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Generalized disjunctive programming model for the multi-period production planning optimization: an application in a polyurethane foam manufacturing plant

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Highlights

- Production planning and stock management are simultaneously optimized.
- GDP model is proposed to address the multi-period problem.
- The model is solved through a rolling horizon approach.
- Different tradeoffs among the integrated problem decisions are assessed.
- The presented approach is applied to a real plant operation in the PU foam industry.

Abstract

A Generalized Disjunctive Programming (GDP) model for the optimal multi-period production planning and stock management is proposed in this work. The formulation is applied to a polyurethane foam manufacturing plant that comprises three stages: a first step that produces pieces with certain characteristics, a second process that involves the location of these pieces in a limited area and a third stage where pieces are stored in dedicated spaces. This article shows the GDP capabilities to provide a qualitative framework for representing the problem issues and their connections in a natural way, especially in a context where decisions integration is required. Due to the multi-period nature of the planning problem, a rolling horizon approach is suitable for solving it in reasonable computing time. It serves as a tool for analyzing the trade-offs among the different costs. Through the examples, the capabilities of the formulation and the proposed resolution method are highlighted.

Keyword: Generalized Disjunctive Programming, production planning, stock, optimization, rolling horizon, mattress industry.

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