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Economic model predictive inventory routing and control. (English) Zbl 1397.90034
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Summary: The paper proposes an economic model predictive control (EMPC) strategy for the inventory routing problem under demand uncertainty. The strategy is illustrated using an application on industrial gas distribution systems, where the product is transported to customers in small tanks and the inventory levels at the customers' sites are monitored and controlled by the supplier following a vendor managed inventory approach. The objective is to produce balanced decisions for the joint routing and the inventory control problem over the planning horizon with respect to the decision maker's perspective against stock-out risk. The proposed EMPC strategy makes use of a mixed integer mathematical programming optimization model that describes the deterministic inventory routing problem with simultaneous pickups and deliveries over a specific planning horizon. A time series decomposition forecasting model is used for predicting future demand and an exact linearization of the quadratic term of the objective function guarantees optimality of the solutions. The proposed methodology is illustrated using two examples featuring a single distribution centre, and three customers with simple and complex demand profiles. It is shown that EMPC offers a useful tool for producing balanced decisions between transportation and inventory costs and tracking of the safety inventory levels.

MSC:

90B05 Inventory, storage, reservoirs
90B06 Transportation, logistics and supply chain management
90C11 Mixed integer programming

Keywords:

inventory routing; industrial gas distribution; mathematical modelling; inventory control; mixed integer programming; economic model predictive control

Software:

Concorde; expsmooth

Full Text: DOI

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