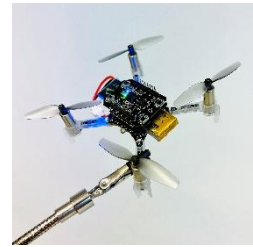


Research field: Applied mathematics, Complex systems modelling, Control

Swarm countermeasure with intercepting swarms

Context

Recent events have highlighted a critical problem in modern defence systems: traditional, high-cost platforms designed to counter individual threats can be overwhelmed by large numbers of relatively simple and inexpensive unmanned aerial vehicles (UAVs). To address this challenge, ISL is currently working on the concept of counter-UAVs (C-UAVs) and counter-swarms (c-swarms) as a promising strategy. A swarm in this context is a group of self-organizing and autonomous UAVs that are deployed to engage and neutralize incoming swarms of malicious UAVs (M-UAVs).



Crazyfly by Bitcraze

The goal of this project is to develop new swarm countermeasures using intercepting c-swarms. In this context, task allocation and decision-making are important problems for swarms to solve. Existing algorithms often assume prior knowledge of task location, neglect dynamic effects, or fail to consider the spatial distribution of tasks on the completion time and feasibility. One main objective in this project is to develop new algorithms to dynamically assign multiple C-UAVs to multiple M-UAVs. Additionally, maintaining permanent communication links with an operator on the ground station is often undesired due to potential risks of losing the entire swarm. Thus, a second objective is to ensure robust, distributed operation of the algorithms. The project also includes the prototypical implementation of the countermeasures in multi-agent simulations to evaluate the performance under different scenarios, as well as the execution of hardware tests. The PhD candidate will present the research findings at international conferences and publish in peer-reviewed journals.

Candidate profile

- Master of science in mathematics, engineering, or related with experience in complex systems modelling, dynamical systems or multi-agent systems
- Expertise in areas like control theory, graph theory, optimization, or algorithms is helpful
- Proficient in at least one programming language like Python or C
- Excellent command in spoken and written English
- Ability to propose new solutions, reliability and enjoyment to collaborate in a dynamic research environment

What we offer

- A PhD project within a dynamic and international collaborative environment
- Unique multi-disciplinary experience
- Access to state-of-the-art experimental facilities
- Competitive salary

Localization

The project is carried out at the French-German Research Institute of Saint-Louis (ISL).

Contact

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