ETH Zürich

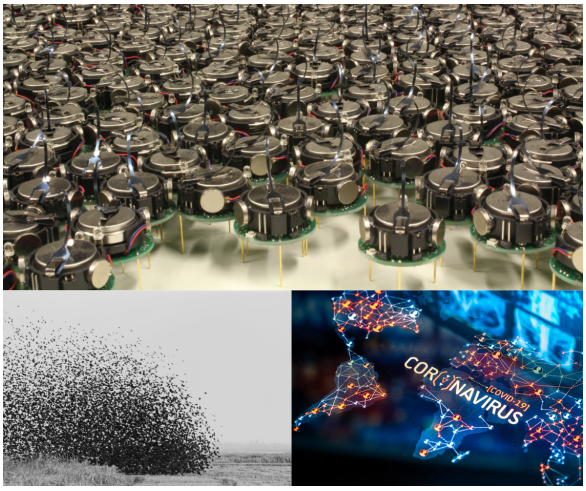
Advanced Topics in Control
227-0690-12 Spring 2022

AUTOMATIC CONTROL LABORATORY

Distributed Systems and Control

Course description: Distributed control systems include large-scale physical systems, social or engineered multi-agent systems, as well as their interconnection in cyber-physical systems. Representative examples are electric power grids, swarm robotics, sensor networks, distributed computing and epidemic spreading over networks. The challenges associated with these systems arise due to their coupled, distributed, and large-scale nature, and due to limited sensing, communication, computing, and control capabilities. This course covers modeling, analysis, and design of distributed control systems as well as applications in various engineering domains. Specific topics covered in the course include:

- the theory of graphs with an emphasis on algebraic and spectral graph theory;
- basic models of interconnected dynamical systems and multi-agent systems;
- continuous-time and discrete-time distributed averaging and consensus algorithms;
- event-triggered control subject to networked communication constraints;
- distributed algorithms, computation, and optimization over networks; and
- applications in robotic coordination, social networks, sensor networks, electrical networks, and epidemic spreading.



Lecture / exercise times & locations

Lectures:	Mondays	16:00 to 18:00	HG D1.1
Exercises:	Fridays	10:00 to 12:00	HG D1.1

Lecturers:	Florian Dörfler	dorfler@ethz.ch
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Prerequisites

Control systems (227-0216-00L), Linear system theory (227-0225-00L), or equivalents, basic Matlab skills as well as sufficient mathematical maturity.

Grading

The class is based on three homework assignments (50%) and a final project (50%).