

14. "Enhancing Shortage Management in Inventory Systems Using Trapezoidal Fuzzy Logic"

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Abstract

In this paper, fuzzy inventory model with shortages has been considered. Trapezoidal fuzzy number with Weibull distribution is used to fuzzify the data of an inventory model. All the parameters used in the inventory model is converted to trapezoidal fuzzy numbers using function principle. We find the estimate of the total inventory cost by defuzzifying the trapezoidal fuzzy numbers using the the graded mean integration. The optimum total cost for the inventory model is found.

Keywords: Inventory · Trapezoidal fuzzy numbers · Defuzzification

1. Introduction

Inventory models are the models which is used to determine the optimum levels of the inventories which has to be maintained during the various stages of production, storing, ordering and managing the goods.

Inventory models deals with certainty and uncertainty of demand which occurs before and after the production of goods. The inventories during manufacturing can be classified as raw materials, work-in-progress and finished goods. After finishing the product, we have two costs that deals with holding the inventories. They are named as ordering costs and carrying costs.

There are two major models in the world of inventory. One is the deterministic model which deals with no uncertainty of demand and replenishment of inventories. The Probabilistic model which deal with uncertainty with demand pattern and lead time of the inventories.

Inventory models with and without Back orders are considered by Yao et al [24] in fuzzy environment. Trapezoidal number is used to fuzzify the order quantity q . With the help of centroid strategy along with the extension principle, they found the membership functions of fuzzy total cost.

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2. Preliminaries

“Definition 2.1: A Weibull distribution is defined as a random variable X is said to have a *Weibull distribution* with parameters α and β ($\alpha > 0$; $\beta > 0$) if the probability density function of X is $f(x; \alpha, \beta) = \begin{cases} \frac{\alpha}{\beta\alpha} x^{\alpha-1} e^{-\left(\frac{x}{\beta}\right)^\alpha} & x \geq 0 \\ 0 & x < 0 \end{cases}$ where α is a shape parameter and β is a scale parameter.”

3. Methodology

Graded Mean Integration by Chen and Hsieh [6] is used to defuzzify the fuzzy number which is based on the mean integral value with h -level. The generalised fuzzy number is described as follows.

Suppose \tilde{X} is the fuzzy number considered then $\tilde{X} \subseteq \mathbb{R}$. The following conditions are met by the membership function $\mu_{\tilde{X}}$ of \tilde{X}