A Simulation Driven Robust Optimization Methodology for the Spare Parts Inventory Management System of a Manufacturing Firm

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Abstract

This study deals with the situation of a manufacturing company that wants to determine the correct reordering point and the maximum amount of inventory to allow for its spare parts inventory. It seeks the optimum level of these quantities such that inventory holding cost is minimized and service level given by spare parts to the machine that it supports meets a desired pre-specified level. A methodology to address the company's concern was developed. The methodology involved development of a discrete event simulation model for the inventory management process which can then be used to carry out virtual experimentation on the inventory system. Experimentation is guided by the design of experiment (DOE) approach so that results can eventually be subjected to a robust optimization procedure in the presence of noise factors involving spare parts breakdown and replacement patterns and behaviors. The paper details the application of the methodology for a certain spare part as a sample. Validation run results for average inventory level and service level are well within the ranges predicted by the regression models obtained through DOE for the robustly optimized maximum inventory and reorder level values. The methodology is seen to be widely applicable to different spare parts regardless of breakdown and replacement patterns as it is not tied down to any statistical distributional assumptions.