Contribution ID: **90** Type: **Apresentação regular**

An Optimisation and Simulation Approach for the Design of Demand Responsive Transport Services

Demand-responsive transport (DRT) systems are quite flexible, adapting quickly to changes in demand through dynamic routing, scheduling, and fleet sizing. Unlike conventional public transport, DRT operations are often planned daily, especially in low-demand contexts. However, as demand grows, planning becomes computationally intensive. While effective methods exist in the literature, many are complex and not easily implemented.

This work proposes a two-phase heuristic embedded in a simulation-based framework to support the design and operation of DRT services. In the first phase, a constructive algorithm generates feasible routes by sequencing trips to avoid overlaps. The second phase enhances these routes by adjusting pick-up and drop-off times to facilitate ride-sharing and improve vehicle utilization. This optimization component is integrated into a simulation environment that evaluates system performance under varying demand conditions.

Preliminary experiments on small-sized instances showed that the heuristic provides high-quality solutions with very low computational effort. The approach offers a balance between simplicity, efficiency, and practical applicability, making it suitable for iterative simulation optimization schemes. This study is part of a broader framework aimed at designing more adaptive and efficient DRT systems.

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Session Classification: Session 1.1 - Optimization-Simulation