Simulation Study: Rotor Drop Downs in Backup Bearings

Relevance to the Automotive Industry:	With the increase of electric vehicles, many more charging stations are needed. However, the current electrical infrastructure is not designed to support this large number of charging stations. It is therefore important to explore new concepts for reliving this increasing load on the electric grid.
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:	Benedikt Schüßler, 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 investigating the use of energy storage systems to relieve the increasing load on the electric grid that is imposed by the increased deployment of electric vehicles. Of particular interest are hybrid storage systems that use lithium-ion batteries and a flywheel. To decrease the energy loss in the flywheel, an active magnetic bearing levitates the rotor. However, in the case of a malfunction or power outage, a mechanical backup bearing system is needed to guarantee a safe spin-down, making the backup bearing an essential part of a safe energy-storage system. The goal of this NSF REU project is to model, simulate, and analyze various potential backup-bearing designs with regards to rotor drop-downs, using the MATLAB-based simulation tool ANEAS that has been developed by IMS. **PHASE A** (2 weeks): During this introduction phase, the NSF REU student will review relevant literature. **PHASE B** (4 weeks): Next, the student will begin to work with the MATLAB-based simulation software ANEAS. Once familiar with ANEAS, the student will model several promising designs, and run simulations for these designs using different initial conditions. **PHASE C** (2 weeks): Then, the student will analyze these simulations to determine which design performs the best. **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:	• ISMB 17- International Symposium on Magnetic Bearings (August 2020)
Necessary Skills/ Knowledge:	• Experience with MATLAB
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.