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# FUZZY ECONOMIC ORDER QUANTITY INVENTORY MODEL

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Abstract. *This paper proposes a fuzzy economic order quantity (FEOQ) inventory model. In this model, costs and quantities are expressed in trapezoidal fuzzy numbers. The purpose of this paper is to provide a defuzzification technique for the fuzzy economic order quantity inventory model using (a) the Function Principle (b) the Graded Mean Integration Representation method and (c) the Kuhn-Tucker conditions. Firstly, the Function Principle is applied to fuzzy arithmetical operations on fuzzy numbers. Secondly, we calculate the representation of fuzzy number by using the Graded Mean Integration Representation method. Thirdly, we obtain the optimal economic order quantity for the fuzzy EOQ model by using the Kuhn-Tucker conditions. Finally, the utilization of the proposed fuzzy economic order quantity inventory model is demonstrated with a numerical example.*

**Keywords:** Fuzzy sets, Fuzzy inventory, Fuzzy economic order quantity, Function principle, Graded mean integration representation method, Kuhn-Tucker conditions

1. **Introduction.** Several researchers have applied the fuzzy set concepts to deal with the inventory problems. Park [16] examined the economic order quantity model from the fuzzy set theoretic perspective by using trapezoidal fuzzy numbers for ordering and inventory holding costs. The Extension Principle is applied to the fuzzy arithmetical operation on fuzzy numbers. Chen *et al.* [6] proposed a fuzzy backorder inventory model with fuzzy yearly demands, fuzzy ordering costs, fuzzy inventory costs and fuzzy backorder costs. They used the Function Principle [2] to deal with the fuzzy arithmetical operation on fuzzy numbers, and then used the median rule to obtain the optimal backorder quantity for the fuzzy backorder inventory model. Yao and Lee [20] developed a fuzzy inventory model, and then used the Extension Principle to find the optimal backorder quantity. Chang [1] discussed how to obtain the economic order quantity when the quantity of demand is uncertain. Chen and Hsieh [4] presented a fuzzy backorder inventory model. The Second Function Principle [3] is applied to the fuzzy arithmetical operations on generalized trapezoidal fuzzy numbers. Chen *et al.* [5] proposed a fuzzy economic production quantity model with fuzzy costs, fuzzy quantities, and imperfect production. They used the Function Principle, the Graded Mean Integration Representation method, and the Kuhn-Tucker conditions to obtain the optimal fuzzy economic production quantity.

Tominaga *et al.* [19] studied the effects of inventory control on bullwhip in supply chain planning for multiple companies. The production planning model for multiple companies under uncertain demand situations is developed to represent an actual planning environment where demand variances in the future periods are gradually available with respect to the progress of time steps. The paper examines the bullwhip effect caused by the inventory control method in consideration of safety stock. The relationship between the total profit and bullwhip effects is investigated from numerical simulations.