



PhD in INGEGNERIA AEROSPAZIALE / AEROSPACE ENGINEERING - 39th cycle

**PARTENARIATO PNRR Research Field: GUIDANCE, NAVIGATION AND CONTROL OF VTOL
UAVS**

Monthly net income of PhDscholarship (max 36 months)

€ 1400.0

In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity

Motivation and objectives of the research in this field

A wide range of civil applications of drones require platforms capable of fixed-wing-like operation and vertical take-off and landing. Such performance cannot be provided by conventional multirotor platforms but only by VTOL ones, which however pose significant challenges from the point of view of guidance, navigation and control, still partially open in the literature. The aim of this project is to define an integrated and systematic development process for the guidance, navigation and control systems of VTOL drones, to face requirement specifications corresponding to current needs in last-mile delivery and infrastructure inspection applications. The scope of this project embraces: modelling and identification of the dynamics of VTOL UAVs; development of detailed simulation tools to support the design, verification and validation of GNC systems; development of systematic analysis and design methods for such systems; verification in controlled conditions, using the FlyART facility of Politecnico di Milano; in-field validation in representative application scenarios.

Borsa parzialmente coperta da fondi PNRR Centro Nazionale della Mobilità Sostenibile (CUP D43C22001180001)

Methods and techniques that will be developed and used to carry out the research

The candidate will first develop the skills required to perform the project, building on pre-existing competences of control theory and control engineering, robot control,



	of control theory and control engineering, robot control, drone flight dynamics, and the related mathematical methodologies.
Educational objectives	The candidate will develop skills in control theory and control engineering, robot control, drone flight dynamics, and in general in all disciplines that characterize the dynamics and control of VTOL drones. In addition, by working in a mixed and vibrant academic and industrial context, the candidate will have the opportunity to learn on the job several transferable skills, including communication skills, team working, leadership, ethical aspects associated with the use of innovative technologies. In support of this, the PhD School of Politecnico di Milano provides a complete and rather diverse offer of courses. Each candidate must include in their syllabus at least 10 ECTS in transferable skills, to complement at least other 5 ECTS in technical disciplines associated with Aerospace Engineering, for a total of at least 20 ECTS.
Job opportunities	The candidates will find natural opportunities in the national, European and worldwide drone industry in a sector that is currently growing very rapidly. At the national level strong competitiveness is needed to position the the national industry at the top-level role. The candidates may also find opportunities in numerous other high-tech industrial fields, in which competences in dynamics, control, aeromechanics and optimization, as well as experience gathered in the integrated design of complex systems play a fundamental role, centered on but not limited to industrial engineering.
Composition of the research group	13 Full Professors 0 Associated Professors 1 Assistant Professors 5 PhD Students
Name of the research directors	Prof. Marco Lovera

Contacts

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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
The PhD candidate will receive a desk, possibly through a hot-desking procedure, and a personal computer, if needed. Apart from the compulsory ones, the PhD candidate will have the opportunity to follow additional courses and receive economic support to attend summer schools and participate in conferences. There will be the possibility of paid teaching assistantship.