

Using Response Surface Methodology to Build a Meta-Model for a Non-Linear Mixed Integer Lean Supply Chain Problem

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Abstract

This paper describes how response surface methodology was used to build a meta-model based on the non-linear mixed integer model of Cruz and Kabling (2005) that deals with a supply chain employing mechanisms of lean logistics. In this study, the experiments made use of the Central Composite Design. Three independent variables were considered, namely demand variability, holding cost, and transportation cost, as these came out as the most significant in the Plackett-Burman screening design. The following responses were recorded: total system cost, presence or absence of milk runs, number of open facilities, total system inventory, and number of ConWIP and Kanban routes. Regression models and response surfaces were developed and analyzed for each of the above. Finally, they were used to describe the supply chain environment, as characterized by the variations in costs, and demand behavior, where the use of particular lean principles are truly applicable from a cost reduction perspective, at least for the range of parameter values used in the designed experiments.