



DEPARTMENT OF MECHANICAL ENGINEERING
Purdue School of Engineering and Technology

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Time: 10:15 am - 11:15 am

Room: SL 165

Tire/Road Friction Estimation, Emergency Braking Control and Traffic Flow Stability for Automated Vehicles

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Abstract. Improving driving safety and increasing highway capacity is the main objective of designing an automated highway system (AHS). In this talk, two important problems in AHS are discussed: tire/road interaction which determines the vehicle's braking/traction capability, and traffic flow stability which affects traffic performance.

Tire/road interaction is an important factor for vehicle safety operations and traffic capacity in AHS. The tire/road friction characteristic determines the vehicle's deceleration and acceleration capabilities and needs to be monitored and estimated on-line.

In this talk, two different schemes for on-line estimation of the tire/road friction coefficient are presented: the first is based on the pseudo-static relationship between the tire/road friction coefficient and the tire slip; the latter uses a dynamic friction model. An attractive property of these two approaches is that, with an appropriate selection of initial conditions and gains of the adaptation systems, the estimate of the maximum friction coefficient and slip remain below their true values, which, in turn, guarantees safety of the AHS spacing policies.

A general approach to the macroscopic traffic flow stability of adaptive cruise controlled (ACC) vehicles is presented in the second part of the talk. In this study, a wavefront expansion technique is applied to establish a traffic flow stability criterion for ACC vehicles. The newly derived stability results are consistent with previous stability findings obtained using both microscopic and macroscopic models of a constant time headway (CTH) policy. Moreover, quantitative relationships between traffic flow stability and model parameters are derived for a generalized automated traffic flow model. The stability criteria found in this study can be used to design other ACC spacing policies.

Biographical information. Jingang Yi is a systems engineer at Lam Research Corporation. He holds a Ph.D. in mechanical engineering from University of California, Berkeley, 2002. His prior degrees include B.S. in electrical engineering from Zhejiang University, P.R. China in 1993; Master's in Engineering from Tsinghua University, P.R. China, 1996; and Master's in Applied Mathematics from University of California, Berkeley, 2001. His research interests include dynamic systems and intelligent controls, intelligent transportation systems, and microelectronics manufacturing systems.