

PhD in Aerospace Engineering

Description of the PhD Programme

The PhD program in Aerospace Engineering aims at the acquisition of the high level competence in the aerospace field required to carry out innovative research and/or advanced applications in universities, industries, public or private research centers, service companies. The level of the course allows the graduates to compete in a European and international environment. Over the years the PhD students have developed researches relevant to aircraft, rotorcraft and space applications, but also to technical areas not strictly related to the aerospace field. Example of PhD thesis topics are in:

- Computational and experimental fluid mechanics.
- Aeroservoelasticity, dynamic and control of aerospace structures.
- Flight mechanics and flight control.
- Passive structural safety of both aerospace and non-aerospace vehicles.
- Space missions analysis and design.
- Orbital mechanics and control
- Space debris
- Planetary protection
- Space situation awareness
- Innovative materials and structures design and testing.
- Advanced rotors
- Mathematical modelling and simulation
- Airworthiness and certification
- Space propulsion
- Wind turbines

The PhD program is hosted at the Department of Aerospace Science and Technology of Politecnico di Milano.

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Info about program rules are available at the following web-page:

<http://www.dottorato.polimi.it/en/during-your-phd/regulations/>

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Research Area n. 1 - Aerospace Engineering

Specific Research Subject: Space trajectory optimisation in perturbed environment

Scholarships and Financial support – Departmental scholarships	
Monthly net income of PhD scholarship (max 36 months)	€ 1.200,00
Number of scholarships	1
Deadline for applications	15/09/2016
Beginning of PhD	01/11/2016
Context of the research activity	
Motivations and objectives of the research in this field	Spacecraft and space debris orbit evolution around the Earth, planets and small bodies shows a very interesting behaviour under the effects of natural orbit perturbations such as solar radiation pressure, third body perturbations, or irregularity of the gravity field. Semi-analytical techniques and dynamical system theory can be applied to describe the long-term evolution of the orbit and study the existence of long-term stable orbits or unstable conditions. A recent study funded by the FP7 EU framework in the Marie Skłodowska-Curie Actions, within the “Space Debris, Evolution, Collision Risk and Mitigation” project has developed the PlanODyn tool, based on semi-analytical techniques, for long-term propagation under the effect of perturbations.
Methods and techniques that will be developed and used to carry out the research	<p>Within this PhD project we will leverage the dynamics of natural orbit perturbations to reduce the high mission cost and create new opportunities for space exploration and exploitation. This project will develop techniques for trajectory optimisation and design under the effect of orbit perturbations for the application to end-of-life mission design, asteroid missions, interplanetary missions and low-thrust trajectory design. Optimal control techniques will be investigated to exploit and enhance the complex perturbed orbital dynamics. Branching optimisation techniques will be also used for interplanetary trajectory planning. Mission scenarios will be Earth centred orbits, mission to asteroids and interplanetary.</p> <p>The PhD programme is open to candidates with a background in Aerospace Engineering, Applied Maths, Computational Engineering or Control Engineering. Analytical, numerical and programming skills are required.</p>
Educational objectives	The main educational objectives concern the achievements of capabilities in the development of techniques for trajectory propagation and mission analysis and design. These skills include numerical methods, orbital dynamics, programming, control and optimisation.
Job opportunities	Job opportunities are identified in the fields of mission analysis, flight dynamics, navigation, space situation awareness, control engineering.
Composition of the research group	Number of Full Professors: 1 Number of Associate Professors: 3 Number of Assistant Professors: 3
Names of the research director	Dr. Camilla Colombo
E-mail address, phone number and web-page	camilla.colombo@polimi.it
List of Universities, Companies, Agencies and/or National or International	European Research Council through the ERC Starting Grant 2015 COMPASS

Institutions that are cooperating in the research	
Additional support	
<u>Educational activities:</u> financial aid per PhD student per year	1 st year: max € 0 per student 2 nd year: max € 1370 per student 3 rd year: max € 1370 per student Additional travel funding are available within the research group.
<u>Teaching assistantship:</u> availability of funding in recognition of supporting teaching activities by the PhD student	There is the possibility to get 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.
<u>Computer availability:</u>	Individual personal computer and access to world-class high-performance computing, if necessary.
<u>Desk availability:</u>	1 st year: <i>individual use</i> 2 nd year: <i>individual use</i> 3 rd year: <i>individual use</i>