

Influence of Pitching on Drivetrain Oscillations During Load Changes

Relevance to the Automotive Industry:	In order to develop new control algorithms aimed towards increasing passenger comfort in passenger cars, precision in simulation models describing drivetrain load change phenomena is required. Current models consider backlash in the development of drivetrain control algorithms; however, they are only based on differential equations describing rotational degrees of freedom. Because of this, vehicle pitching is not included in those models and the influence on drivetrain oscillations is unclear.	
Research Location:	TUD Institute for Mechatronic Systems (IMS)	VT Vehicle Terrain Performance Laboratory
Homepage (Engl.):	http://www.ims.tu-darmstadt.de	http://www.me.vt.edu/VTPL
Faculty Mentor:	Prof. Dr.-Ing. Stephan Rinderknecht	Prof. John B. Ferris, Ph.D.
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Project Description: May 21 - Jul 13, 2012; (8 weeks, 40h/week)	<p>The TUD Institute for Mechatronic Systems (IMS) and the VT Vehicle Terrain Performance Laboratory (VTPL) are working together to understand how pitching influences drivetrain oscillations in automotive powertrains. To complete this task, two NSF REU students, one at TUD and one at VT, will work together and with their graduate mentors to extend and modify an existing backlash afflicted drivetrain model by adding a vehicle pitching and tire model. The main focus of this research is to analyze the influence of dynamic wheel load fluctuation and vehicle pitch on drivetrain oscillations due to different terrain and driver's desired torque inputs. In this work only the longitudinal case is considered. This joint effort will be organized in three phases:</p> <p><u>PHASE 1 (2 Weeks):</u> IMS and VTPL will work together to conduct a literature review and select a suitable vehicle model for predicting pitch.</p> <p><u>PHASE 2 (4 Weeks):</u> The project will be divided into two parts: IMS will parameterize the vehicle model with the vehicle data and investigate the influence of vehicle pitching on drivetrain oscillations while varying requested driver commands. Simultaneously the influence of varying terrain and tire models on vehicle pitching will be investigated at VTPL. As a result of the work the following will be identified: 1) the vehicle model parameters to which the pitch response is most sensitive and 2) the frequency range over which these parameters are influential on drivetrain oscillations.</p> <p><u>PHASE 3:</u> IMS and VTPL will coordinate results and generate a presentation, report, and a conference paper.</p>	
Target publications:	<ul style="list-style-type: none"> • Vehicle System Dynamics • International Conference Vehicle Dynamics • SAE World Congress 2013 	
Necessary Skills/ Knowledge:	<ul style="list-style-type: none"> • 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.