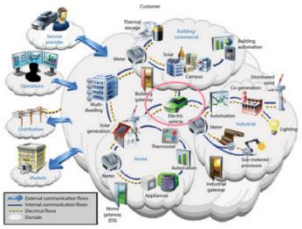
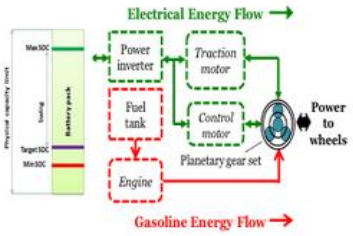
Department of Energy Systems Engineering
Seminar

Orkun Karabaşoğlu, Ph.D.

Optimal Operation of Interdependent Power Systems and Electrified Transportation Networks





Date: Wednesday, March 22, 2017
Time: 11:30-12:30
Room: Y212

ABSTRACT

Electrified transportation and power systems are mutually coupled networks. In this talk, a novel framework and methodology for the joint operation of power and transportation networks will be presented. Our approach constitutes solving an iterative least cost vehicle routing process, which utilizes the communication of Electrified Vehicles (EVs) with competing charging stations to exchange data, such as electricity price, energy demand, and time of arrival. EV routing problem is solved to minimize the total cost of travel using the Dijkstra algorithm with the input from EVs battery management system, electricity price from charging stations, powertrain component efficiencies, and transportation network traffic conditions. Through the bidirectional communication of EVs with competing charging stations, EVs charging demand estimation is done much more accurately. Then, the optimal power flow problem is solved for the power system, to find the locational marginal price at load buses where charging stations are connected. Finally, the electricity prices are communicated from the charging stations to the EVs, and the loop is closed. Locational electricity price acts as the shared parameter between the two optimization problems, i.e. optimal power flow and optimal routing problem. Electricity price depends on the power demand, which is affected by the charging of EVs. On the other hand, location of EV charging stations and their different pricing strategies might affect the routing decisions of the EVs. Our novel approach that combines the electrified transportation with power system operation, holds tremendous potential for solving electrified transportation issues and reducing energy costs. The effectiveness of the proposed approach is demonstrated using Shanghai transportation network and IEEE 9-bus test system. The results verify the cost-savings for both power system and transportation networks.

BIO

Orkun Karabasoglu, PhD received his PhD and M.Sc. in Mechanical engineering from Carnegie Mellon University (CMU) in 2013. Later on, he worked as a postdoctoral research associate in the Mechatronics Research Laboratory at Massachusetts Institute of Technology (MIT). He is currently an Assistant Professor of Electrical and Computer Engineering at the Sun Yat-Sen University - Carnegie Mellon University, Joint Institute of Engineering. He is the Founder and Director of the Laboratory for Intelligent Vehicles and Energy Systems (LIVES) which is an externally funded research program. He is an affiliated faculty at Carnegie Mellon University, associate professor at Sun Yat-sen University, and Distinguished Visiting Professor at Beijing Jiaotong University. He has published more than 25 peer reviewed journal and conference papers and has 8 patent applications in US and China. His research has been featured in Bloomberg, Reuters, Fox42 News, Green Car Congress, Environmental Leader, The Wall Street Journal, EV World, Italian TV, and etc.