
**PhD School - Politecnico di Milano**

**Regulations of the PhD Programme in:**

***Aerospace Engineering***

**Cycle XXXVIII**

# 1 General information

PhD School - Politecnico di Milano

PhD Programme: **Aerospace Engineering**

Course start: November 2022

Location of the PhD Programme: Milano Bovisa

Department promoting the PhD programme: Aerospace Science and Technology

Scientific Disciplinary Sectors:

- ING-IND/03 Flight Mechanics
- ING-IND/04 Aerospace Structures and Design
- ING-IND/05 Aerospace Equipment and Systems
- ING-IND/06 Fluid Dynamics
- ING-IND/07 Aerospace Propulsion
- ING-IND/08 Fluid Machines
- FIS/01 Experimental Physics

PhD School Website: http://www.polimi.it/phd/

PhD Programme Website: http://www.aero.polimi.it/education/phd-in-aerospace-engineering/

E-mail: phd-daer@polimi.it

# 2 General presentation

The PhD Programme in Aerospace Engineering aims at educating students and creating world-class researchers in all the main technological disciplines of the aerospace field, but not limited to it, preparing them for tomorrow's scientific and technical challenges, but also for cultural, societal, and environmental ones. The Programme is proposed by the Department of Aerospace Science and Technology (DAER) and is part of the PhD School of the Politecnico di Milano.

The PhD Programme covers a wide range of topics related to Aerospace Engineering. Based on classical aerospace disciplines such as, for example, Aerodynamics and Fluid Mechanics, Structures and Materials, Flight Mechanics and Control, the Programme includes emerging disciplines requiring an enhanced multidisciplinary approach such as rotary wing aircraft, electric airplanes, drones, innovative materials and structures, space mission design, space trajectory design, space situation awareness, innovative propulsion technologies, advanced fluid dynamics, etc. Several problems considered require the understanding of the underlying physical processes, integration of multiple disciplines, the effective use of sophisticated mathematical models and of numerical and experimental methods. Successful programme graduates are expected to be able to conduct and manage original, cutting-edge research in the aerospace science and technology domain, with the ability to rapidly move to neighbouring areas, such as wind energy, fixed-wing and automotive engineering, data analytics, human-machine interaction, Earth observation, and other related high-tech engineering fields. Indeed, over the years PhD students in Aerospace Engineering have developed research relevant to aircraft and space applications but also to technical areas not strictly related to the aerospace field.

Examples of research topics in which PhD theses have been recently developed are:

- Computational and experimental fluid mechanics;
- Passive and active control of turbulence;
- Aeroservoelasticity, dynamics and control of aerospace structures;
- Passive structural safety of both aerospace and non-aerospace vehicles;
- Space missions analysis and planning;
- Space trajectory design and control;
- Space economy;
- Distributed spacecraft missions;
- Space situational awareness;
- Advanced materials and structures: design and testing;
- Innovative space propulsion systems;
- Identification, dynamic and control of complex systems;
- Mechatronics;
- Advanced rotors;
- Maintenance-based design;
- Mathematical modelling and simulation;
- Software development;
- Artificial intelligence application to the aerospace sector;
- Airworthiness and certification;

- Design and control of wind turbines

The PhD course is run by a designated Coordinator and a Faculty Board. The Coordinator chairs the Faculty Board, coordinates the preparation of the annual Educational Programme, and organises the general educational activities of the PhD course (see Attachment A1). The Faculty Board is responsible for the Educational programme and for teaching and administrative activities related to the PhD course (see Attachment A2).

# 3 Objectives

The aim of the PhD programme is the acquisition of the high level of competence required to carry out innovative research and/or state of the art advanced applications in industries, start-ups, research centres, Universities and service companies operating in the aerospace industrial and research area, including all fields having any connection with aerospace. The level of the programme allow graduates to highly compete in both the European and International aerospace environment.

# 4 Professional opportunities and job market

Due to the breadth and interdisciplinary nature of the aerospace arena, the professional skills attainable span a wide area and are not limited to just a few specific topics. The PhD therefore aims to create high level specialists in most domains related to aerospace activities.
In such context, a high level of competence can be gained either in a single subject or in the integration of multiple subjects such as: dynamics and control, fluid mechanics, systems and equipment, flight mechanics, passive structural safety, intelligent and automated systems, structures and materials, aeroservoelasticity.
In this light, a number of examples of professional skills acquired during the past 30 years of the PhD programme are provided below:

1) expert in computational and/or experimental fluid mechanics, with capabilities to develop methods and models for both aerospace applications and generic vehicles;
2) expert in active and passive control of the dynamics of aerospace structures, integrating global and subsystem design;
3) expert in active and passive safety of vehicles, both aerospace and non-aerospace;
4) expert in vibration and noise control, including modelling, analysis, system design and implementation of specific subsystems;
5) expert in the dynamics and control of aerospace vehicles and related operational missions;
6) expert in integrated design of complex aerospace systems.
7) expert in space propulsion development and control
8) expert in space mission analysis and design, spacecraft design, flight dynamics engineer
9) expert in spaced debris modelling
10) expert in drone design and applications

The possible employment positions for graduates can be inferred from past experience and include:

- highly qualified activities in spin-off companies and/or small and medium high technology enterprises;
- research in public institutions, e.g.: Italian or foreign Universities;
- management of research in medium and large industries.

# 5 Enrolment

## 5.1 Admission requirements

Italian and International citizens can apply. They are requested to have graduated in accordance with the pre-existing laws D.M. 3.11.1999 n. 509, or to have a Master of Science degree in accordance with D.M. 3.11.1999 n. 509, or a Master of Science in accordance with D.M. 22.10.2004 n. 270, or similar academic title obtained abroad, equivalent for duration and content to the Italian title, with an overall duration of university studies of at least five years.
The certified knowledge of the English language is a requirement for admission. Please refer to the PhD School website for details. The admission to the programmes will be established according to the evaluation of the candidates' curricula, motivation letters, and an illustrative report about the development of a possible PhD research, which candidates will send contextually with their application to the admission announcement.

## 5.2 Admission deadlines and number of places available

The number of positions is indicated in the Call for admission to the 38$^{th}$ PhD cycle Programmes: http://www.polimi.it/phd
Scholarships both on general and on specific themes are available, in accordance with what is specified in the call for admission.

# 6 Contents

## 6.1 Requirements for the PhD title achievement

The achievement of the PhD title in Aerospace Engineering requires a study and research activity of at least three years equivalent of full-time study, research and development of PhD thesis.

PhD candidates in Aerospace Engineering must earn **a minimum of 20 credits** from PhD level courses (see Section 6.3 below) and to continuously conduct studies and research.

The Faculty Board identifies one of its members to act as “tutor” (academic co-supervisor). The role of this tutor is to assist them in the overall training programme and support the representation of their instances in case of contrast with the supervisor, acting as their “ombudsman”, or first point of contact for addressing issues. Along with the supervisor, the tutor supports the candidate in the choice of courses to be included in the study plan, which is eventually submitted for approval to the Coordinator of the PhD Programme (see also Section 6.4 below). The Faculty Board may assign extra course credits to one or more candidates in case they need to complete their preparation in specific topics, relevant for their research projects. In addition to the above requirements, the PhD candidates must complete,

during the program, *at least one* of the following activities:

1. present a paper, as co-author, at an International Conference
2. submit a manuscript, as co-author, to an International Peer-reviewed Journal

In case none of these objectives is met, the candidate and the supervisor must justify it in front of the Faculty Board.

## 6.2 Research development

The main aim of all Politecnico di Milano PhD programmes is the development in the candidates of a research-oriented mind-set, with expertise and skills in a specific research topic. To this end, candidates develop a problem-solving capability in complex contexts, including the capacity of performing in-depth analysis of the problem, identifying original solutions, and evaluating their applicability in practical contexts. These skills provide PhD candidates with major opportunities of development in their research both in the academic field and in public and private organisations.
PhD candidates are requested to develop an original research contribution. The PhD thesis must thus contribute to increasing the knowledge in the candidate's research field. Besides, it must be coherent with the research topics developed in the Department where the PhD Programme is carried out. The original research results are collected in the PhD thesis, where the candidate's contribution is put in perspective with respect to the research state of the art in the specific research field.
The PhD research is developed under the guidance of a supervisor, who supports the candidate in the setting-out and in the everyday activities related to their thesis development. The supervisor is not necessarily a member of the Faculty Board and may also belong to an institution other than Politecnico di Milano. The supervisor can be supported by one or more co-supervisors.
Further activities intended to develop the candidate's personal skills and research expertise are encouraged during the PhD path. Candidates must acquire the capability to present and discuss their work in their research community. Consequently, both the participation to international conferences and the publication of the research results in in peer-reviewed journals, in accordance with internal procedures, are encouraged (see requirements in Section 6.1).
The PhD programme favours the candidates' research interactions with other groups in their research field, preferably abroad. Research visits of at least three months are strongly encouraged, as through them the candidates may acquire further skills to develop their research work and thesis (such internships may be required for some specific grants). The duration of the programme is normally three years.

## 6.3 Objectives and general framework of the teaching activities

The PhD Programmes and the PhD School activate teaching forms of different kind and credit value, including courses, seminars, project workshops, laboratories. Teaching activities both cover basic research issues (problems, theories, methods), which represent the founding element of the PhD Programme and identify clearly its cultural position and deepening in a specialist way some research issues connected with the problems developed in the theses.
Lessons are usually in English, except when indicated otherwise. The PhD programme includes at least one complete path delivered in English language.
Structured teaching activities allow to earn ECTS credits. Other activities, typically specialised and for

which it is difficult to evaluate the learning and its quantification, fall within the scientific activities of which the Faculty Board considers in the overall evaluation, but they do not allow to earn ECTS.

Courses and activities are developed as follows:

1. **Main courses**: they are designed to develop PhD students' expertise in structuring research programmes in the area of their thesis. These courses should be attended in the first two years (mainly in the first year) to refine tools and methods to fully develop high-level research in the last part of the PhD period.
2. **Other activities**: internships, external courses (held by companies or other institutions), national and international seminars, conferences and workshops, participation in national and international research projects, scientific paper writing and paper presentations on research results, support to teaching activities.
3. **Development of the PhD thesis**: all thesis related activities.

A typical scheduling of PhD activity is given in Figure 1.

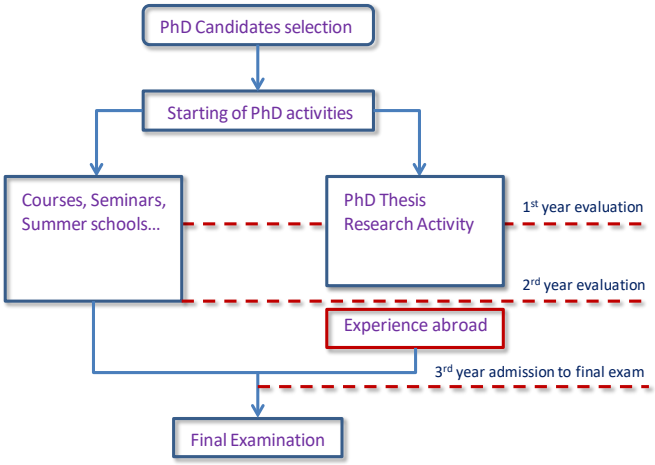


*Figure 1. PhD activity schedule.*

Among the 20 credits required, **at least 10 credits** of doctoral level must be acquired through PhD School Courses (Type A), **at least 5 credits** from PhD courses characterising the PhD program in Aerospace Engineering (Type B) and the remaining 5 or less credits may be acquired through external PhD courses, e.g. from other PhD programmes (Type C). All the mentioned courses foresee an evaluation of the PhD student to acquire the corresponding credits. Master of Science courses may be inserted in the curriculum of the student, in agreement with the Supervisor (see below) and the Tutor, but do not contribute to the acquisition of credits.

Table 1 shows the foreseen path for candidates and refer only to coursework activities. At the same time, the programme foresees that the candidate is devoted to research activity in a continuous way, following the guidelines of their supervisors and of the Faculty Board.

*First/Second Year (proposed structure to be personalised)*

*Table 1. PhD credits and courses.*

| Courses | Reference to following tables | Number of credits (min-max) | Note |
|---|---|---|---|
| PhD School Courses | A | Min 10 | See: http://www.dottorato.polimi.it/en/during-your-phd/phd-school-courses/ |
| Courses characterising the PhD Programme | B | Min 5 | These must be selected from the PhD courses offered by the PhD Programme in Aerospace Engineering. |
| Other PhD Courses | | | These should be selected on topics connected with the research subject from PhD courses offered by the Politecnico di Milano and/or other Universities, subject to approval of the Faculty Board. |

*Second and Third year*

In the second half of the second year and during the whole of the third year the candidate should be devoted entirely to research and development of the PhD thesis.

**PhD Course List**

The PhD School of Politecnico di Milano proposes a set of courses aiming to train the PhD candidates in soft and transferable skills. The skills and abilities provided by these courses are expected to help candidates across different areas of their career to respond to the rapidly evolving needs of the global economy and society at large. The PhD School courses activated for the 2022-2023 Academic Year are summarised in Table 2.

Table 2. PhD school courses.

| Course name | Professor |
|---|---|
| Strengthening Critical Spatial Thinking | Armondi Simonetta |
| English for Academic Communication | Biscari Paolo |
| Industrial Skills | Biscari Paolo |
| Scientific Communication in English | Biscari Paolo |
| Innovative Teaching Skills | Brunetto Domenico |
| Creative Design Thinking | Canina Maria Rita |
| European Culture | Cardilli Lorenzo |
| Professional Communication | Di Blas Nicoletta |
| Project Management Basics | Fuggetta Alfonso |
| The Copernicus Green Revolution for Sustainable Development | Oxoli Daniele |
| Power of Images and Visual Communication for Research Dissemination | Iarossi Maria Pompeiana |

| | |
|---|---|
| Ethical Aspects of Research on Dual-Use Technologies | Masarati Pierangelo |
| Research Communication. Issue mapping: exploring public debates surrounding academic topics | Mauri Michele |
| Sulla responsabilità tecnica | Ossi Paolo Maria |
| How to support Complex decisions: Approaches and Tools | Oppio Alessandra |
| La comunicazione nella Scienza | Paganoni Anna Maria |
| Practicing Research Collaboration | Pizzocaro Silvia Luisa |
| Science, Technology, Society and Wikipedia | Raos Guido |
| Teaching Methodologies, Strategies and Styles | Sancassani Susanna |
| Research Skills | Sciuto Donatella |
| Introduction to Academic Research | Volonte' Paolo Gaetano |
| Project Management (In Action) | Mancini Mauro |
| Cognitive biases and discriminations: implications, risks and opportunities | Tanelli Mara |
| Approaches to Resilience: Social, Economic, Environmental and Technological Challenges of Contemporary Human Settlements Modeling and Automated Verification of Real-Time Systems | Balducci Alessandro |

As already mentioned, at least **10 of the 20 course credits** that each candidate is required to earn **shall be obtained through soft and transferable skills courses** organized by the PhD School.

The Aerospace Science and Technology Department organises specific courses (Table 3), characterising the PhD program in Aerospace Engineering. Courses proposed in cooperation with other departments may be included as well in the PhD program in Aerospace Engineering. The acquisition of **at least 5 credits** is **mandatory among the PhD courses characterising the PhD Programme**. The courses scheduled for the 2022-23 academic year are listed in Table 3.

*Table 3. PhD courses characterising the PhD Programme.*

| SSD | Name of Course | Professor | Semester | Language | Credits |
|---|---|---|---|---|---|
| ING-IND /05 | Advanced Aerospace Control | D. Invernizzi | 2nd semester | English | 5 |
| ING-IND /04 | Advanced Materials for Aeronautical and Space Applications | A. M. Grande | 2nd semester | English | 5 |
| ING-IND /06 | Aerodynamics and Aeroacustics of Rotors | L. Vigevano | 2nd semester | English | 5 |
| ING-IND /06 | Applied Computational Fluid Dynamics | F. Auteri | 2nd semester | English | 5 |
| ING-IND /04 | Multibody System Dynamics | P. Masarati / F. Cheli | 2nd semester | English | 5 |
| ING-IND /04 | The Advanced Air Mobility Revolution | G. Quaranta | 2nd semester | English | 5 |

| | | | | | |
|---|---|---|---|---|---|
| ING-IND /04 | Mechanics of Elastic Solids | M. Morandini | 2nd semester | English | 5 |
| ING-IND /05 | Nonlinear Optimal Control | F. Topputo | 2nd semester | English | 5 |
| ING-IND /04 | Technologies for Smart Aerospace Structures | G. Sala | 1st semester | English | 10 |

**Preparatory courses**

If the supervisor and the tutor find it useful or necessary, that the candidate attends preparatory courses (chosen among the courses activated at the Politecnico di Milano) the Faculty Board of the PhD programme may assign some extra-credits to be acquired to complete the training path. The credits acquired in this way will be considered as additional, in relation to the mandatory credits to be acquired with the PhD courses.

**Specialistic courses long-training seminars**

The attendance of Specialist Courses, Workshops, Schools, Seminars cycles is strongly encouraged and (if these seminars, workshops are certified and evaluated) may permit to acquire credits according to the modalities established by the Faculty Board and previous approval of the study plan submitted by the candidate. These courses and workshops can be inserted in the study plan, even if they are not evaluated (and therefore not qualified as credits), as optional "additional teaching".

## 6.4 Presentation of the study plan

PhD candidates must submit a study plan, which may be revised periodically (approximately every three months), to align them to possible changes in the course list, or to needs motivated by the development of their PhD career. The study plans must be approved by the PhD programme Coordinator, according to the modalities established by the Faculty Board of the PhD Programme itself.

## 6.5 Yearly evaluations

Candidates present their work to the Faculty Board at least once a year. In particular, the candidates must pass an annual evaluation to be admitted to the following PhD year. The third-year evaluation establishes the candidate's admission to the final PhD defence.

As a result of each annual evaluation, the candidates who pass the exam receive an evaluation (A/B/C/D) and may proceed with the enrolment at the following year. Candidates who do not pass the exam are qualified either as "Repeating candidate" (Er) or "not able to carry on with the PhD" (Ei). In the former case (Er), the candidates are allowed to repeat the PhD year at most once. The PhD scholarships – if any – **are suspended during the repetition year**. In the latter case (Ei) the candidates are excluded from the PhD programme and lose their scholarships – if any.

In case the Faculty Board holds appropriate to directly assign an exclusion evaluation (Ei) without a previous repetition year, the request must be properly motivated, and validated by the PhD School.

After the final year, candidates who have achieved sufficient results but need more time to draw up their theses, may obtain a prorogation of up to 12 months.

## 6.6 PhD thesis preparation

The main objective of the PhD career is the development of an original research contribute. The PhD thesis is expected to contribute to the advance of the knowledge in the candidate's research field. The PhD study and research work is carried out, full time, during the three years of the PhD course. Stages or study periods in (Italian or International) companies or external Institutions may complete the candidate's preparation. The resulting theses need to be coherent with the research issues developed in the Department where the PhD programme is developed.
The candidate must present an original thesis, discuss its contribution to the state of the art in the research field in the research community.
The PhD research is developed following the lead of a supervisor, who supports the candidate in the setting out and in the everyday activities regarding the thesis development. At the conclusion of the PhD studies, the Faculty Board evaluates the candidates. Candidates who receive a positive evaluation submit their theses to two external reviewers for refereeing. If the evaluation provided by the reviewers is positive (o after the revisions required by the external reviewers), the candidates defend their thesis in a final exam, in front of an examination Committee composed by three members (at least two of which must be external experts).

# 7 Laboratories, PhD Secretary Services

The Department of Aerospace Science and Technology is equipped with many experimental and research labs, including:

- Aerodynamics
- Composites and smart structures
- Crashworthiness
- Flight simulation
- Space systems
- Space propulsion
- Structural testing

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# 8 Internationalisation and other activities

A research period between three and six months to be spent at foreign universities, research laboratories and industries is not compulsory but strongly recommended for all PhD candidates. Politecnico di Milano supports joint PhD paths with International Institutions, as well as Joint and Double PhD programmes. Further information can be found on the PhD School and PhD programme websites.

More specifically, the PhD programme in Aerospace Engineering is actively participating in the following Marie-Curie European programs:

- coordinator of EJD program **NITROS** (Network for Innovative Training on ROtorcraft Safety), in collaboration with Delft University, University of Liverpool and University of Glasgow
- partner in ETN program **UTOPIAE** (Uncertainty Treatment and OPtimisation In Aerospace Engineering), in collaboration with University of Strathclyde, University of Durham, Ghent University
- partner in ETN program **STARDUST-R** (Stardust Reloaded), in collaboration with University of Strathclyde, Università degli Studi di Roma Tor Vergata, Universitatea Alexandru Ioan Cuza Din Iasi, Università di Pisa, Universidad Autonoma de Madrid, Academy of Athens, University of Belgrade, Technische Universiteit Delft
- partner in EID program **EDEM** (Experimentally Validated DNS and LES Approaches for Fuel Injection, Mixing and Combustion of Dual-Fuel Engines), in collaboration with City University of London, Friedrich-Alexander-Universität Erlangen-Nürnberg, Brunel University, Technische Universität München, Chalmers University of Technology
- partner in ETN program **FLOAWER** (FLOAting Wind Energy netwoRk), in collaboration with Centrale Nantes, Carl von Ossietzky Universität Oldenburg, University of Stuttgart, CNRS-LEGI - S. Barre, University College Cork, Norwegian University of Science and Technology - E. Bachynski, Technical University of Denmark, University of Rostock
- partner in ETN program **ASCenSIon** (Advancing Space Access Capabilities - Reusability and Multiple Satellite Injection), in collaboration with Università degli Studi di Roma La Sapienza, Universite Libre de Bruxelles, Hochschule Bremen, Università di Pisa, Technische Universitaet Braunschweig

and is associated with the ETN program **MIGRATE**, in collaboration with Karlsruher Institut fuer Technologie, University of Limerick, Università di Bologna, Institut National Des Sciences Appliquées de Toulouse and University of Thessaly, providing training and secondments.

It is also carrying out joint/double PhD programs with Beihang University, Istanbul Technical University, Nanjing University of Science and Technology, Technische Universiteit Delft, Universidade de São Paulo, University of Glasgow, University of Liverpool, Vrije Universiteit Brussel, Warsaw University of Technology, and Xi'an JiaoTong University, and more.

Interaction with and exposure to non-academic sectors provides significant benefits to doctoral candidates as well as to research and innovation intensive employment sectors. Direct exposure to the challenges and opportunities in non-academic sectors of the economy and society at large is fostered by networking, connectivity, inter-sectoral mobility, and wide access to knowledge. In particular, the PhD programme in Aerospace Engineering collaborates with several Research Agencies and Industrial

partners, including:

- D-Orbit Spa
- European Space Agency, ESA
- Italian Space Agency, ASI
- Istituto Nazionale di Astrofisica, INAF
- Leonardo SpA
- Eumetsat
- Italian Air Force

through the activation of thematic scholarships.

# Attachment A1 – PhD Programme Coordinator

Prof. Pierangelo Masarati CV

1996 degree in Aeronautical Engineering at Politecnico di Milano
1998 6 month internship at Army Research Laboratory, NASA LaRC
1999 2 month internship at Army Research Laboratory, NASA LaRC
2000 Ph.D. in Aerospace Engineering at Politecnico di Milano
2001-11 Ricercatore (Assistant Professor) at the Department of Aerospace Engineering of Politecnico di Milano
2010 Visiting Assistant Professor at the School of Energy Resources of the University of Wyoming
2011-16 Associate Professor at the Department of Aerospace Engineering of Politecnico di Milano
2016-ongoing Full Professor at the Department of Aerospace Science and Technology of Politecnico di Milano

2016-2018 Member of ASN for SC 09/A1
2018-ongoing Coordinator of the PhD programme in Aerospace Engineering
2022-ongoing Member of the executive board of the PhD School of Politecnico di Milano

Associate editor for the Aeronautical Journal, CEAS Aeronautical Journal, Multibody System Dynamics, the ASME Journal of Computational and Nonlinear Dynamics, the International Journal of Mechanical System Dynamics, and l'Aerotecnica, Missili & Spazio.

Member of the European Rotorcraft Forum International Committee (ERF-IC), Chairman of the Rotorcraft Technical Committee of CEAS and member of ASME's Multibody System and Nonlinear Dynamics Technical Committee (MSND-TC).

Research:

- development of algorithms and methods for the investigation of the dynamics of multibody/multidisciplinary systems, including aspects related to deformability, control, stability, interactional forces modeling, biomechanics, human-machine interaction, real-time simulation
- structural dynamics and aeroelasticity, with specific reference to aircraft and rotorcraft
- dynamics and control of vibrations, by means of classical and smart materials based techniques

Participation in several research projects, national and international, in cooperation with industries and research centers, including:

- ATTILA (tiltrotor aeroelasticity, H2020 Clean Sky 2, 2019-2023)
- RoCS (tiltrotor certification by simulation, H2020 Clean Sky 2, 2019-2022)
- NITROS - Network for innovative training on rotorcraft safety (Marie Skłodowska-Curie Action Joint European Doctorate on rotorcraft safety, 2016-2020)
- CROP (Cycloidal Rotor Optimized for Propulsion, PI, FP7, 2013-2014)

- “Real-time wing-vortex and pressure distribution estimation on wings via displacement and strains in unsteady and transitional flight conditions” (USAF, 2012-2016, PI, coordinator)
- GARTEUR HC EG-31 (conceptual design of helicopters, 2012-2013, coordinator)
- National relevance project “Aeroelastic Analysis of Wind-Turbines by Coupled Computational Fluid Dynamics/Multibody System Dynamics”, Ministry of Foreign Affairs, 2011 (PI, coordinator).
- ARISTOTEL (rotorcraft-pilot coupling, PI, FP7, 2010-2013)
- MAST/CTA (Micro-aerial vehicles, PI, with University of Maryland, since 2009)
- PRIN 2007 (man-machine interaction, PI, national coordinator, 2008-2010)
- NICETRIP (aeroelasticity of tiltrotors, FP6, 2006-2011)
- GARTEUR HC AG-16 (rotorcraft-pilot coupling, research unit coordinator, 2005-2008)
- FRIENDCOPTER (active control of helicopter blades, FP6, 2003-2008)
- ADYN (whirl flutter of tiltrotors, FP6, 2002-2006)
- cooperation with Siemens (multibody system dynamics, virtual sensing)
- cooperation with REpower System AG (aeroelasticity of wind turbines)
- cooperation with Leonardo Helicopters (formerly Finmeccanica Helicopters Division, AgustaWestland, and Agusta, dynamics and aeroservoelasticity of helicopters and tiltrotors)
- cooperation with NASA Langley and Army Research Laboratory (tiltrotor aeroelasticity)
- cooperation with Hutchinson CRC (multibody system dynamics)

# Attachment A2 – PhD Faculty Board

Description of the composition of the Faculty Board.

*Table 4. Faculty board.*

| Name | Affiliation | SSD |
|---|---|---|
| Pierangelo MASARATI (coordinator) | Full Prof. | ING-IND/04 |
| Antonella ABBÀ | Assistant Prof. | ING-IND/06 |
| Franco AUTERI | Associate Prof. | ING-IND/06 |
| Franco BERNELLI ZAZZERA | Full Prof. | ING-IND/05 |
| Paolo BETTINI | Associate Prof. | ING-IND/04 |
| Stefano CACCIOLA | Assistant Prof. | ING-IND/03 |
| Andrea COLAGROSSI | Assistant Prof. | ING-IND/03 |
| Camilla COLOMBO | Associate Prof. | ING-IND/03 |
| Giovanni CONSOLATI | Associate Prof. | FIS/01 |
| Luca DI LANDRO | Full Prof. | ING-IND/04 |
| Pierluigi DI LIZIA | Associate Prof. | ING-IND/05 |
| Lorenzo DOZIO | Full Prof. | ING-IND/04 |
| Antonio GRANDE | Assistant Prof. | ING-IND/04 |
| Alberto GUARDONE | Full Prof. | ING-IND/06 |
| Davide INVERNIZZI | Assistant Prof. | ING-IND/05 |
| Michèle LAVAGNA | Full Prof. | ING-IND/03 |
| Marco LOVERA | Full Prof. | ING-IND/05 |
| Filippo MAGGI | Associate Prof. | ING-IND/07 |
| Mauro MASSARI | Associate Prof. | ING-IND/05 |
| Marco MORANDINI | Associate Prof. | ING-IND/04 |
| Christian PARAVAN | Assistant Prof. | ING-IND/07 |
| Federico PISCAGLIA | Associate Prof. | ING-IND/08 |
| Maurizio QUADRIO | Full Prof. | ING-IND/06 |
| Carlo RIBOLDI | Assistant Prof. | ING-IND/03 |
| Giuseppe SALA | Full Prof. | ING-IND/04 |
| Francesco TOPPUTO | Full Prof. | ING-IND/05 |
| Riccardo VESCOVINI | Associate Prof. | ING-IND/04 |
| Alex ZANOTTI | Assistant Prof. | ING-IND/06 |

# Attachment A3 – PhD Advisory Board

| Last Name | First Name | Company-Organization | Position |
|---|---|---|---|
| CIOFFI | Valerio | Leonardo Aircraft Division | Chief Technology Officer |
| DALLARA | Gian Paolo | Dallara Automobili | President |
| MEDICI | Luca | Leonardo Helicopter Division | Head of Aircraft Systems Integration |
| MOLINA | Marco | SITAEL | Space Commercial Director |
| ONGARO | Franco | Leonardo | Technical Director |
| RAGAZZI | Matteo | Leonardo Helicopter Division | Chief Technology Officer |
| VITTADINI | Grazia | Rolls-Royce | Chief Technology Officer |