

Development of a Ball Screw Drive Shift Actuator for Dog Clutches in Electric Drivetrains

Relevance to the Automotive Industry:	Increasing electrification in the automotive sector is changing the requirements for system components such as shifting actuators. Their design and control can have a significant impact on dynamics, cost, and comfort of the entire system. New requirements, such as low shifting forces, are leading to a shift in focus towards alternative concepts.	
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:	Edward Kraft, M.Sc.	
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Project Description:	<p>The Technische Universität Darmstadt Institute for Mechatronic Systems (IMS) has developed a shifting actuator test bench to explore and compare new systems and control strategies. The aim of this proposed NSF REU project is to develop a new ball screw drive shift actuator. The new actuator will need to meet several requirements, such as taking into account the dynamics of the shifting operation and the connection to the existing test bench. Building on previous work, the actuator will be designed and dimensioned using computer simulation tools, and then described using the Siemens NX CAD software system. Finally, the NSF REU student will select suitable components to build and install the new actuator system on the IMS shifting actuator test bench.</p> <p>PHASE A (2 weeks): During this introduction phase, the NSF REU student will review relevant research and investigate existing software and hardware.</p> <p>PHASE B (3 weeks): Next, the student will develop and implement a simulation model and a control strategy in MATLAB/Simulink, to analyze the dynamics of the shifting actuator.</p> <p>PHASE C (3 weeks): Then, the student will design a new ball screw drive shift actuator using Siemens NX, and select suitable components to build the shifting actuator and install and test it on the IMS shifting actuator test bench.</p> <p>PHASE D (2 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.</p>	
Jun 05 - Aug 10, 2018 (10 weeks, 40 h/week)		
Target publications:	<ul style="list-style-type: none"> • VDI International Conference on Gears 2019 	
Necessary Skills/ Knowledge:	<ul style="list-style-type: none"> • Experience with MATLAB • Experience with CAD 	
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.