SPCEET RESEARCH SEMINAR SERIES

Dr. Jorge A. Laval

Jorge A. Laval is a Professor at Georgia Tech in the School of Civil and Environmental Engineering. He obtained his PhD in Civil Engineering from the University of California, Berkeley under the supervision of Carlos Daganzo. Professor Laval held two consecutive one-year postdoctoral positions at the Institute of Transportation Studies at UC Berkeley and at the University of Lyon, France. His main research focus is understanding urban traffic congestion to devise improved control methods, combining aspects from traffic flow theory, complex systems theory and machine learning. Recently, he has made important contributions towards understanding the significant challenges that machine learning methods have when it comes to urban network control, and towards improved autonomous vehicle control models that promote traffic stability. Other contributions include methods for estimating the macroscopic fundamental diagram of urban networks, stochastic car-following models that allow the statistical inference of parameters, models for the capacity of freeway sections.

TRAFFIC FLOW AS A SIMPLE FLUID: TOWARDS A SCALING THEORY OF URBAN CONGESTION

The analogy between the theory of phase transitions in simple fluids and vehicular traffic flow has long been suspected, promising a new level of understanding of urban congestion by standing on one of the firmer foundations in physics. The obstacle has been the interpretation of the thermal energy of the gas-particle system, which remains unknown. This talk proposes the flow of cars through the network as a viable interpretation, where the fundamental diagram for traffic flow would be analogous to the coexistence curve in gas-liquid phase transitions. Thanks to the power-law form of the coexistence curve, it was possible to formalize that the resulting network traffic model belongs to the Kardar-Parisi-Zhang universality class. The scaling relationships arising in this universality class are found to be consistent with West's scaling theory for cities. It is shown that congestion costs (delays + fuel consumption) scale superlinearly with city population, possibly and worryingly more so than predicted by West's theory. Implications for sustainability and resiliency are discussed.

Date:

Wednesday, February 28th

Time:

11:15 AM - 12:15 PM

Location:

Q 314