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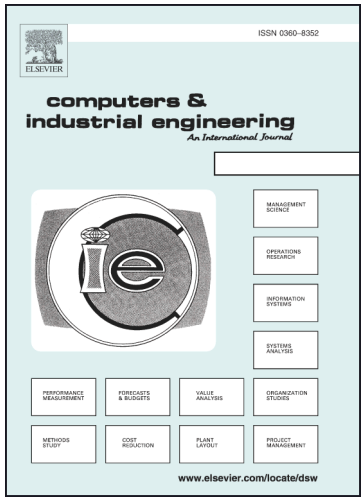

Minimizing Earliness and Tardiness Costs in Scheduling Jobs with Time Windows

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Abstract

Motivated by the practical scheduling problem of facilities in an interrelated supply chain network, this study addresses the scheduling problem of jobs on unrelated parallel machines with sequence-dependent setup times, as well as machine- and job-dependent processing rates. Each job includes a time window delimited by its ready and due dates. For a manufacturer, the ready date of a job refers to the delivery date for the job's raw materials promised by its upstream supplier, whereas the due date of the job is the date the manufacturer promised to deliver to its downstream customer. Ready and due dates are the parameters of the scheduling problem of the manufacturer and the processing times in which all orders are expected to lie within their time window. Finding a feasible schedule is sufficient for most manufacturers who disregard the objective functions commonly seen in existing literatures. If such a feasible schedule is not possible, suggestions for re-negotiation with the supplier and/or buyer are calculated using the proposed method which minimizes earliness and tardiness costs.

To the best of our knowledge, no prior research has thoroughly addressed this scheduling problem. Three methods based on the mixed integer programming (MIP), namely, the hard-constraint mixed integer programming (HCMIP), the earliness-tardiness mixed integer programming (ETMIP), and the three-phase heuristics-initialized mixed integer programming (HIMIP), are proposed and tested. The experiment results show that HIMIP is the most effective in solving the problem.

Key words: production scheduling; unrelated parallel machine; arbitrary time windows; machine eligibility; sequence-dependent setup time.