A hybrid solution approach for the 3L-VRP with simultaneous delivery and pickups

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Abstract

A vehicle routing problem with three-dimensional loading constraints and simultaneous delivery and pickups is introduced (3L-VRPSDP). Sets of different three-dimensional (cuboid) items have to be delivered to customers. At the same time, items have to be picked up from the customer locations and brought to the depot. This approach requires the integration of three-dimensional packing problems into the VRPB so that packing constraints such as stability requirements or LIFO constraints can be considered.

A particular challenge of the problem is to transport delivery and pickup items simultaneously on the same vehicle. In order to avoid any reloading effort during a tour, we consider two different loading approaches of vehicles: (i) loading from the back side with separation of the loading space into a delivery section and a pickup section and (ii) loading at the long side.

A hybrid algorithm is proposed for solving the problem consisting of an *Adaptive Large Neighbourhood Search* for the routing and different packing heuristics for the loading part of the problem. The solution approach was tested for newly generated instances for the 3L-VRPSDP and well-known instances form the literature for the one-dimensional VRPSDP. The corresponding results will be presented.

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