16:650:606 Drones II: Control & Coordination

Part 1: Course Information

Instructor Information

Instructor: Laurent Burlion, Ph.D., Assistant Professor
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Office Hours: by appointment

Course Description

The course is focused on modeling and control of multi-agent systems, with experimentation on Unmanned Aerial Vehicles (UAVs). The module is taught for students with basic knowledge in automatic control and optimization and it intends to increase their interest in applying advanced control techniques on UAVs in an enjoyable framework favorable to develop creativity, practical and team working skills.

The course offers a valuable international experience to the students and is run in parallel at Rutgers and CentraleSupélec, one of the most prestigious French "Grandes Ecoles." The final projects are realized by teams combining both US and French students. The final projects aim at developing some guidance and control algorithms for unmanned aerial vehicles applications (search and rescue, inspection, building digitalization, etc). Identical experimental setups composed of fleets of Crazyflie drones are available in both universities.

Tentative Course schedule

INTRODUCTION: BRIEF HISTORY
DESIGN

- Dynamic modeling of a quadrotor UAV
- Sensor technology
- Observability
- Kalman filter
- State estimation
- Stability and controllability
- Hierarchical control
- PID control
- Advanced control
- Path planning
- Introduction to multi-agent systems
- Dynamic modeling of multi-agent systems
- Consensus-based control laws
- Multi-UAV control
- Multi-agent systems coordination strategies
- simulations, possibly tests on UAVs
- Poster design
- Interactive poster session

Course Prerequisites: Graduate student status or by permission of the instructor for undergraduate students

Textbook & Course Materials

Recommended Textbook

- "*Introduction to Multicopter Design and Control",* by Quan Quan, Springer, 2017. (available on https://www.libraries.rutgers.edu/)

Other "Readings"

- https://w3.onera.fr/dromooc/home

Part 2: Grading Policy

Graded Course Activities

Points	Description
30	Matlab (and/or Python) assignments
20	Reading and presentation of a research paper
50	Final project
100	Total Points Possible

Any questions regarding the **scores** must be discussed with the instructor within two weeks of the date of return of these scores to the class and no changes in these scores will be considered after these two weeks.

Inform Your Instructor of any Accommodations needed within the first two weeks of the course.

Commit to Integrity

As a student in this course (and at this university) you are expected to maintain high degrees of professionalism, commitment to active learning and participation in this class and also integrity in your behavior in and out of the classroom.

You are expected to switch on your camera when you attend the lectures remotely.