Improved Longitudinal Dynamic Driving Simulator Control

Relevance:	Dynamic driving simulators are increasingly used during the automotive vehicle development process. These simulators offer the opportunity to explore driving situations even before a physical prototype is available. Areas of interest include the analysis of man-machine interfaces, evaluation of driver-assistance systems, and investigating autonomous driving.	
Research Location:	TUD Institute for Mechatronic Systems (IMS)	
Homepage (Engl.):	http://www.ims.tu-darmstadt.de	
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Graduate Mentor:	Philipp Erler, M.Sc.	
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Project Description: Jun 06 - Aug 11 2017 (10 weeks, 40h/week)	Most driving simulators have a motion platform based on a hexapod system that can represent lateral, vertical, and longitudinal dynamics; though most systems do address longitudinal dynamics because it must be displayed in a highly-scaled format due to limited motion space. IMS has therefore developed a new simulator for investigating a vehicle's longitudinal dynamics: It improves on the presentation of the longitudinal dynamics, and it enables investigation of the perception of longitudinal dynamic maneuvers. The control module is developed using Matlab and Simulink, and describes a driving dynamics model that focuses on valid representation of drive train behavior and motion cueing, using accelerator and breaks pedals as input, and converting acceleration into translational motion and inclination in the simulator motion platform using the motion cuing algorithm. The objective of this NSF REU project is to optimize the motion cueing algorithm and the driving dynamic model in order to improve the simulation quality of the IMS simulator. **PHASE A** (2-3 weeks): During this introduction phase, the student will review relevant research, and investigate the existing IMS driving simulator. **PHASE B** (3 weeks): The student will investigate the driving dynamics model, characteristics of different motion cueing algorithms, and identify maneuver-specific optimal parameters in Simulink. **PHASE C** (3 weeks): Conduct objective and subjective investigations and comparisons of motion cueing algorithms in the IMS driving simulator. **PHASE D** (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 research performed.	
Target publications:	• 2018 IEEE 87th Vehicular Technology Conference	
Necessary Skills/ Knowledge:	• Experience with Matlab	
Desirable Skills/ Knowledge:	• Familiarity with the fundamentals of control engineering • Experience with Simulink	
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.