Development and Construction of a Piezoelectric Acceleration Sensor

Relevance to the Automotive Industry:	Advanced Driver Assistance Systems (ADAS) require a vast amount of information in order to implement new functionalities. Vehicles therefore need to be equipped with a multitude of diverse sensors to assess the actual state of the vehicle. For instance, acceleration sensors are needed for the longitudinal control. Future engineers will therefore need to be able to understand, design, and implement such sensors in order to realize this increasing growth of new ADAS functionalities.
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:	Philippe Jardin, M.Sc.
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Project Description: Jun 05 - Aug 10, 2018 (10 weeks, 40 h/week)	The Technische Universität Darmstadt Institute for Mechatronic Systems (IMS) is concerned with teaching and research on automotive systems, including ADAS. To ensure appropriate technical competencies among future engineers, the IMS actively aligns its course materials with emerging trends in the automotive industry, including the growing number of sensors in todays' automotive vehicles. The objective of this NSF REU project is to develop and construct an apparatus for a laboratory experiment in the required Mechanical Engineering undergraduate course, *Machine Elements and Mechatronics*, to help improve the technical understanding of the fundamental working principles of piezoelectric acceleration sensors; one of several types of sensors that are introduced in that course. **PHASE A** (2-3 weeks): First, the NSF REU student will become familiar with the fundamental working principals of piezoelectric acceleration sensors and the associated course learning objective. Using the engineering design process, the students will then design the proposed laboratory apparatus, based on the main mechanical components that have already been purchased. **PHASE B** (3 weeks): Next, the student will construct the laboratory apparatus, including identifying components to be purchased or fabricated using a 3D printer. **PHASE C** (3 weeks): The apparatus will then be assembled, tested, and redesigned as needed. **PHASE D** (1-2 weeks): Finally, the NSF REU student will document the work performed, prepare a written report to support subsequent publications, and deliver an end-of-summer presentation on the work performed.
Target publications:	• 2019 IEEE SENSORS
Necessary Skills/ Knowledge:	• Experience with CAD; Experience with modelling (e.g., stiffness, resonance) • Ability to work independently
Desirable Skills/ Knowledge:	• Practical experience in system design • Experience in 3D printing; Experience with sensor systems
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.