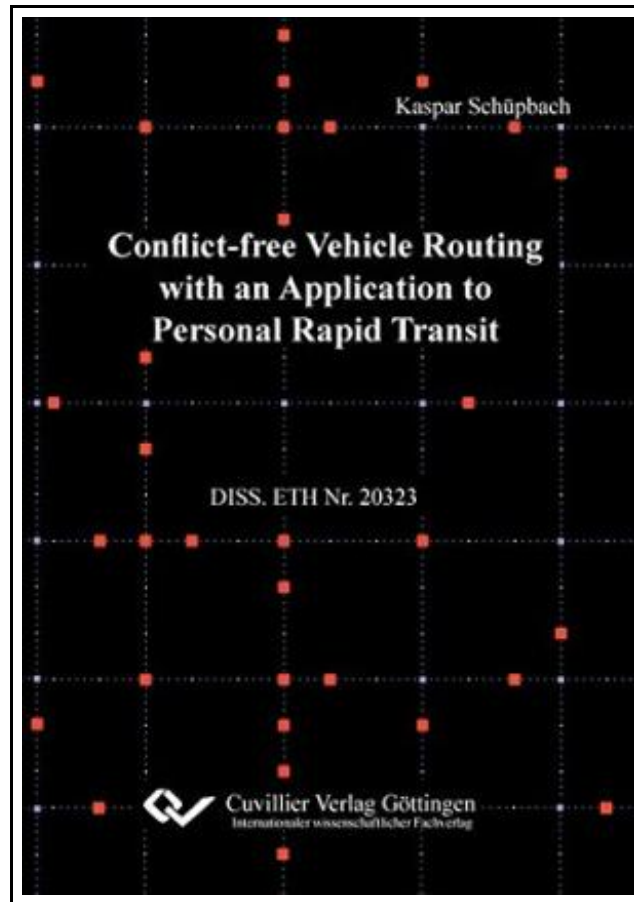# Conflict-free Vehicle Routing with an Application to Personal Rapid Transit

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CONFLICT-FREE VEHICLE ROUTING WITH AN APPLICATION TO PERSONAL RAPID TRANSIT

Cuvillier Verlag Sep 2012, 2012. Taschenbuch. Book Condition: Neu. 210x147x7 mm. Neuware - This thesis investigates the conflict-free routing of vehicles through a track network, a problem frequently encountered in many applications in transportation and logistics. The most common routing approach for conflictfree routing problems in various settings is a sequential one, where requests are greedily served one after the other in a quickest way without interfering with previously routed vehicles. There is a need for a better theoretical understanding as guarantees on the quality of the routings are often missing. Conflict-free vehicle routing also is of inherent interest as a sister problem of the well-studied packet routing problem. In the first part, we present new theoretical results for the case of bidirectional networks. We consider a natural basic model for conflict-free routing of a set of k vehicles. Previously, no efficient algorithm is known with a sublinear (in k) approximation guarantee and without restrictions on the graph topology. We show that the conflict-free vehicle routing problem is hard to solve to optimality even on paths. Building on a sequential routing scheme, we present an algorithm for trees with makespan bounded by O(OPT) + k. Combining this result with ideas known from packet routing, we obtain a first efficient algorithm with sublinear approximation guarantee, namely an O(k)-approximation. Additionally, a randomized algorithm leading to a makespan of O(polylog(k)) * OPT + k is presented that relies on tree embedding techniques applied to a compacted version of the graph to obtain an approximation guarantee independent of the graph size. The second part is about routing in the Personal Rapid Transit (PRT) application. PRT is a public transportation mode in which small automated vehicles transport passengers on demand. Central control of the vehicles leads to interesting possibilities for optimized routings. Routing in...

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