



PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 39th cycle

Research Area n. 3 - Systems and Control

THEMATIC Research Field: FIRST-STAGE AUTONOMOUS FLIGHT CONTROL IN A SPACE LAUNCHER

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

The launch vehicle reusability is the one of the most effective ways to reduce the costs to access to space but at the same time remains a great technical challenge for the European aerospace industry when compared with the US companies (SpaceX, Blue Origin). One of the challenges lies in the recovery of the vehicle first stage through a powered-landing phase which must enable an accurate and soft landing with reduced fuel margins and dispersions. Therefore, GNC strategy and algorithms play a fundamental role. While state-of-the-art solutions for Navigation and Control problems can be applied, namely, hybrid navigation techniques and robust control, for the powered descent guidance problem novel techniques are required to enable on-board optimization necessary to achieve the landing accuracy required to safely recover the first stage. The objective of the research activity is to develop the appropriate, based on an end-to-end approach, GNC strategy and algorithms to be used for a Two Stage to Orbit (TSTO) flight demonstrator.

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

- Review and assessment of the reference literature and available design/experimental data.
- Definition of the more appropriate GNC strategy, mathematical models, algorithms, computational framework and numerical set up for the specific



	application, also referring to similar and notable non-aerospace applications. - Development of control strategies and algorithms. - Validation of different case studies in simulation. - Elaboration of Papers/Articles to be published in the appropriate Journals.
Educational objectives	Knowledge and understanding. The Ph.D. candidate will learn: - The principles of vehicle dynamics of Two Stage to Orbit (TSTO) launchers - The principles of a control system for the powered-landing of the first stage of the launcher - Applying knowledge and understanding. The Ph.D. candidate will be able to apply space-vehicle control systems to different case studies - Critical assessments. The Ph.D. candidate will learn how to identify crucial aspect of space navigation and control - Communication: the PhD Candidate will learn how to communicate the results of the Ph.D. research presenting results analysis in a scientific context and policy brief to decision-makers.
Job opportunities	This research activity will qualify the candidate for future academic and research positions, as well as for a highly qualified professional career in industries or organizations.
Composition of the research group	0 Full Professors 3 Associated Professors 0 Assistant Professors 30 PhD Students
Name of the research directors	Proff. Savaresi; Corno; Panzani

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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)	1st year	2nd year	3rd year
	2500.0 € per student	2500.0 € per student	2500.0 € per student
	max number of financial aid available: 1, given in order of merit ..		

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
Premiality: Premialities will be recognized to the PhD candidate. Up to 1400 euro (gross amount) after the completion of the 1st year; up to 2200 euro (gross amount) after the completion of the 2nd year; Up to 3000 euro (gross amount) after the completion of the 3rd year. The premialities will be assigned provided that she/he demonstrates a significant contribution to the growth of scientific excellence, the industrial valorization of research, the networking and communication activities of the Department. EDUCATIONAL ACTIVITIES (purchase of study books and material, including computers, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student. TEACHING ASSISTANTSHIP: availability of funding in recognition of supporting teaching activities by the PhD student. There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations. COMPUTER AVAILABILITY: individual use. DESK AVAILABILITY: individual use