PRODUCTION PLANNING AND CONTROL WITH A DISCRETE LOT SIZING AND A ROLLING HORIZON

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Abstract

In this paper we consider a production system for producing a certain set of products. The products are known in advance and can therefore be produced prior to a customer’s order. Orders are only given for a certain time horizon. In the course of time, new customer orders are revealed. No feasible plan can consider all customer orders, because only a certain, restricted part of the future is known in advance: the planning horizon. Although a scheduling strategy cannot provide an optimal solution due to a lack of complete knowledge about future customer orders, it should still avoid circumstances that will handicap future production processes. Hence, our basic rule: Independent of future events, the performance of the production, respectively the scheduling strategy, is not allowed to fall below a certain threshold. Of course, this threshold should depend on an optimal solution’s value. Unfortunately, this threshold can only be determined as soon as all customer orders are known- and that is in retrospect. We are facing the challenge of how a company should produce today, even though only customer orders for the near future are known, or even worse, only the next customer order? Problems like this are handled by the framework of online optimizing [Krumke, 2005]. Here, in contrast to classical offline optimization, the input is revealed piece by piece and hence the optimal solution is unknown in advance. Still certain bounds are guaranteed to be kept independent of future events.

A schedule covers several periods with several time segments each (e.g. a horizon with 4 weeks, and with 10 or 15 working shifts each). It is updated periodically. At any one time, the first period is considered to be the schedule implemented. The realization of a schedule is therefore the sustained implementation of respective first periods. Updates to the schedule only occur at proper points in time that are previously fixed for scheduling. Those are beyond the calendar (that is e.g. not during the weekend if a weekly planning cycle is considered). The scheduled demands (reduction in inventory) can be postponed or changed in value until their final fixation (latest by the time they are scheduled in the first scheduling period). The considered production system is planned, taking into account the assumptions of the Discrete Lotsizing and Scheduling Problems; the production of a product always covers complete time segments (e.g. shifts, hours or discrete parts of an hour).

Using online-optimization to solve the DLSP

The proposed approach offers for a special form of production (DLSP) as an on-line optimization in the sense of a comparison to an optimal off-line solution. The approach is demonstrated in examples with production and inventory costs. A special process model for formularization of online-problems for production planning is introduced. The competitiveness of our online approach to an offline-approach is measured. An extension to other forms of production as well as other forms of costs (e.g.) setup will be illustrated.
Figure 1: Partition in two subtasks; an example where the DLSP solutions differ

LITERATURE


