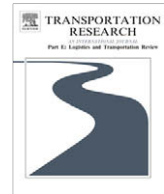




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# Scheduling trucks in cross-docking systems: A robust meta-heuristics approach

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### ABSTRACT

In a cross-docking system, trucks must be scheduled to minimize the total flow time of the system. This problem is NP-hard, and this study proposes two hybrid meta-heuristics—hybrid simulated annealing and hybrid variable neighborhood search—to solve it by achieving the best sequence of truck pairs. The Taguchi method serves to reveal the best robustness of these algorithms. To demonstrate the effectiveness of the proposed methods, especially for large-sized problems, this study solves various test problems, and the computational results clearly reveal that the proposed methods outperform previous approaches.

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## 1. Introduction

A typical modern warehouse is a dynamic, intelligent distribution center (DC) in which products and packages are processed in real-time and moved in and out on schedule. These dynamic and intelligent warehouses also tie together all distribution and logistic functions, with minimal inventory storage. Inputs and outputs must be regulated precisely and streamlined in an intelligent manner.

Therefore, the distribution environment aims to make operations ever more efficient. Companies can cut costs by reducing inventory at every step of the operation, including distribution. At the same time, customers demand better services, which translate into more accurate and timely shipments. Instead of waiting a week to receive a product, most customers want delivery in 1 or 2 days. In most manufacturing environments though, it is difficult to ship directly from the manufactures to the customer, so intermediate points are necessary to connect them. One such intermediate point in a supply chain system is the DC.

Distribution center operations consist of five basic functions: receiving, sorting, storing, picking, and shipping. If cooperation among these five elements improves, the DC can reduce costs and improve productivity. However, the best way to reduce costs and improve efficiency is not simply improving a function but rather eliminating it if feasible. In this context, cross-docking offers the potential of eliminating storage and picking, the two most expensive warehousing operations. This method of distribution management also helps companies better control their distribution operations, because it represents a material handling and distribution concept in which items move directly from the receiving dock to shipping dock, without

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