VM566 DYNAMICS AND CONTROL OF CONNECTED VEHICLES SU 2020

Instructors: Prof Gábor Orosz
Dept. of Mechanical Engineering
Dept. of Civil and Environmental Engineering
orosz@umich.edu

Mr Lejun Jiang
Dept. of Mechanical Engineering
lejun.jiang@sjtu.edu.cn

Lectures: Tu 10:00-11:40am
Th 10:00-11:40am

Recitation: Fr 10:00-11:40am

Office hours: M 8:00-9:00pm (L)
We 9:30-10:30am (G)
We 8:00-10:00pm (L)

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.

The Engineering Honor Code: http://umji.sjtu.edu.cn/academics/academic-integrity/honor-code/
No member of the community shall take unfair advantage of any other member of the community.

Homework Assignments: Eight homework assignments will be set during the term that will be posted on the course's website. Homework sets are **due no later Thursdays 6pm**. The lowest homework score for the term will be dropped. Homework solutions will be available through the course web site.

You are encouraged to discuss and work on homework together but the final document must represent your own understanding of the material.

If you find errors in your graded homework (e.g. scores do not add up, the grader missed a page etc.) you may ask for re-grade. You need to attach a sheet where you write up the issue and resubmit the homework to the professor within one week after receiving the graded homework.

Grading:

Class attendance	10%
Homework	40%
Project 1	20%
Project 2	30%

LECTURE	DATE	TOPICS	READING	HW DUE DATES
1	Tu 5/12	Car-following traffic models		
2	Th 5/14	Plant stability and string stability		
3	Tu 5/19	Ring configuration		
4	Th 5/21	Time delay systems		HW#01
5	Tu 5/26	Car-following with reaction time		
6	Th 5/28	Car-following with reaction time		HW#02
7	Tu 6/2	Adaptive cruise control		
8	Th 6/4	Adaptive cruise control		HW#03
	Tu 6/9			
	Th 6/11			HW#04
	Tu 6/16			
	Th 6/18			
	Tu 6/23			
	Th 6/25			
	Tu 6/30			
	Th 7/2			
9	Tu 7/7	Connected cruise control – acceleration feedback		
10	Th 7/9	Connected cruise control – head-to-tail string stability		Project #01
11	Tu 7/14	Connected cruise control – head-to-tail string stability		
12	Th 7/16	Connectivity-based energy efficiency		HW#05
13	Tu 7/21	Robust control of connected vehicle networks		
14	Th 7/23	Experimental data of connected vehicle networks		HW#06
15	Tu 7/28	Machine learning for connected vehicle networks		
16	Th 7/30	Project presentations		Project #02
	Tu 8/4			
	Th 8/6			

HW#01 – Dynamics and control
HW#02 – Plant stability and string stability
HW#03 – Human car following
HW#04 – Adaptive cruise control
HW#05 – Connected cruise control – network control design and robustness
HW#06 – Connected cruise control – robustness and energy efficiency