

# Robust Design Method for Complex Stochastic Inventory Model

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## Abstract

There are many sources of uncertainty in a typical production and inventory system. There is uncertainty as to how many items customers will demand during the next day, week, month, or year. There is uncertainty about delivery times of the product. Uncertainty exacts a toll from management in a variety of ways. A spurt in a demand or a delay in production may lead to stockouts, with the potential for lost revenue and customer dissatisfaction.

Firms typically hold inventory to provide protection against uncertainty. A cushion of inventory on hand allows management to face unexpected demands or delays in delivery with a reduced chance of incurring a stockout.

The proposed strategies are used for the design of a probabilistic inventory system. In the traditional approach to the design of an inventory system, the goal is to find the best setting of various inventory control policy parameters such as the re-order level, review period, order quantity, etc. which would minimize the total inventory cost.

The goals of the analysis need to be defined, so that robustness becomes an important design criterion. Moreover, one has to conceptualize and identify appropriate noise variables.

There are two main goals for the inventory policy design. One is to minimize the average inventory cost and the stockouts. The other is to the variability for the average inventory cost and the stockouts.

The total average inventory cost is the sum of three components: the ordering cost, the holding cost, and the shortage costs. The shortage costs include the cost of the lost sales, cost of loss of goodwill, cost of customer dissatisfaction, etc.

The noise factors for this design problem are identified to be: the mean demand rate and the mean lead time. Both the demand and the lead time are assumed to be normal random variables. Thus robustness for this inventory system is interpreted as insensitivity of the average inventory cost and the stockout to uncontrollable fluctuations in the mean demand rate and mean lead time.

To make this inventory system for robustness, the concept of utility theory will be used. Utility theory is an analytical method for making a decision concerning an action to take, given a set of multiple criteria upon which the decision is to be based. Utility theory is appropriate for design having different scale such as demand rate and lead time since utility theory represents different scale across decision making attributes with zero to one ranks, higher preference modeled with a higher rank.

Using utility theory, three design strategies, such as distance strategy, response strategy, and priority-based strategy. for the robust inventory system will be developed.