

REVIEWER'S REPORT

Manuscript No.: IJAR-59482

Title: A two-phase decomposition heuristic versus a hybrid genetic algorithm for solving a multi-product, multi-compartment vehicle routing problem with simultaneous pickup and delivery and time windows for the transport of perishable products .

Recommendation:

Accept

Rating	Excel.	Good	Fair	Poor
Originality	Yes			
Techn. Quality		Yes		
Clarity	Yes			
Significance		Yes		

Reviewer's ID: JPR- 015

Detailed Reviewer's Report

Reviewer's Comment for Publication.

Acceptance Comment are mentioned below suitable for the paper titled "A two-phase decomposition heuristic versus a hybrid genetic algorithm for solving a multi-product, multi-compartment vehicle routing problem with simultaneous pickup and delivery and time windows for the transport of perishable products "

Reviewer Comments: Accept

Reviewer Comments –

1. Introduction

The manuscript addresses a relevant and complex vehicle routing problem involving the transportation of perishable products under practical logistical constraints. It integrates multiple products, multi-compartment vehicles, simultaneous pickup and delivery, time windows, and product degradation based on road categories. The study considers both transportation costs and the opportunity costs associated with the loss of product economic value. The research problem is clearly defined and has strong relevance to perishable goods distribution and supply chain management. Overall, the introduction establishes a sound foundation for comparing approximate optimization methods.

2. Literature Review

The manuscript builds on established research in vehicle routing problems, particularly those involving time windows, simultaneous pickup and delivery, and multi-compartment vehicle configurations. It draws on established benchmark instances and heuristic approaches to position the proposed problem within the broader vehicle routing literature. The use of Solomon's insertion heuristic and benchmark

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instances demonstrates an appropriate connection with recognized solution techniques. The study addresses an important combination of operational constraints and product degradation considerations. The literature review provides a suitable foundation for the methodological comparison and highlights the practical relevance of the research.

3. Solution Approach / Methodology

The study compares a two-phase decomposition heuristic (TPDH) with a hybrid genetic algorithm for solving the MPMC-VRPSPDTW. The TPDH combines nearest-neighbour customer clustering with inter-route local search, while the hybrid GA uses a feasible initial population generated through an insertion heuristic inspired by Solomon's I1 method. Both approaches address the integrated routing constraints and the combined cost objective. The experimental evaluation uses 45 configurations derived from the C101, R104, and RC107 benchmark instances, with CPLEX solutions providing an optimality reference for selected configurations. The methodological framework is clearly structured and appropriate for evaluating the relative effectiveness of the two approaches.

4. Results and Discussion

The reported findings demonstrate the superior performance of the hybrid genetic algorithm across the evaluated configurations. It achieves lower costs in 34 of the 45 configurations, reduces mean cost by 5.1%, and decreases the mean number of vehicles by 25.8% compared with TPDH. Although the hybrid GA requires a longer mean computational time, its performance improvements provide a compelling trade-off. For the 23 configurations solved to optimality by CPLEX, the mean optimality gap is 4.4% for the hybrid GA compared with 12.6% for TPDH. The paired Wilcoxon test results further support the reported performance differences.

5. Conclusion

The manuscript presents a meaningful comparative evaluation of two approximate solution methods for a challenging and practically relevant vehicle routing problem. The findings establish the hybrid genetic algorithm as the stronger approach in terms of solution quality and vehicle utilization across the tested configurations. The study also transparently reports the computational time required, enabling readers to assess the trade-off between solution quality and computational effort. Its integration of transportation costs and product degradation provides useful insights for the distribution of perishable products. Overall, the manuscript offers a valuable contribution to vehicle routing and logistics optimization and is suitable for publication.