INTERACTIVE AERIAL ROBOTS

Organizers

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Abstract (up to 300 words)

Aerial robotics has experienced a significant development in the last years. Many application functionalities such as surveillance, mapping, and target tracking have been developed. Aerial robots have been integrated as component in more complex systems which requires enhancing their capability for interaction.

In the last decade aerial robots have been integrated for cooperation with sensor networks or other aerial, ground or marine robots for tasks such as detection, monitoring, tracking in applications such as environmental analysis, search and rescue or frontier surveillance, among many others. Recently, new applications that involve physical interaction with objects in the environment have been developed including load transportation and deployment by means of one or several robots, remote inspection by contact, structure construction, and cooperative assembly and manipulation by several aerial robots. However, several problems remain opened and require further scientific and technological efforts to allow the adoption of these robotic systems in real industrial applications.

This workshop is devoted to aerial robots interacting with other robots, sensor networks or with objects in the environment. The workshop will present scientific and technological results and facilitate discussion on technology gaps and research directions.

Intended audience

Researchers and practitioners from academia, government, and industry interested in the research topics related to the free flying robots interacting with the environment, other robots or sensor networks and their potential technology transfer and applications to inspection, assembly, structure construction, and space.

Main list of topics

- Multi-UAS systems and aerial robots collaborating with other robots
- Aerial robots in contact with the environment
- Cooperation between aerial robots and sensor networks
- Architectures, perception and planning
- Application of aerial robots for industrial inspection
- Control of interactive aerial robots

List of confirmed speakers (alphabetical order):

- Anibal Ollero (Univ. de Sevilla, Spain)
- Tin Muskardin (DLR, Germany)
- Vincenzo Lippiello (Univ. of Naples, Italy)
- J. Ramiro Martínez-de Dios (Univ. de Sevilla, Spain)
- Joao Soussa (Univ. of Porto, Portugal)

Abstracts:

Visual servoing for aerial manipulation (Vincenzo Lippiello)

A number of innovative applications in the context of aerial service robotics have been recently considered, e.g. surveillance, monitoring, agriculture, delivering, etc. This promising research frontier is involving several scientists from different disciplines. In the last years, thanks to this impulse, new sophisticated unmanned aerial vehicle (UAV) prototypes and control solutions have been developed with the capacity to physically interact with the surrounding environment.

In this talk different approaches adopting an on-board camera as the main source of information to accomplish aerial grasping and assembling tasks will be presented. Both image-based and position-based techniques have been formulated in the case of an UAV endowed with a robotic arm.

Both simulation and experimental results will be presented to show the effectiveness of the proposed control solutions.

Cooperative multi robot aerial systems: applications and control (Tin Muskardin)

The safe interaction of aerial robots with their environment and other robots, as well as their integration into reliable real world applications is an unmet challenge. The technological development in this field will create many new application scenarios such as construction work in difficult to access or dangerous areas, exploration under severe weather conditions, communication networks based on long endurance stratospheric platforms and many others. A number of big companies have long perceived the

potential benefits of cooperative multi robot systems for the general population and have drastically increased their research activities in this area. Technical issues such as precise relative state estimation and efficient cooperative control have to be solved for the successful and reliable execution of any coordinated interaction task.

In this workshop we will present several promising application scenarios including autonomous landing man oeuvres on ship decks or mobile ground vehicles, aerial manipulation tasks, and the deployment of sensor nodes by means of aerial robots. The respective control strategies will be shown and the key technical challenges discussed.

UAS-WSN cooperation for data collection in large environments (J. Ramiro Martinez-de Dios)

The cooperation between Wireless Sensor Networks (WSN) and Unmanned Aerial Vehicles (UAS) have been exploited in many different applications including security, surveillance, search and rescue, agriculture, among others. Existing approaches tend to consider UAS and WSN as independent entities, disregarding that data collection requires in fact the cooperation of UAS and WSN.

This talk presents cooperative strategies for collection of data from WSN nodes deployed in large environments using UAS. They are based on organizing WSN nodes in clusters. Each cluster has one cluster head. Non-head nodes gather data and transmit them to its cluster head. Only cluster heads communicate with the UAS, reducing the energy required for packet transmission. The proposed scheme enables bidirectional cooperation between UAS-WSN, i.e. the operation of the WSN nodes is used to modify the trajectory of the UAS during data collection and the trajectory of the UAS is used to modify the operation of the WSN during cluster head rotation. The talk presents simulation and experimental results showing the validity of the approach and methods developed.