



Séminaire conjoint / Joint Seminar
Chaire de recherche du Canada en logistique et en transport et
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REGULATING ONE-WAY VEHICLE SHARING SYSTEMS THROUGH PARKING RESERVATION POLICIES

Abstract: One-way vehicle sharing systems allow users to rent vehicles in one of many unmanned stations scattered in the city, use them for a short ride and return them at any station. The demand processes for vehicles and parking spaces are typically unbalanced. Consequently, shortages in vehicles or parking spaces may occur in some of the stations along the day. We propose implementing passive regulations as means for redirecting the demand so as to improve the performance of the system. In particular, we focus on parking reservation policies. Under such policies, the users may be required, upon renting a vehicle, to reserve a parking space at their destination and these spaces are kept for them. We measure the performance of the vehicle sharing system in terms of the total excess travel time users spend due to shortages of vehicles or parking spaces. We formulate a Markovian model of the system and use it to compare two extreme policies: a complete parking reservation (CPR) policy under which all users are required to reserve a parking space and a baseline policy entitled no-reservation (NR). Through this model, we prove that under realistic demand rates, the CPR policy outperforms the NR policy. We also devise mathematical programming based bounds on the total excess travel time under any passive regulation and in particular under any parking space reservation policy. These bounds are compared to the performance of: the above policies, several partial parking reservation policies and a utopian parking space overbooking policy. A detailed user behavior model for each policy is presented and a discrete event simulation is used to evaluate the performance of the system under various settings. The analysis of two case studies of real-world systems demonstrates that: (1) a significant improvement of what theoretically can be achieved is obtained by the CPR policy. (2) The performance of the proposed partial reservation policies monotonically improve as more reservations are required. (3) Parking overbooking is not likely to be beneficial. In conclusion, our results demonstrate the effectiveness of the simple CPR policy and suggest that parking space reservations should be used in practice, even if only a small share of the users are required to place reservations.

Joint work with Michal Tzur and Tal Raviv (Tel-Aviv University).

Note: Mor Kaspi is a Ph.D. candidate in the Industrial Engineering department at Tel Aviv University. His research interests are in the transportation and logistics areas. His Ph.D. thesis focuses on vehicle sharing systems and is written under the supervision of Prof. Michal Tzur and Dr. Tal Raviv. He holds a B.Sc. (2008) and a M.Sc. (2010) from the Industrial Engineering Department at Tel-Aviv University. His Master's thesis is concerned with line planning and timetabling of passenger trains. He is the co-author of papers that were published in Transportation Science, Operations Research Letters and Transportation Research Part B. In addition, he serves as a reviewer for several scientific journals and as a lecturer of an undergraduate course in Operations Research at Tel-Aviv University.

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Pavillon André-Aisenstadt
Université de Montréal

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