Influence of Damper Failure on Driving Dynamics

Relevance to the Automotive Industry:	State-of-the-art semi-active or active suspension systems are entering the automotive market place. Such dampening systems are essential components, affecting both driving comfort and driving dynamics. Cavitation or aeration under dynamic conditions is a common problem for all dampers. Low damping forces corresponding to such phenomena occur in the motion cycle, especially at the points where the moving direction changes. An improved understanding of the influence of damper failure on driving dynamics is therefore important to improving the design and tuning of dampers in the automotive industry.
Research Location:	TU Darmstadt Fahrzeugtechnik (FZD)
Homepage (Engl.):	http://www.fzd.tu-darmstadt.de/fzd/aktuell/aktuelle_meldungen.en.jsp
Faculty Mentor:	Prof. Dr. rer. nat. Hermann Winner
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Graduate Mentor:	Ning Zhang, M.Eng.
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Project Description: May 21 - Jul 12, 2013; (8 weeks, 40h/week)	An ongoing research project at the TUD Institute of Automotive Engineering (FZD) is investigating the influence of damper properties on trailer stability. This NSF REU project will focus on the influence of damper failure on driving dynamics for passenger cars without a trailer. It will involve both dynamic simulations and driving tests. In particular, the NSF REU will student work with her or her mentors at FZD to investigate the influence of a damper's failure on the lateral driving dynamics, including basic variables such as the yaw rate and the yaw damping ration. This effort will be organized into three phases: PHASE 1: During the first two weeks, the NSF REU student will perform a literature review on damper characteristics, become introduced to the *CarMaker* simulation software, and explore the influence of low damping forces on the yaw motion and perform sensitivity analysis using existing system model. PHASE 2: During the next four weeks, the NSF REU student will perform reproducible driving tests, with normal and faulted dampers, on a passenger car equipped with a data measurement system, at different velocities. The student will process the measurement data collected, and perform sensitivity analysis. PHASE 3: During the final two weeks, the results of the data analyses of both the simulation and road tests will be compared and conclusions will be drawn. The NSF REU student will generate a presentation, report, and parts of a potential paper under the supervision of the graduate mentor.
Target publications:	• ATZ (Automobile Technical Journal) Journal paper • IEEE Journal or Conference paper on the topic of vehicle stability/safety
Necessary Skills/ Knowledge:	• High motivation to solve problems independently • Basic knowledge of driving dynamics • MATLAB/Simulink programming
Desirable Skills/ Knowledge:	• Knowledge of passenger car's chassis (suspension, damper, spring) • Data processing and analysis
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.