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Dynamic analysis and optimization of a production control system under supply and demand uncertainties. (English) Zbl 1374.90148

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Summary: This study investigates the dynamic performance and optimization of a typical discrete production control system under supply disruption and demand uncertainty. Two different types of uncertain demands, disrupted demand with a step change in demand and random demand, are considered. We find that, under demand disruption, the system's dynamic performance indicators (the peak values of the order rate, production completion rate, and inventory) increase with the duration of supply disruption; however, they increase and decrease sequentially with the supply disruption start time. This change tendency differs from the finding that each kind of peak is independent of the supply disruption start time under no demand disruption. We also find that, under random demand, the dynamic performance indicators (Bullwhip and variance amplification of inventory relative to demand) increase with the disruption duration, but they have a decreasing tendency as demand variance increases. In order to design an adaptive system, we propose a genetic algorithm that minimizes the respective objective function on the system's dynamic performance indicators via choosing appropriate system parameters. It is shown that the optimal parameter choices relate closely to the supply disruption start time and duration under disrupted demand and to the supply disruption duration under random demand.

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