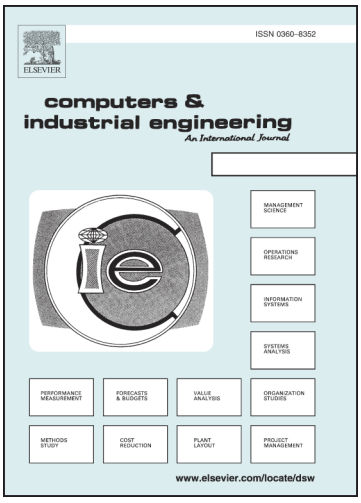

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Abstract

This paper addresses the job-shop scheduling problem in which the machines are not available during the whole planning horizon and with the objective of minimizing the makespan. The disjunctive graph model is used to represent job sequences and to adapt and extend known structural properties of the classical job-shop scheduling problem to the problem at hand. These results have been included in two metaheuristics (Simulated Annealing and Tabu Search) with specific neighborhood functions and diversification structures. Computational experiments on problem instances of the literature show that our Tabu Search approach outperforms Simulated Annealing and existing approaches.

Keywords: Scheduling, Job Shop, Metaheuristic, Availability Constraints, Disjunctive Graph

1. Introduction

In scheduling theory, the vast majority of studies assumes that resources are continuously available for processing throughout the scheduling horizon. However, in many realistic situations, machines may be unavailable during certain periods for different reasons, such as failures or unexpected quality control problems. To avoid these failures without stopping the production too often, preventive maintenance tasks are planned on machines by trading off between planned unproductive downtimes and the risk of unscheduled downtimes due to machine failures. These preventive maintenance activities make machines unavailable for processing operations. As this work deals with deterministic scheduling, only unavailability periods that are known in advance are considered such as preventive maintenance or machine unavailabilities that are due to previous scheduling decisions within a rolling horizon framework.

The continuous availability of machines during the whole scheduling horizon is an assumption that might be justified in some cases but cannot apply to all industrial settings. Semiconductor manufacturing is an example where it is important to consider machine availability constraints. In this industry, machines are complex, thus requiring frequent preventive maintenance, and very expensive, thus must be used as much as possible (Bureau et al. (2006)). Also, due to the complexity of scheduling problems in