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# The Simultaneous Vehicle Scheduling and Passenger Service Problem with Flexible Dwell Times

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## Abstract

In this talk, we deal with a generalization of the well-known Vehicle Scheduling Problem (VSP) that we call Simultaneous Vehicle Scheduling and Passenger Service Problem with Flexible Dwell Times (SVSPSP-FDT). The SVSPSP-FDT generalizes the VSP because the original timetables of the trips can be changed (i.e., shifted and stretched) in order to minimize a new objective function that aims at minimizing the operational costs plus the waiting times of the passengers at transfer points. Contrary to most generalizations of the VSP, the SVSPSP-FDT establishes the possibility of changing trips' dwell times at important transfer points based on expected passenger flows. We introduce a compact mixed integer linear formulation of the SVSPSP-FDT able to address small instances. We also present a meta-heuristic approach to solve medium/large instances of the problem. The effectiveness of the proposed solution methods is shown on a set of real-life instances provided by the main bus operator on the greater Copenhagen area. The effects of considering flexible dwell times on the objective function and on the provided solutions are also analysed.

## Keywords

Bus timetable optimization, dwell times, mixed-integer programming, meta-heuristics