Constructive and Tabu Search Algorithms for Hybrid Flow Shop Problems with Unrelated Parallel Machines and Setup Times

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Abstract. This paper investigates scheduling heuristics to seek the minimum of a positively weighted convex sum of makespan and the number of tardy jobs in a hybrid flow shop environment where at least one production stage is made up of unrelated parallel machines. Sequence-and machine-dependent setup times are considered. The problem is a combinatorial optimization problem which is difficult to be solved optimally, and hence heuristics are used to obtain good solutions in a reasonable time. Some dispatching rules and flow shop makespan heuristics are developed. Then this solution may be improved by fast polynomial heuristic improvement algorithms based on shift moves and pairwise interchanges. In addition, a metaheuristic tabu search algorithm is proposed. Some tabu search parameters are briefly discussed. The performance of the heuristics is compared relative to each other on a set of test problems with up to 50 jobs and 20 stages.

Keywords: Hybrid flow shop scheduling, Unrelated parallel machines, Setup times, Constructive algorithms, Improvement heuristics, Tabu Search algorithm.

1 Introduction

This article is concerned with an industrial scheduling problem, which belongs to the class of NP-hard combinatorial optimization problems. Therefore, the search for efficient methods providing a