RISUD Research Salon on Supply-Demand Rebalance for Large-Scale One-Way Carsharing Systems: Integrating Multiple Resources by Linear and Nonlinear Programming Methods

Bio of Prof. Chi XIE

Dr. Chi Xie obtained his Ph.D. in Systems Engineering from Cornell University in 2008. He has been teaching at University of Texas at Austin, Shanghai Jiaotong University and Tongji University over the past decade and is currently a Professor in the School of Transportation Engineering at Tongji University. Dr. Chi Xie's research covers infrastructure network analysis and management, electrified and shared transportation systems, and intelligent transportation and logistics systems, in which his research interest is focused on developing innovative methods to analyze and optimize large-scale urban and regional systems on the strategic, tactic and operational levels. His research results have been published in over 100 international journal and conference papers and book chapters.

Dr. Chi Xie is a recipient of the Young 1000-Talent Award from the China Recruitment Program of Global Experts in 2013-2016, an Outstanding Young Scholar of Frontiers of Engineering from the Chinese Academy of Engineering in 2017, a recipient of the Best Paper Award from World Transport Convention in 2018 and 2021, a recipient of the Outstanding Advisorship Award from National Alliance of Electric Vehicles of China in 2020. He is currently serving the academic community as an Associate Editor of International Journal of Transportation Science and Technology, the Chair of the Transportation and Logistics System Planning Cluster (GH03) and the Co-Chair of the Emerging Waterborne Technologies Cluster (SS07) of World Transport Convention, and a Member of the Travel Demand Management Committee (ABE50), the Transportation Network Modeling Committee (ADB30) and the Freight Transportation Planning and Logistics Committee (AT015) of Transportation Research Board.

Abstract

Though its first use dates back to 1940s, carsharing has not widely attracted the public's awareness, until the last decade as an emerging form of sharing economy. Different from the eodem loco pickup-and-dropoff policy employed by traditional car rental companies, most of current carsharing services allow for taking and returning a shared car at different service stations. This one-way setting greatly enhances travelers' car renting and returning convenience and hence increases the attractiveness and competitiveness of carsharing in the transportation service market. Such flexibility, however, comes up with a serious imbalance problem between car supply and user demand across stations. To reduce the negative impacts due to the supply-demand imbalance, carsharing planners and managers suggested various technological and managerial rebalancing strategies. The most primitive and widely used strategy is vehicle relocation, compulsorily or advisorily, the main operation of which is to employ full-time or part-time human operators or stimulate vehicle users by economic incentives to drive cars from stations with car abundance to other stations with car shortage. Obviously, in a large-scale carsharing system, such operations are rather time- and cost-consuming, calling for a complex decision process executed at a frequent basis in real time and involving hundreds or even thousands of vehicles. This salon presents some of research advances made by Dr. Chi Xie's research group, which can be accommodated by a new modeling framework and linear and nonlinear programming methods for optimizing vehicle relocation and vehicle-passenger rebalance decisions for one-way carsharing systems by invoking different resources (such as professional operators, designated drivers and vehicle users).