

# Handling synchronization in Vehicle Routing: Efficient feasibility checking and hybridization for VRP with cross-docking

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This seminar first present a synthesis of contributions to the solving of three vehicle routing problems involving synchronization constraints. These problems are: the Pickup and Delivery Problem with Transfers (PDPT), the Two-Echelon Multiple-Trip Vehicle Routing Problem with Satellite Synchronization, and the Heterogeneous Full Truckload Pickup and Delivery Problem with Time Windows and Resource Synchronization. All these problems have been solved with an Adaptive Large Neighborhood Search (ALNS). A special focus is given to the temporal feasibility evaluation of an insertion which has been proposed for the PDPT and extended to the other problems. The concept of forward time slack is extended to provide a constant time feasibility test of temporal constraints. Experiments confirm the solving time reduction provided by the implementation of this test in a meta-heuristic.

The second part of the talk will focus on a recent extension of these contributions to the solving of the vehicle routing problem with cross-docking. An hybridation of ALNS with the solving of a integer programming model is introduced. The IP solver selects the best pickup and delivery legs, which are matched according to temporal constraints at the cross-dock in a branch-and-check fashion by constraint programming.