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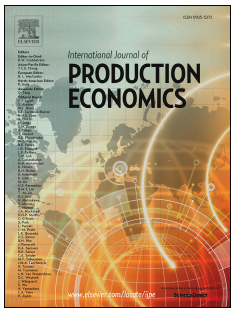

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A coupled process configuration, lot-sizing and scheduling model for production planning in the molded pulp industry

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Abstract

This paper proposes an application-oriented model for a coupled process configuration, lot-sizing and scheduling problem in the molded pulp industry. In this case, products are obtained by alternative process configurations, which can produce one or more types of product simultaneously. A process configuration consists of defining a feasible setup state for the main components of the production line, i.e., the molding machine, where molds to shape the products are attached, and a set of conveyors, where products are transported. Production quantities depend on the configurations selected and the time that each one is used over the planning horizon. The number of possible configurations is large and sensitive to the characteristics of the production environment, the size of the molding machine and the number of conveyors. Therefore, determining all possibilities beforehand is a challenging and extensive task. We propose a novel formulation to support production decisions in molded pulp companies, which generates the process configurations implicitly at the same time that lot-sizing and sequencing decisions are made. This optimization problem involves challenging operational and synchronization constraints, and sequencing decisions which include three types of setups. The objective is to minimize the total setup, inventory and backlogging costs. Several sets of instances based on real data and market information were tested. Computational experiments using a commercial Mixed Integer Programming (MIP) solver show the capability of this approach to represent the problem decisions and to provide production schedules for different production environments. Comparisons with real schedules and others formulations show the practical savings and the advantages of this formulation over enumerating modeling approaches. A simplified version of this new formulation is also proposed to solve more efficiently particular problem instances. In addition, a heuristic solution strategy is proposed to find feasible production plans fro all data sets in shorter computing times.

Keywords: lot-sizing and scheduling, process planning, production planning, molded pulp industry, mixed integer programming

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