



Cognitive  
Robotics



AUTONOMOUS  
MULTI-ROBOTS LAB

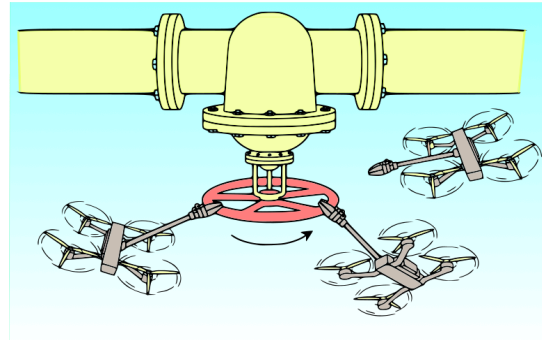
TU Delft



# Multi-Agent Reinforcement Learning for Cooperative Aerial Manipulation

## Background

Aerial manipulators are aerial robots designed to manipulate objects and physically interact with the environment. In other words, they function as “flying hands” rather than simply “flying cameras.” However, a single aerial manipulator has very limited wrench capabilities, namely, it can only generate limited forces and torque to the environment. As a result, exploring methods to coordinate multiple aerial manipulators for cooperative manipulation is a promising direction. In this project, you will investigate cooperative aerial manipulation methods using multi-agent reinforcement learning. You are expected to set up simulation environments in Isaac Sim, conduct training in simulation using multi-agent RL (such as MAPPO), and carry out real-world demonstrations at the Mobile Robotics Lab.



## Research questions

- How to define the observation space for RL to perform cooperative aerial manipulation?
- How to define action space to balance between sim-to-real transfer and system agility?
- How to effectively combine the RL-generated command with low-level controllers of the aerial manipulator?
- How to design real-world experiments to demonstrate the result?

## What we expect from you:

- Highly motivated.
- Experience in programming languages such as Python and C++.
- Experience with ROS/ROS2.
- Experience with NVIDIA Isaac Sim is a bonus.
- Experience with real-world experiments with drones is a bonus.

## What you can learn from this project:

- Hands-on experience with RL for controlling multi-UAV (aerial robot) systems.
- Access to our optimization-based control framework of drone systems in C++, ROS, and Docker.
- Hands-on experience in hardware development of aerial robots.
- Chance to publish in high-ranking robotic and ML conferences/journals.

## Reference

- [1] Ramon-Soria, Pablo, Begoña C. Arrue, and Anibal Ollero. "Grasp planning and visual servoing for an outdoors aerial dual manipulator." *Engineering* 6.1 (2020): 77-88.
- [2] Ollero, Anibal, et al. "Past, present, and future of aerial robotic manipulators." *IEEE Transactions on Robotics* 38.1 (2021): 626-645.
- [3] Sun, Sihao, et al. "Agile and Cooperative Aerial Manipulation of a Cable-Suspended Load." *arXiv preprint arXiv:2501.18802* (2025).

**Contact:**

If you are interested in conducting this cool project, please contact [Dr. Sihao Sun](#) via [s.sun-2@tudelft.nl](mailto:s.sun-2@tudelft.nl)

When applying, please provide a short motivation, an up-to-date CV, a transcript of your current degree program, and an intended start date.

**Short bio of the supervisor:**

Dr. Sihao Sun is a new member of CoR funded by the NWO talent program “Veni” grant. He has extensive experience in the control, planning, estimation, and machine learning of aerial robotic systems by working with Prof. Davide Scaramuzza, Prof. Antonio Franchi, and Prof. Guido de Croon. He’s the winner of the Best Paper Award of Robotics and Automation Letters (RAL) and the NASA Tech Brief award. He has supervised over 20 MSc students, and three of them won CumLaude respectively in TU Delft and ETH / Zurich.