Decision Tree Based Scheduling for Flexible Job Shops with Multiple Process Plans

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Abstract : This paper suggests a decision tree based approach for flexible job shop scheduling with multiple process plans, i. e. each job can be processed through alternative operations, each of which can be processed on alternative machines. The main decision variables are: (a) selecting operation/machine pair; and (b) sequencing the jobs assigned to each machine. As an extension of the priority scheduling approach that selects the best priority rule combination after many simulation runs, this study suggests a decision tree based approach in which a decision tree is used to select a priority rule combination adequate for a specific system state and hence the burdens required for developing simulation models and carrying out simulation runs can be eliminated. The decision tree based scheduling approach consists of construction and scheduling modules. In the construction module, a decision tree is constructed using a four-stage algorithm, and in the scheduling module, a priority rule combination is selected using the decision tree. To show the performance of the decision tree based approach suggested in this study, a case study was done on a flexible job shop with reconfigurable manufacturing cells and a conventional job shop, and the results are reported by comparing it with individual priority rule combinations for the objectives of minimizing total flow time and total tardiness.

Keywords : flexible job shop scheduling, decision tree, priority rules, case study