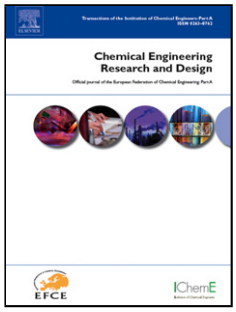

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Optimisation Approaches for Supply Chain Planning and Scheduling under Demand Uncertainty

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1 Highlights:

- MILP-based approaches for supply chain network under demand uncertainty
- Planning & scheduling of multiproduct multistage continuous plants are considered
- HMPC and Local Search algorithms are combined to solve a motivated problem
- Solutions are compared with Cutting Plane approach and MPC from literature

Abstract

This work presents efficient MILP-based approaches for the planning and scheduling of multiproduct multistage continuous plants with sequence-dependent changeovers in a supply chain network under demand uncertainty and price elasticity of demand. This problem considers multiproduct plants, where several products must be produced and delivered to supply the distribution centres (DCs), while DCs are in charge of storing and delivering these products to the final markets to be sold. A hybrid discrete/continuous model is proposed for this problem by using the ideas of the Travelling Salesman Problem (TSP) and global precedence representation. In order to deal with the uncertainty, we proposed a Hierarchical Model Predictive Control (HMPC) approach for this particular problem. Despite of its efficiency, the final solution reported still could be far from the global optimum. Due to this, Local-Search (LS) algorithms are developed to improve the solution of HMPC by rescheduling successive products in the current schedule. The effectiveness of the proposed solution techniques is demonstrated by solving a large-scale instance and comparing the solution with the original MPC and a classic Cutting Plane approach adapted for this work.

Keywords: Supply Chain Network, Planning and Scheduling under uncertainty, MILP, Model Predictive Control, Local Search Algorithm.

2 Introduction

In this paper, we address the integration of planning and scheduling on multiproduct multistage continuous plants in a supply chain (SC) network with price elasticity of demands under uncertainty. For this, decisions at tactical and operational levels should be done together to improve the efficiency of the supply chain network.
Tactical decision in SC are focused on different echelon nodes including plants, distribution centers (DCs), markets. In here, planning decisions have to also consider the interrelation between different echelon nodes in a complex SC network. These include assignment and transportation decisions on products; for example from which plant DCs must be supplied and from which DCs individual markets are served at each time period. Other important issue is the sequence-dependent changeovers along consecutive time periods. This limitation forces the system to take into account the previous states of the plants at the end of each time period in order to plan the next time period. The inventory level at plants and DCs represents another important hard condition between planning