#3 Research Option Description

Doctoral Course	**Industrial Engineering**
Department name	Department of Industrial Engineering
Research topic A	Industry 4.0 and industrial bioengineering
Research option	Development and experimental validation of an aerial manipulator with enhanced grasping precision
Supervisor	Silvio COCUZZA (silvio.cocuzza@unipd.it)
Webpage	https://sciprofiles.com/profile/794657 https://www.dii.unipd.it/en/mmsa https://orcid.org/0000-0001-9746-4642 https://scholar.google.it/citations?user=uvUiyMcAAAAJ&hl=en
Context of the research activity and objectives	Aerial manipulators (i.e., rotary-wing Unmanned Aerial Vehicles (UAV) augmented with a robot manipulator) have many important applications in industrial environment, for example in logistics and for inspection & maintenance of machinery in hazardous environments. The precise positioning and control of the end-effector of the robot for grasping and precise manipulation is very challenging, due to the coupled kinematics and dynamics of UAV and robot. In this research, a dynamically balanced aerial manipulator will be developed and experimentally validated. The robot arm configuration and control will be optimized concurrently in order to minimize the reactions transferred by the arm to the UAV. Open/closed chain robots, and cable-driven and hyper-redundant manipulators will be investigated. The developed experimental prototype will be validated through an extensive testing campaign.
Infrastructures	Automation and Robotics Labs, Mechatronics Lab, Mechanical Vibrations Lab, Modal Analysis Lab (University of Padova). Robotics and Mechatronics Labs (TU Delft, University of York, Queen Mary University of London).
Skills and competencies for the development of the activity	Knowledge of kinematics and dynamics of machinery and/or robots. Basic knowledge of mechanical design and control systems.
Training offer	Training courses of the PhD Course in Industrial Engineering (Univ. of Padova): Collaborative robotics: the future of smart manufacturing (8 hours); Vibration Energy Harvesting (8 hours). Master's Degree Courses (Univ. of Padova): 1. Industrial Robotics (72 hours) https://en.didattica.unipd.it/off/2020/LM/IN/IN2547/001PD/INQ0091301/N0 2. Modeling and Simulation of Mechanical Systems (48 hours) https://en.didattica.unipd.it/off/2020/LM/IN/IN0518/000ZZ/INO2044864/N0
Possible Secondments	Academic (3 months): TU Delft (NL), University of York (UK), Queen Mary University of London (UK). Non-academic (3 months): Sonsub – ENI Group (I/UK), Horus Dynamics (I).