ECE 960C: Networked and Embedded Control Systems

Fall 2018 (Credits: 3)

Access d2l.msu.edu for homework, additional reading, and other materials

OVERVIEW:

The world is becoming increasingly smart and connected because of rapid advances in computing, communications, sensing, and actuation devices. Emerging from the trend of pervasive computing is the concept of networked control systems, examples of which include smart grid, teleoperation over internet, mobile sensor networks, and intelligent highway systems. In such systems components communicate and interact, often in a distributed manner, to achieve desired functions. Aside from these engineered systems, networked systems are also ubiquitous in natural and social settings, where notable examples include flocking of birds, propagation of infectious diseases, and opinion dynamics in social networks.

This course will expose students to fundamentals on dynamics and control of network systems, by drawing tools from algebraic graph theory, control theory, and dynamical systems. In particular, students will learn basic formulations and mathematical tools for the analysis and design of multi-agent systems, be empowered to access the growing literature in this active research area, and be equipped to apply what they learn to advance the field.

INSTRUCTOR:

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Office hours: Monday, 3-4 pm; Wednesday: 9:30-10:30 am

CLASS TIME AND PLACE:

Monday, Wednesday: 1-2:20pm, 151 Communication Arts and Sciences Building

TEXT BOOK:

F. Bullo, Lectures on Network Systems, CreativeSpace, 2018 (Free download for personal non-commercial use: http://motion.me.ucsb.edu/book-lns/)

REFERENCE BOOK:

M. Mesbahi and M. Egerstedt, Graph Theoretic Methods in Multiagent Networks, Princeton University Press, 2010 (available online via MSU Library)

COURSE OUTLINE:

- Motivating examples
- Elements of matrix theory
- Elements of graph theory
- Elements of algebraic graph theory
- Averaging systems and consensus
- Nonlinear multi-agent systems
- Distributed estimation
- Other topics in multi-agent control

GRADING:

The final grade is based on

- Class attendance (5%) - For attendance credit, you earn 5 points if you miss less than (<) five lectures, and receive zero otherwise.
- Homework (45%)
- Closed-book midterm (25%)
- Open-book final (25%)