Cost Analysis of Electric Vehicles and the Influence of Different Powertrain Control Strategies

Relevance to the Automotive Industry:	The cost of a vehicle consists of its purchase price, the cost of its fuel or energy, and its maintenance cost. In order to achieve the minimum cost of ownership, all these aspects should be considered and formalized as assessment criteria for the powertrain topology and control strategy.
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
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Graduate Mentor:	Yikai Tao, M.Sc.
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Project Description: Jun 03 - Aug 09, 2019 (10 weeks, 40 h/week)	The Institute for Mechatronic Systems (IMS) at the Technische Universität Darmstadt is a key partner in an electric vehicle research project. The research interest of this project involves an innovative control strategy, which aims to not only minimize energy consumption, but also maximize the lifetime of the powertrain. The goal of this NSF REU project is to develop a cost analysis model to compare different control strategies, as well as different powertrain topologies, with respect to a common cost criterion. This cost analysis model should be sophisticated so that it covers the full cradle-to-grave product lifecycle. **PHASE A** (2 weeks): During this introduction phase, the NSF REU student will perform literature review of relevant research, and develop an understanding of these cost analysis models and methods. **PHASE B** (3 weeks): Next, the student will develop a cradle-to-grave cost analysis model, and assess different control strategies for the pure electric vehicle. **PHASE C** (3 weeks): Then, the student will investigate several vehicle powertrain topologies, expand the assessment in Phase B to include these topologies, and develop cost analysis model that integrates these different powertrain topologies and control strategies for use with a common cost criterion. **PHASE D** (2 weeks): Finally, the NSF REU student will prepare a written summary report and documentation of the research performed, and deliver an end-of-summer technical presentation on the research performed.
Target publications:	• SAE World Congress 2020
Necessary Skills/ Knowledge:	• Experience with MATLAB • Basic Knowledge about automotive technologies and industry
Desirable Skills / Knowledge:	
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.