ABSTRACT

In this study, inventory systems for repairable-parts with service level consideration are studied. The first study develops a multi-parts inventory system and transportation decisions. A failed part might be repairable at the stock location, or at repair facilities, or it might be non repairable, which should be replaced by a new purchased part. The objective is to find the base stock levels and shipping modes that maximizes the total weighted fill rate within a given budget. An optimization model and the properties of the objective function are developed. An approximation method is used to eliminate the highly non-linearity of the objective function, and the optimality of approximated model is discussed under specific conditions. The results of numerical experiments show the benefits of alternative transportation mode. Failure rates are observed to be the most significant factor in determining the assigned base stock level and shipping mode.

A two-echelon repairable-parts inventory system is considered in the second study, where emergency purchasing and ordering from the central warehouse are allowed to obtain high service level. A dynamic decision making model is developed that minimizes the system’s operational costs, including transportation, stocking and purchasing new parts during the contract period, and provides the required service level over the contract period. The numerical experiments show the benefits of purchasing and ordering options in systems with high penalty costs and long repair times, especially where the allocated inventory to the stock location is not enough to guarantee the target service level. Our model also provides the best base stock levels that minimize the operational costs and initial investments at the stock location.
In the previous studies, we assumed that the contractual terms are given to the supplier and are considered as fixed parameters. The main focus in the last study is providing the contractual terms to the supplier that prompts him to provide a better service performance. The decision maker in this system is the customer, and he requires a minimum service level from the supplier. The customer is willing to grant the supplier for a better service performance by providing incentives. The objective is to find the terms of contract, the fixed payment, incentives and contract duration, that maximize the service provided by the supplier during the planning horizon under a constrained budget. We first develop a mixed integer programming model assuming the information on the supplier’s cost and service is visible to the customer. Then, we extend our model to a robust model in which the uncertainty of information is included.