

Guidance, navigation and control strategies for small-scale robotic platforms

Florin Stoican and Sylvain Bertrand and Ionela Prodan

We propose a full-day workshop (8 hours of theoretical & application topics and discussions) with the schedule:

09³⁰- 10⁰⁰ Preliminaries:

- Introduction of the speakers and of the participants.
- Thematic of the workshop.
- Technicalities (configuration of necessary software)

10⁰⁰- 10⁴⁵ Trajectory generation (F. Stoican, I. Prodan):

- Feedback linearization via flat output characterizations (ground and aerial dynamics);
- Spline parameterizations. Properties. Optimal and heuristic resolution of associated problems.

10⁴⁵- 11⁰⁰ **Coffee break**

11⁰⁰- 11⁴⁵ Trajectory tracking (I. Prodan, F. Stoican)

- Control architecture for a single agent.
- Feedback via nonlinear MPC.

11⁴⁵-12⁴⁵ Experimental validation (F. Stoican, S. Bertrand):

- Standard obstacle avoidance problem using flatness and spline parameterizations in simulation.
- Trajectory tracking for a Crazyflie drone.

12⁴⁵-14⁰⁰ **Lunch**

14⁰⁰-14⁴⁵ Distributed state estimation (S. Bertrand):

- Consensus and Kalman filters

- Moving horizon observers
- Distributed trajectory estimation of a ground robot by a sensor network

14⁴⁵-15³⁰ Distributed control (S. Bertrand, I. Prodan):

- Consensus and formation control.
- Event-triggered approaches.

15³⁰-15⁴⁵ **Coffee break**

15⁴⁵-17⁰⁰ Simulations and experimental validation (S. Bertrand, F. Stoican):

- Implementation and simulation on multi-robot systems using ROS and Gazebo.
- Experiments on a multi-robot system (Turtlebots and Crazyflie drones).

17⁰⁰-17³⁰ Workshop wrap-up:

- Open questions.
- Conclusions. Topics for further study.
- Participants' feedback.

All practical sessions assume **involvement and interaction with the participants**:

- Practical examples and implementations of simple extensions for the existing code.
- Validation in both Gazebo and experimentally on the robotic platforms.