A control theoretic formulation of green driving strategies based on inter-vehicle communications

Date / Time: Friday, Mar 14 2014, 1:30pm – 2:30pm
Location: Ketter Hall, 140 (limited sitting; beverages will be served)

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In this talk, I will present a control theoretic formulation of distributed, cooperative green driving strategies based on inter-vehicle communications (IVCs) to smooth traffic flow and lower pollutant emissions and fuel consumption in stop-and-go traffic. The control variable is the advisory speed limit, which is designed to smooth a following vehicle’s speed profile without changing its average speed. We theoretically analyze the performance of a constant independent and three simple cooperative green driving strategies and present three rules for effective and robust strategies. We then develop a distributed cooperative green driving strategy, in which the advisory speed limit is first independently calculated by each individual vehicle and then averaged among green driving vehicles through IVC. By simulations with Newell’s car-following model and the Comprehensive Modal Emissions Model (CMEM), we demonstrate that such a strategy is effective and robust independently as well as cooperatively for different market penetration rates of IVC-equipped vehicles and communication delays. In particular, even when 5% of the vehicles implement the green driving strategy and the IVC communication delay is 60 s, the fuel consumption can be reduced by up to 15%. In the end I will also present our latest field test results.

Bio:
Dr. Wenlong Jin (BS in Automatic Control, University of Science and Technology of China, 1998; PhD in Applied Mathematics, UC Davis, 2003) is an Assistant Professor of Civil and Environmental Engineering at UC Irvine. He is interested in fundamental and systematic studies on modeling, analysis, monitoring, and control of transportation systems through interdisciplinary approaches based on behavioral modeling, mathematical analysis, systems theory, and information and communication technologies. He has been a principal or co-principal investigator over ten federally- and state-sponsored projects. Dr. Jin has co-authored 33 peer-reviewed journal articles, including 17 in Transportation Research and Transportation Science journals, 30 conference proceedings, and five reports, and has given over 40 invited talks and conference presentations. He is an editorial board member of Transportation Research Part B and an Associate Editor of Transportmetrica B.