Charging Infrastructure for Electric Vehicles in Complexes

Relevance to the Automotive Industry:	The charging infrastructure is critical to the success deployment of electrically powered mobility systems (e-mobility). Across Germany there is much ongoing research on this charging infrastructure, both concerning the various charging technologies and the optimal deployment of public and private charging systems. Complexes will likely have a hybrid of public and private (home) charging systems.
Research Location:	Technische Universität Darmstadt Institute for Mechatronic Systems (IMS)
Homepage (Engl.):	http://www.ims.tu-darmstadt.de
Faculty Mentor:	Prof. Dr.-Ing. S. Rinderknecht
Faculty Mentor Email:	rinderknecht@ims.tu-darmstadt.de
Graduate Mentor:	Georg Franke, M.Sc.
Graduate Mentor Email:	franke@ims.tu-darmstadt.de
Project Description: Jun 05 - Aug 10, 2018 (10 weeks, 40 h/week)	The Technische Universität Darmstadt Institute for Mechatronic Systems (IMS) conducts research on integrated systems for the generation, storage, and integration of renewable energies in apartment, office, and hybrid complexes, with a focus on electric storage systems. The local charging infrastructure will be of critical importance to the successful deployment e-mobility in complexes. The IMS has developed a simulation and optimization tool to represent the energy supply systems in complexes. The aim of this NSF REU project is to extend this tool to model the local charging infrastructure for electric vehicles: The NSF REU student will perform basic research on the state of the art of electric vehicles, battery technologies, and charging infrastructures. This information will then be integrated to develop MATLAB models that address different aspects of the integration of local charging infrastructure in complexes. Examples include technical aspects (e.g., battery aging, parameters of electric vehicle charging stations), economic aspects (e.g., charging strategies, repayments and taxes), and social aspects (e.g., charging behavior of the residents, possibilities of influencing this behavior). The student will gain comprehensive insights into issues of e-mobility and charging infrastructure, and will learn about mathematical modeling in the context of a practically relevant project. **PHASE A** (2-3 weeks): During this introduction phase, the NSF REU student will review relevant literature and get familiar with the existing software tools. **PHASE B** (6 weeks): Next, the student will develop MATLAB models that address certain aspects of e-mobility and the charging infrastructure in complexes. **PHASE C** (1-2 weeks): Finally, the NSF REU student will document the research performed, prepare a written report to support subsequent publications, and deliver an end-of-summer presentation on the work performed.
Target publications:	• IEEE 89th Vehicular Technology Conference • 2019 IEEE SmartGridComm
Necessary Skills/ Knowledge:	• Experience with MATLAB
Desirable Skills/ Knowledge:	• Drivetrain concepts, from mild-hybrid-electric- to full-electric vehicles • Charging infrastructure • Power Grids and Smart Grid concepts
Additional Online Resource(s):	

NSF REU Students must have completed at least two semesters of engineering studies prior to the proposed summer research, and they must have at least one semester remaining before they can earn their BS in Engineering.