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EOQ-BASED INVENTORY MANAGEMENT IN SINGLE-MACHINE MULTI-ITEM SYSTEMS

Tommaso Rossi°*, Rossella Pozzi°, Mariapaola Testa^

°School of Industrial Engineering, LIUC-Cattaneo University (Italy), ^Past: Operations Research Center, Massachusetts Institute of Technology (MA). Present: Boston Consulting Group (UK)

*Corresponding Author: School of Industrial Engineering, LIUC-Cattaneo University, Corso Matteotti 22, 21053, Castellanza (VA), Italy
trossi@liuc.it, +39.0331.572.388

Abstract

The present paper proposes an approach for including the finite capacity constraint in the EOQ model (and, in more general terms, in inventory systems) to study the context of single-machine multi-item systems. In particular, the proposed approach regulates the processing of different items by a shared resource according to a control model based on an ordering policy that combines the Economic Order Quantity with a policy based on minimum and maximum inventory levels (min–max policy). To achieve such a challenging result, the present work exploits the analogy between "switched arrival systems" (a particular class of hybrid systems) and min-max inventory systems. The development and parameterization of the abovementioned control model, therefore, refers to switched arrival systems control theory and mixed-integer linear programming. The present work also contributes to the integration of static tools (i.e., the EOQ model) and control tools, approaching these areas. The paper concludes with a real case application that illustrates the proposed approach and allows for a future research path to be drawn.

Keywords: multi-item, single-machine; Economic Order Quantity; switched arrival systems

1. Introduction

Since the seminal work by Harris (1913), which first determined the number of parts to produce at one time, researchers and practitioners have studied the adaptation of the economic order quantity (EOQ) model to overcome the limitation of its application to real production systems (Holmbom & Segerstedt, 2014). In particular, the literature has faced the issue of adapting the EOQ model in the case of multi-product production contexts characterized by a single (shared) resource with finite capacity, i.e., when more products are made by the same resource and there is a need to produce items consecutively rather than concurrently (Rogers 1958).

The first attempt to address this problem sought to determine a production schedule to minimize costs subject to capacity constraints ("a sequence of production periods arranged so that production