

## **Trajectory Estimation in Multi-Agent Formations**

Formation control (FC) is used when many mobile agents shall achieve and move in a predefined geometrical configuration in space. Novel applications involve the use of multiple unguided aerial vehicles (UAVs) in use cases like load transportation, search-and-rescue missions, telemetry or other imaging tasks.

A special form of FC is a leader-follower based approach, where the leading agent collects information that is not directly available to the followers. However, via wireless communications, the information can be disseminated between the agents belonging to the formation. Such information could be, e.g., a trajectory that is not known to all agents in the formation in advance. To guarantee a stable formation, it is necessary to obtain a reliable estimate of the intended trajectory quickly by all followers. The estimation process can be negatively affected by imperfect communications including latencies and packet losses, which may lead to instabilities in the formation and worst-case collisions of the agents. Therefore, estimation techniques that take into account the communications effects shall be developed.

Within the thesis, the following tasks shall be covered:

- Literature research on remote trajectory estimation techniques based on the information exchanged through communications
- Development of a suitable estimator based on information transmitted by preceding agents
- Definition of performance metrics and performance analysis under the defined metrics
- Implementation of the considered strategies and use-cases in software
- Numerical evaluation under different transmission strategies
- Documentation of the results

Requirements:

- Knowledge in estimation techniques
- Good programming skills in Matlab/Python
- Strong interest in working in research

Possible start: From May 2021

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