

Day 1 - Perception for Aerial Robotics

| Time | Speaker | Topic | Short Abstract |
|-------|--|---|--|
| 08:30 | | Summer School Intro | |
| 08:45 | Dr. Helen Oleynikova Senior Researcher, Autonomous Systems Lab, ETH | 3D Perception for Planning on-board aerial robots | For drones, every gram counts, which limits the amount of compute power they can carry on-board. However, collision avoidance and perception of 3D, potentially cluttered environments is very important for fast-moving robots: how can we balance these two needs? How can drones perceive their environments in high enough detail to do collision avoidance, and with low enough computational cost to run on-board? |
| 09:30 | | Coffee break | |
| 10:00 | Marco Antonio Montes Grova Senior Perception & AI Engineer, CATEC | Aerial Robots Application for Inspection and Maintenance in GNSS-Denied Industrial Environment and Civil Infrastructures | Robotics solutions for inspection and maintenance tasks increase efficiency as well as safety for human workers. During this talk, we will discuss different use cases of aerial robots for industrial inspection and maintenance applications, where a reliable GNSS signal is not available. We will analyze perception algorithms for these use cases, focusing on real-time solutions running on on-board computers, necessary for aerial autonomous inspection tasks. |
| 11:00 | | Camera Theory | Camera Theory Basics: Pinhole camera model and conversion from image plane to 3D coordinates |
| 11:30 | | Lunch Break | |
| 12:30 | Qi Zhang PhD Student, Tampere University Antonia Hüfner PhD Student, ASL, ETH | Target detection using classical Computer Vision methods | Lecture with Exercises |
| 13:15 | Andrea Berra PhD Student, CATEC Riccardo Franceschini PhD Student, EURECAT | Intro to ROS - Part 1 | Lecture with Exercises |
| 14:30 | | Coffee break | |
| 14:45 | Andrea Berra PhD Student, CATEC Riccardo Franceschini PhD Student, EURECAT | Intro to ROS - Part 2 | Lecture with Exercises |
| 15:45 | Kashita Niranjana Udayanga PhD Student, DTU | Target detection using Deep Learning | Lecture with Exercises |
| 16:45 | | Final Remarks | |
| 18:30 | | Social Dinner: Self-Paid, MEZEDOSCHOLEIO https://maps.app.goo.gl/MuLHkBeT3F4g258fA | |

Day 2 - Control for Aerial Robotics

| Time | Speaker | Topic | Short Abstract |
|---------------|--|--|--|
| 08:30 | | Day Introduction | |
| 08:35 | Dr. Carlos de Cos Education Customer Success Engineer, Mathworks | Aerial Robotics Simulation in MATLAB & Simulink: From Simscape to Unreal Engine | Simulation plays an essential role in the development of control algorithms for aerial robots. In this session, we will dive into the latest updates from MathWorks to simulate aerial robots dealing with complex environments with physical interaction or realistic lighting. We will start with the physics-based simulations in Simscape Multibody, which allows us to assemble simple subsystems and model their contact interaction with external entities. Later, we will explore how we can co-simulate UAVs in Simulink with Unreal Engine, providing realistic visual feedback that we can use to develop a visual-based control strategy, and we will discuss how Unreal Engine 5 support in R2024a will impact this workflow. |
| 10:15 | | Coffee break (30 minutes) | |
| 10:45 | Dr. Thomas Stastny Senior Researcher, Autonomous Systems Lab, ETH | Exploring the Challenges and Realities of Aerial Field Robotics | Join us for a dive into field robotics with the Aerial Robotics Group at the Autonomous Systems Lab. We'll discuss the practical challenges and lessons learned from projects spanning Greenland's glaciers, the Swiss Alps, and Ukrainian farms, with topics including aerial photogrammetry, agricultural monitoring, and hybrid vehicle control. Through insights into sensing, modeling, control, and path planning, we'll explore the realities of deploying autonomous aerial robots in the wild. |
| 11:45 | | Quick Break (5 minutes) | |
| 11:50 | Tong Hui PhD Student, DTU Antonio Gonzalez Morgado PhD Student, Seville University | Eyes in the Sky: Visual Servoing for Enhanced UAV Performance | This presentation provides an overview of visual servoing and its applications in Unmanned Aerial Vehicles (UAVs). It covers the background, state of the art, and future prospects of visual servoing, including sensor technologies, methods, and real-world use cases in UAV navigation and control. |
| 12:20 | | Lunch Break (1 hour) | |
| 13:20 | Fernando Ruiz Vincueria PhD Student, Seville University Hameed Ullah PhD Student, Naples University | Connecting Simulink and ROS | Lecture with Exercises |
| 14:05 | | Quick Break (10 minutes) | |
| 14:15 | Fernando Ruiz Vincueria PhD Student, Seville University Hameed Ullah PhD Student, Naples University | Using Simulink to control an Aerial Robot in Gazebo | Lecture with Exercises |
| 15:15 | | Coffee break (15 minutes) | |
| 15:30 | Eugenio Cuniato PhD Student, ASL, ETH Fernando Ruiz Vincueria PhD Student, Seville University | Implementing a Visual Servoing Controller | Lecture with Exercises |
| 17:00 | | Final Remarks | |
| 19:15 - 20:30 | | Sunset Boat Trip Bring a swimsuit! Meeting point: 19:15: Chania Boat Trips: https://maps.app.goo.gl/acJ2syVkk2MkFTia6 | |

Day 3 - Teleoperation and haptics

| Time | Speaker | Topic | Short Abstract |
|-------|---|--|--|
| 08:30 | | Day Introduction | Present the topic of the day |
| 08:45 | Viswa Narayanan Sankaranarayanan PhD Student, Luleå University Achilleas Santi Seisa PhD Student, Luleå University Gerasimos Damigos PhD Student, Ericsson AB | Presentation: Network Controlled Systems | The focus of this presentation is on network controlled systems such as remote teleoperation and control |
| 09:15 | Viswa Narayanan Sankaranarayanan PhD Student, Luleå University Achilleas Santi Seisa PhD Student, Luleå University Gerasimos Damigos PhD Student, Ericsson AB | Tutorial 1 - Exercise 1 | Implementation of UAV velocity controller |
| 10:00 | | Coffee break (30 minutes) | |
| 10:30 | Viswa Narayanan Sankaranarayanan PhD Student, Luleå University Achilleas Santi Seisa PhD Student, Luleå University Gerasimos Damigos PhD Student, Ericsson AB | Tutorial 1 - Exercise 2 | Implementation of keyboard interface for teleoperation |
| 11:00 | Viswa Narayanan Sankaranarayanan PhD Student, Luleå University Achilleas Santi Seisa PhD Student, Luleå University Gerasimos Damigos PhD Student, Ericsson AB | Tutorial 1 - Exercise 3 | Position prediction for communication delay compensation |
| 12:00 | Viswa Narayanan Sankaranarayanan PhD Student, Luleå University Achilleas Santi Seisa PhD Student, Luleå University Gerasimos Damigos PhD Student, Ericsson AB | Tutorial 1 - Conclusions | Server-client environment for teleoperation and remote control |
| 12:15 | | Lunch Break (1 hr 15 min) | |
| 13:30 | Manuel Fernandez Gonzalez PhD Student, DTU Julien Mellet PhD Student, Naples University | Presentation: Haptics | How to interface operator with aerial manipulators? |
| 13:45 | Manuel Fernandez Gonzalez PhD Student, DTU Julien Mellet PhD Student, Naples University | Tutorial 2 | How to interface operator with aerial manipulators - tutorial |
| 15:00 | | Final Remarks | AERO-TRAIN Summer School Grand Finale :) |