



Full Syllabus



Course Title

Methods of finite-time control and observation, **0372-4007**

Lecturer

Prof. Arie Levant

Semester

2021/22, Spring

Course requirements

Standard basic courses of ordinary differential equations, linear algebra and infinitesimal calculus

Final grade components

Final project: design and simulation of a non-linear output-feedback controller for a simple multi-input-multi-output uncertain system under noisy discrete sampling

Course schedule

Class no. / Date	Subject and Requirements (assignments, reading materials, tasks, etc.)
1	Control theory, Lyapunov stability theory. Controllability and observability.
2	Normal form of controllable linear autonomous system. Ackermann's formula.
3	Lie derivative. Feedback linearization. Relative degree. Zero dynamics
4	Differential equations with discontinuous right-hand sides, Filippov theory.
5	Sliding Mode (SM), Invariance, Chattering, Equivalent control, Sliding Order
6	Twisting, super-twisting and terminal controllers. 1st-order differentiator.
7	Homogeneity theory. Homogeneous Filippov differential inclusions (FDIs).
8	Sampled and delayed homogeneous FDIs. Accuracy in the presence of noises.
9	Simulation/discretization methods: implicit and explicit Euler schemes.
10	Single-input single-output (SISO) control. Finite and fixed time stability.
11	General recursive homogeneous SISO control design.
12	Exact differentiation and filtering. Output-feedback control. Discretization.
13	Quasi-continuous MIMO SM control. Integral SMs. Homogeneity in bilimit.

Required course reading

Optional course reading

Filippov, A.F., Differential Equations with Disc. Right-hand Sides, Kluwer, 2010; Shtessel Y., Edwards C., Fridman L., Levant A., Sliding Mode Control and Observation, Birkhauser Basel, 2013

Comments