A route-selecting order batching model with the S-shape routes in a parallel-aisle order picking system

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Introduction

In general, order batching requires two decisions, a batching decision and a routing decision, to form the batches based on an appropriate routing method.

This paper **focuses on a problem commonly encountered in retail product supply chains**: order batching picking operations tightly coupled with a routing method in a wide-aisle Order Picking System (OPS).

Paper Contributions

(1) Proposing a route-set construction method and the route selection to manage the S-shape routing in a wide-aisle OPS.

(2) Generalizing a route-packing order batching procedure to manage a large-scale S-shape routing order picking case.

(3) Developing a lower bound algorithm for order batching utilizing with S-shape routing.

Key Findings

This paper aims to address **a route-set for the S-shape routes and composites a best fit route for batches from the predefined S-shape routes** while partitioning orders into batches.

This study highlights **a large-scale order batching model for an S-shape routing method** producing very efficient solutions **in a six parallel-aisle order picking system with 500 orders**.

The **proposed batching procedure develops batches from the predefined S-shape routes**, which also produced the tight lower bound by the combination with the route-selection based relaxed batching model. This study, therefore, is **able to evaluate other large-scale batching algorithms in the published literature by comparing with a lower bound**.

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Model Formulation

(1) Developing route-packing based order batching procedure (RBP).

(2) Constructing S-shape-route-selecting batching model (SRSB) and its extension using integer programming problem and finalize the large-scale batching procedure and its lower bound model.

Simulation Results

Computational results

- Impacts of the route-set.
- The total travel distance comparing commonly used algorithms.
- Effects of the routing methods.

Sensitivity Analysis

- Warehouse configuration with varied number of aisles, 8-aisles and 10-aisles.
- Order size with two uniformly distributed cases, uniform(1,3) and uniform(2,6).
- Two different storage strategies, random-based storage policy and class-based storage policy.