DEPARTMENT OF MECHANICAL ENGINEERING
Purdue School of Engineering and Technology

FALL 2006 SEMINAR SERIES

Date: Thursday, November 9, 2006
Time: 11:00 am - 12:00 pm
Room: SL 165

Reception at 10:45 am (cookies and refreshments served)
Everyone is invited

Optimal Control of an On-Demand All-Wheel-Drive System

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Abstract. A novel optimal control law for an on-demand all wheel drive vehicle for traction enhancement via slip regulation in a driving event has been developed. Based on a reasonably simplified vehicle model (bicycle model) and optimization of a performance index based on wheel slip, a closed loop actuator control law is derived. The proposed optimal controller tries to minimize the wheel slip error by dynamically transferring the drive torque from the default driven wheel pair (e.g. front wheels) to the non-driven wheel pair (e.g. rear wheels), in order to enhance vehicle longitudinal traction. The proposed control law has been analyzed for closed-loop stability via Lyapunov stability criteria. Stability conditions for which the control law provides closed-loop stability has been generated. Simulation of the proposed controller was performed on a validated 14 degree-of-freedom detailed vehicle model in SIMULINK. The simulation results show that the proposed control algorithm provides very good acceleration slip regulation in a vehicle traction maneuver on low friction coefficient surfaces when compared with that without the traction-enhanced optimal controller. The proposed control law is then extended to hybrid-electric vehicles having engine driven front wheels and electric-motor driven rear wheels.

About the Speaker. Mr. Yifeng Lin is a graduate student in the Mechanical Engineering department (Mechatronics Track) pursuing his MSE degree at IUPUI. He received his BS in Mechatronics engineering from Beijing Institute of Technology in 1998.