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Solving the Stochastic Multiple Level Warehouse Layout Problem using Simulation of Ant Colony Optimization Algorithm

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Abstract

This research addresses the multiple level warehouse layout problem, which involves assigning items to cells and levels with the objective of minimizing transportation costs. A monthly demand and an inventory requirement are associated with every item type along with vertical and horizontal unit transportation costs. The warehouse has one port to transport items vertically from ground floor to the other levels, where each item must be assigned to exactly one cell on the assigned level.
Both the items' demand and their inventory requirements are stochastic, following a uniform distribution. This NP-complete problem is solved using an optimization-simulation-optimization approach. In particular, Ant Colony optimization (ACO) algorithm is modeled using discrete event simulation to capture the randomness of the items' demand and inventory requirements, then the simulated ACO's parameters are also optimized to guarantee superior solutions.
This approach's performance is evaluated by comparing its solutions to the ones obtained using deterministic data. The results show that simulation was able to identify better assignments of items to cells than the deterministic approach, as the latter did not capture the real randomness of demand and inventory requirements.

Keywords
Multiple Level Warehouse Layout Problem, Ant Colony Optimization, Stochastic Simulation

Biography

Jean-Paul Arnaout is an associate professor of Production/Operations Management and the head of the Business Administration Department at Gulf University for Science and Technology. He received his PhD and M.S. from the Department of Engineering Management and Systems engineering at Old Dominion University, Norfolk, Virginia in 2006 and 2003 respectively. He received his bachelor degree in Mechanical Engineering from the University of Balamand, Lebanon. Dr. Arnaout developed several simulation and optimization models in several areas including but not limited to port operations, supply chain, agriculture, and healthcare. His Research interests include Optimization Techniques, Modeling and Simulation, and Scheduling and Rescheduling.