Design and Modeling of an Ego-Velocity Estimator

Relevance to the Automotive Industry:	Automated and autonomous navigation is becoming increasingly important for all means automotive vehicles. The automated driving functions not only require good environmental perception (e.g., other vehicles), but will also rely on a proper estimation of the ego-vehicle driving state (i.e., of the automated vehicle itself). The automated vehicle, with its multitude and variety of sensors, provide multiple data sources for determining this ego-velocity information.	
Research Location:	Technische Universität Darmstadt Institute for Automotive Engineering (FDZ)	
Homepage (Engl.):	http://www.fzd.tu-darmstadt.de	
Faculty Mentor:	Prof. Dr.rer.nat. Hermann Winner	
Faculty Mentor Email:	winner@fzd.tu-darmstadt.de	
Graduate Mentors:	Timm Ruppert, M.Sc.	
Graduate Mentor Emails:	ruppert@fzd.tu-darmstadt.de	
Project Description: Jun 03 - Aug 09, 2019 (10 weeks, 40 h/week)	The Technische Universität Darmstadt Institute of Automotive Engineering (FZD) is investigating high-automation and driver-assistance systems for trams. This includes the realization of a prototype and evaluation of different sensors and techniques for the automated driving functions. The sensors and functions need a real-time signal of the ego-velocity. The main data sources for providing a velocity signal — directly or indirectly — are a global navigation satellite system (GNSS), rotary encoders, and inertial measuring units. The objective of this NSF REU project is to investigate and design a solution for how to fuse these data sources into on reliable and accurate ego-velocity signal. **PHASE A** (2 weeks): Investigate how the individual data sources can be used to determine a velocity signal. Classification of the reliability and accuracy of a single source. **PHASE B** (2 weeks): Investigate how these individual data sources can be fused into one more reliable velocity signal with known grade of accuracy. **PHASE C** (2 weeks): Design an ego-velocity estimator. **PHASE D** (3 weeks): Simulate and evaluate the design. **PHASE E** (1 weeks): Finally, the NSF REU student will document the research performed, prepare a written report, and deliver an end-of-summer presentation on the research performed.	
Target publications:	• WKM-Symposium 2020	
Necessary Skills/ Knowledge:	• Experience with MATLAB	
Desirable Skills/ Knowledge:	• Experiences with Simulink • Experiences with GNSS, encoders, IMUs	
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.