

Integrated procurement planning and scheduling under supply and demand uncertainty

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In this study, procurement planning to ensure the optimal inputs into the production system is formulated as a Markov decision process (MDP). There are two important issues to maintain sustainable and robust operation. First, possible realizations of supply and demand uncertainties should be incorporated into the decision-making process. At the same time, the planning for ordering raw materials should be integrated with an operational level for deciding a detailed unloading schedule. In the MDP formulation, exogenous information on supply and demand is captured, and one-period cost and inventory transition are computed from the optimal schedule obtained from a scheduling model, expressed by a MILP. We compared the results from the proposed integrated model with those of a reference policy without any rigorous integration with scheduling through benchmark case studies. Furthermore, in order to alleviate the computational challenges, an approximate solution method using linear function approximation and a heuristics-based substitute for the scheduling model are tried. This increases the range of applications at minimum performance loss.