CDS270 DYNAMICS AND CONTROL OF CONNECTED VEHICLES SP 2018

Instructor: Prof Gábor Orosz
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Lectures: Tu 9:00am - 10:30am, ANB 213 (no lecture on April 24)
Th 9:00am - 10:30am, ANB 213

Office hours: Email to meet with the professor

Prerequisites: You are expected to have knowledge of differential equations, linear algebra, and Laplace or Fourier transform.

Reading: Materials will be provided as the course progresses

Course description: This course focuses on modeling and control of connected vehicle systems consisting of human driven and connected automated vehicles. Models are built in terms of ordinary differential equations and delay differential equations. The stability of uniform flow equilibrium studied at the linear and nonlinear levels. Controllers for connected automated vehicles are designed so that they can ensure stability and disturbance attenuation around the equilibrium. The impacts of utilizing connectivity in order to ensure traffic safety and efficiency are highlighted.

Units: 3-0-2

Grading: Pass/Fail

Course Outline:

1. Modeling human driving behavior
1.1 Car-following models with driver reaction time
1.2 Stability and control of time delay systems
1.3 Plant stability and string stability
1.4 Nonlinear dynamics of car-following

2. Vehicle dynamics and control
2.1 Longitudinal vehicle models
2.2 Stability and string stability under digital control
2.3 Adaptive cruise control design

3. V2X connectivity
3.1 WiFi, LTE, xG
3.2 Collecting driving data via V2X
3.3 Model fitting to V2X data

4. V2X-based vehicle control
4.1 Cooperative vs non-cooperative vehicle control
4.2 Network control systems
4.3 Head-to-tail string stability
4.4 Robust control in V2X environment
4.5 Safety, fuel economy, congestion mitigation