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Multi-Objective Optimization for Multi-Product Multi-Period Four Echelon Supply Chain Problems Under Uncertainty

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Abstract

Multi-objective optimization methodology of a multi-product multi-period four-echelon supply chain network consisting of manufacturing plants, distribution centers (DCs) each with uncertain services, retailers each with uncertain services and customer nodes is aimed in this paper. The two conflicting objectives are minimization of the total supply chain cost while maximizing the average number of products dispatched to customers. The decision variables are: the number and the locations of reliable DCs in the network, the optimum number of items produced by plants, the optimum quantity of transported products, the optimum inventory of products at DCs retailers and plants, and the optimum shortage quantity of the customer nodes. The problem is first formulated into the framework of a constrained multi-objective mixed integer linear programming model. As the model developed in this study is hard and time consuming to be solved analytically, a Meta heuristic multi-objective genetic algorithm (MOGA) was utilized to find Pareto fronts. Since there was no benchmark available in the literature to validate the results obtained, another GA-based multi-objective evolutionary algorithm called non-dominated sorting GA (NSGA-II) was used as well. The problem is also solved by Epsilon Constraint Methods. At the end, to demonstrate the practicality of the proposed methodology, RFL Plastic limited was used to as a study and Comparison the result obtained from the MOGA, NSGA-II & Epsilon Constraint Method.

Keywords
Multi-objective optimization, MOGA, NSGA-II, Supply chain management, Uncertainty

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