t_j|C_{max}$). This extension is obtained by transforming the original m-machine problem into a series of two-machine sub-problems, and solving them repeatedly using the optimal algorithm cited above.

A numerical experiment study is performed to evaluate the effectiveness of the proposed algorithm by comparison with three heuristic methods inspired by the literature. The obtained results show that for the two-machine case, the proposed optimal algorithm performs very well even for large instances. For the general parallel machine case, the extended algorithm is shown to perform significantly better than other heuristic methods.

Keywords: Parallel machine scheduling, makespan, simple deteriorating jobs, Two-Machine-Optimal algorithm, lexicographic search, heuristic methods.

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