Chapter 8

Conclusion

In this work, we discussed the problem of how to effectively manage stochastic demand in make-to-stock manufacturing. Specifically, we considered the situation of a manufacturer who decides on the quantities he is willing to sell to different customer classes. The order acceptance decisions take into account on-hand inventory as well as already planned production quantities scheduled to arrive in the future. For each order, the manufacturer has to decide—based on its profitability—whether to accept the order, to reject it, or to backlog it against a price discount. The problem is motivated by the demand fulfillment task in advanced planning systems. A key characteristic of the problem setting is that production orders cannot be changed in the short term. This is in line with the hierarchical planning approach of most advanced planning systems and reflects the reality of many manufacturers.

We presented a literature classification and overview of research in demand management. It turned out that the majority of models considering stochastic demand focuses on make-to-order environments. We adopted ideas from the classified literature, especially from traditional revenue management approaches, and transferred them to make-to-stock manufacturing. To our knowledge, this work is the first to apply revenue management in this context.

We developed two different approaches considering stochastic demand. First, we model the make-to-stock demand fulfillment problem as a stochastic dynamic program. We proved that the optimal policy in this model has a simple, intuitive structure, which can be interpreted as an extension of the well-known booking-limit policies in classical revenue-management problems. By explicitly capturing demand uncertainty, our model differs from the rule-based deterministic models commonly underlying the demand fulfillment modules of advanced planning systems. Second, we combined conventional LP-based models with stochastic demand information by repetitively solving the LP with different random variates. This idea stems from the randomized linear programming of network revenue management problems.

We tested the models numerically and compared them against a first-come-first-served rule and against a deterministic optimization approach. Our results show that explicitly accounting for demand uncertainty significantly improves the performance of demand fulfillment. The results also show that customer differentiation can yield a substantial profit increase, in particular if differences in profitability are large across orders and if supply is scarce. In conclusion, our