

A Memetic Algorithm Approach for Parallel Machine Tardiness Problem

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ABSTRACT

In this study, the parallel machine scheduling tardiness problem (PMTP) is approached with a memetic algorithm integrating features from population based methods and local search (also known as memetic algorithm) to minimize total tardiness. This problem aims to minimize maximum job completion on uniform parallel machines with non-zero ready times and sequence-dependant setup times. The term uniform machine means that the processing time of a job in a particular machine is the ratio of the processing time of a job on a machine with a standard speed of the particular machine.

Previous studies on the NP-hard parallel machines tardiness problem (PMTP) defined by Bilge[2] have proved the effectiveness of local search methods in combinatorial optimization. Therefore, following this fact an MA will be developed to balance the intensification and diversification to guarantee a better performance of the metaheuristic to find better solutions. A metaheuristic will be successful on a given optimization problem if it can provide a balance between the exploitation of the accumulated search experience and the exploration in the search space to identify regions with high quality solutions in a problem specific, near optimal way.

This work aims to determine the possibility to build a MA for combinatorial problems as a fusion of the concepts and characteristics from referenced optimization algorithms as GA and Local Search Methods. A previous study using an HMH to solve PMTP was used in [1] combining features from VNS, TS and SA but this research didn't confirm an improvement from a previous study done by Bilge to solve the GPMTP. Therefore, this research will propose a different approach from the one proposed by previous studies for the same problem[1,2,6,44]. The MA will be applied to this NP-Hard problem to minimize the total tardiness in parallel machine scheduling. Although, it's feasible to add that the following variables are taken on account to make a closer approach to real industrial applications: non-zero ready times, sequence dependant setup times, distinct due dates and uniform processing times, recently proposed by Bilge [2]. To evaluate the performance and effectiveness of the MA for the PMTP a very relevant benchmark has been considered to solve this problem [6].

Keyword: Scheduling Parallel Machines Total Tardiness Problem
Sequence-Dependent Setup Times Memetic Algorithms