

Characterization of Gear Mesh Forces in Automotive Transmissions

Relevance to the Automotive Industry:	Gear whine is a known issue with automotive transmissions. Until now, this problem has been treated by passive measures such as tight manufacturing tolerances for the teeth or specifically located reinforcement ribs on the outer gear box. However, these passive measures have effectively reached their limits with regards to vibration reduction. Various active measures are therefore being explored: The goal is to achieve active vibration control of the gearbox using as few actuators and sensors as possible.
Research Location:	TUD Institute for Mechatronic Systems (IMS)
Homepage (Engl.):	http://www.ims.tu-darmstadt.de
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Project Description: May 23 - Jul 15, 2011; (8 weeks, 40h/week)	This NSF REU project addresses the issue of gear whine in automotive transmissions. This gear whine occurs under certain driving conditions. It is caused, for example, by gear mesh impacts, parameter-induced vibrations, or gear hobbing processes. The goal of this project is to counteract this phenomenon using active vibration control. For this purpose, a finite element model is being used to determine the dynamic properties of the transmission. With these properties, a state space model is being built. Using this model, various investigations will be carried out. The mathematical models describing the excitation forces caused by the gear mesh will therefore be needed. The NSF REU student will conduct a literature review to investigate mathematical models of these forces, and implement a solution in MATLAB. The combination of this MATLAB model with an existing state space model at IMS will enable a closed-loop simulation with known disturbances (i.e., mesh forces). Initially, only simple control strategies such as PID will be used.
Target publications:	<ul style="list-style-type: none"> • INTERNOISE-2012 • Schwingungen in Antrieben 2011 • Schwingungsdämpfung 2011
Necessary Skills/ Knowledge:	<ul style="list-style-type: none"> • MATLAB / Simulink
Desirable Skills/ Knowledge:	<ul style="list-style-type: none"> • Basic knowledge of control theory
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.