

Faculty of Science and Technology

Ph.D. programme in ADVANCED-SYSTEMS ENGINEERING

Website: <https://www.unibz.it/en/faculties/sciencetechnology/>

Duration: 3 years

Academic year: 2019/2020

Start date: 01/11/2019

Official programme language: English

Programme contents

The aim of this full-time Ph.D. programme is to allow students to acquire knowledge and skills to carry out independent research in the areas of advanced systems engineering. The Ph.D. course focuses on the study and development of advanced and intelligent systems through an interdisciplinary approach that responds to the recent technological developments (e.g. Cyber-Physical-Systems, Industry 4.0, Internet of Things) by integrating disciplines of industrial mechanical engineering and information engineering. They are supported by specific skills in mathematics and artificial intelligence.

The research projects of the Ph.D. students will pertain to the following research areas which are being developed by research groups on a long-term basis and are considered in the Ph.D. on Advanced Systems Engineering:

Mechanical-and-Manufacturing-Systems Engineering

- Mechanical and Mechatronic Systems
- Advanced Manufacturing Technologies
- Mechanical Engineering Design and Optimization
- Production Systems and Management,
- Smart Factory

Automation and-Electronic-Systems Engineering

- Autonomous systems
- Human-in-the-loop systems
- Embedded Systems (design, testing and reliability)
- Sensors systems
- Robotic Systems
- Automatic Control
- Computer Vision and Image Processing,
- Intelligent Sensor/Actor Networks

System Modelling and Evolution

- Dynamical System Modelling and Simulation
- Complex Networks for System's Evolution
- Operations Research

Students will further improve their ability to clearly and efficiently communicate ideas orally and in writing, as well as to work in groups. The final thesis must be written in English and shall include translations of its abstract in both German and Italian. Ph.D. students will benefit from the special multilingual opportunities the University offers, which include activities/events in Italian, German or

other languages (seminars, elective courses, social events, etc.). The Ph.D. programme comprises lectures and research activities that shall be completed at the Free University of Bozen-Bolzano, together with some components that may be performed at other universities, in Italy and abroad. Each Ph.D. candidate is required to spend min. 3 (to max. 12) months abroad conducting a part of their research.

The Ph.D. programme is based on the following activities:

- Each student shall develop and organize a research plan and conduct a thorough literature survey, which includes a summary and analysis of the state-of-the-art of their research topic. The literature survey shall be completed within the first 6 months of the course and shall be performed in consultation with their supervisor and any co-supervisors. At the latest after six months, students must present and defend their research plan in front of the Ph.D. Course Committee.
- Students shall present their research results at one or more international conferences. The related research shall be archived in the accompanying conference proceedings as either a paper or a poster.
- Students shall spend at least three months abroad conducting research.
- Students shall attend compulsory courses focused on analysing and writing scientific articles, as well as other courses, workshops or summer schools that will expand their background and deepen their expertise in topics related to their dissertation. These additional courses shall be approved by the Ph.D. Course Committee. The student must pass any relevant exams to receive course credits.

In order to be admitted to the final exam, students must have published at least one article in an international, peer-reviewed indexed, e.g. Scopus, journal as the lead author. Exceptions to this rule shall be evaluated and, if appropriate, approved by the Ph.D. Committee.

Industrial Ph.D. (*Dottorato Industriale*)

These are "co-tutored" positions with companies offered under a company-university agreement on specific topics that enable employees involved in research activities to enter high education programs, i.e. a doctoral course, when appropriate. The Industrial Ph.D. links the doctoral program to the vision of the companies, their dynamics and their needs. This permits research training to be focused on the growth of the industrial Ph.D. student and on the demands of the company. It also enables the interaction and integration of the student into a university research group, thereby promoting collaboration between the university and companies.

Ph.D. stages

The Ph.D. research activities are organized into five milestones, which shall be completed at months 2, 6, 12, 24 and 36 of the programme. At the end of each stage, each student shall meet the Ph.D. Committee to present his/her project and results. The Ph.D. Committee shall review and assess each student's work and provide recommendations, as needed.

Phase 1 (first 2 months): The Ph.D. Committee shall meet with the students and assign each student a supervisor. Together with the supervisor and any co-supervisors the student shall identify his/her research topic (within the areas listed in this advertisement) and develop a study plan, which shall be approved by the Ph.D. Committee. Students may start attending courses that are relevant to their individual study plans.

Phase 2 (2nd -6th month): After an exhaustive review of the literature concerning his/her subject area, as well as having completed the first steps in the research topic activity, each student shall:

- prepare his/her research programme that has to be approved by the Ph.D. Committee;
- possibly complete and/or attend courses that are relevant to his/her individual study plan;
- prepare a report of the state of the art of his/her research topic to be reviewed by the supervisor and another researcher nominated by the council.

Phase 3 (6th -12th month): Each student shall continue performing research on his/her topic and can also attend courses, summer schools, seminars or conferences. Each student shall report in both written and oral form his/her first-year activities, present the research programme he/she plans to conduct abroad and propose a co-supervisor at the foreign university or research centre to the Ph.D. Committee.

Phase 4 (12th -24th month): Each student continues his/her research and finishes any courses that have been started. At this stage, it is likely that some of this time will be spent abroad. During Phases 4 and 5, students are also expected to attend international conferences to present the results of the activities developed within the Ph.D. programme, and to start the preparation of the manuscript(s) for publication in peer-reviewed journals. Each student shall report in both written and oral form his/her second-year activities to the Ph.D. Committee.

Phase 5 (24th-36th month): Each student shall finish: his/her research; any remaining required work abroad; writing and submitting the required journal manuscript(s); and complete his/her (draft) thesis. To be admitted to the final exam, each student shall present a report about his/her third-year activities and final thesis to the Ph.D. Committee.

Proposed Research topics

Topic	Supervisor/s
Advanced nonlinear control of unmanned vehicles	Karl von Ellenrieder
Stability analysis of remote shared human-robot control systems	Karl von Ellenrieder
Action, plan and intention recognition for supporting decision making and action sharing in human-robot collaboration	Angelika Peer
Process robustness optimization for compaction presses in powder metallurgy by adaptive press control	Angelika Peer
Dynamic models for emotion estimation from physiological signals	Angelika Peer
Depth-map estimation using Convolutional Neural Networks	Tammam Tillo
Advanced Design and optimization of lightweight multibody (robotic) systems	Renato Vidoni
Field Robotics: design and development of mobile/climbing robotic platforms for agricultural and/or forestry activities	Renato Vidoni
Development of a smart system to support creative engineering design steered by users' inadvertent inputs	Yuri Borgianni
Interaction with different forms of virtual and physical prototypes to support the design of advanced products	Yuri Borgianni
Augmented Reality Assisted Design and Operation of Cyber-Physical Production Systems	D Matt
Development of a Manufacturing Execution System adapted to the Needs of Small and Medium Sized Enterprises	D Matt
Design and Development of AI-based Intelligent Industrial Assistance Systems in Assembly	E Rauch
Human Factors in the Design of Anthropocentric Cyber-Physical Systems for a Socially Sustainable Production	E Rauch
Characterization of Advanced Materials for Engineering Applications via Experimental and Numerical Approaches	F Concli
Damage Identification and Structural Health Monitoring of Mechanical Systems	F Concli

Application of Machine Learning techniques to support planning, scheduling and monitoring of projects	P Dallasega
Implications of Logistics 4.0 technologies and smart supply chain management concepts in the Make-to-Order industry	P Dallasega
Effects of structural properties of complex networks on dynamics and diffusion on top of them	ML Bertotti / G Modanese
Analysis and applications of assortativity and disassortativity in complex networks	ML Bertotti / G Modanese
Computational aspects of nonlinear differential equations of interest in engineering	ML Bertotti / G Modanese
Design, fabrication and characterization of plasmonic nano-structures for optical sensing.	L Petti (FBK+unibz fellowship)
Development of smart textiles and wearable electronic devices for physiological and motion data monitoring.	L Petti
Realization of energy harvesters and conditioning electronic circuits for wireless sensor networks.	L Petti
Reconfigurable real-time systems	B Russo
Security in Cyber-Physical systems	B Russo

* this is only a partial list of available projects, other topics dealing with the research activity of the members of the Ph.D. Committee can be matter of study.

Admission requirements - Evaluation criteria for examinations/qualifications

Degrees from the former Italian university system: all

Master (laurea specialistica/magistrale): all

Foreign degrees

Applicants who have a foreign degree must have a university level education of at least five years (or equivalent) and hold the prerequisites listed below.

Other:

The requisites for admission to doctoral programmes are related to an appropriate educational, and/or scientific background, and/or have worked in the Ph.D. program research fields.

Qualifications in engineering and computer science are preferable.

Admission to the program is based on the assessment of applicants through:

- CV and academic qualifications;
- a cover letter explaining the student's motivation for applying to this Ph.D. program;
- a technical interview.

The level of English will be assessed during the technical interview. A CEFR B2 level or equivalent is required.

The candidates' profile will be evaluated based on the quality, as well as the potential synergy with the research areas of the Ph.D. program.

To apply for the Ph.D. program, applicants shall submit the following documents:

- A personal statement, written in English (max. 2 pages).
In this document, the candidates shall indicate which of the proposed research areas and

topics they are interested in. They may mention why they think UNIBZ and this Ph.D. program is the right place for their tertiary education and research activities.

- Curriculum vitae (CV) (in English and preferably following the EU format, which can be downloaded here <https://europass.cedefop.europa.eu/en/documents/curriculum-vitae>).
- Master degree certificate or equivalent with final mark (if applicable) and the transcripts of exams taken with their marks (transcript of records).

The certification of Italian university titles, the certification MUST be substituted by a self-declaration or by the Diploma Supplement; **For admission, the (exams) average grade of a master's degree (or equivalent) must be greater than or equal to 24/30.** For foreign degrees, the mark (overall grade point average) will be converted to an equivalent one in out of 30 points.

Industrial Ph.D. (*Dottorato Industriale*)

For those applying to the Dottorato Industriale positions, the following additional document is necessary:

- Copy of the contract of employment at the company or self-declaration.

Other documents to be included by applicants, when available:

- Up to max 2 reference letters, written in Italian, German or English provided by a university lecturer or a researcher from a research institute, describing the work carried out and the quality of the same,
- list of publications (published, being published or submitted for publication) and the digital copy of at most 3 selected publications from the past 5 years,
- any language certificates.

The application process consists of three stages:

1. The applications are first reviewed for completeness and eligibility by the UNIBZ Central Office.
2. Those complete applications which fulfill the base admission requirements are then evaluated by the Evaluation Committee, which shall consider the applicant's CV, cover letter, qualifications (including any publications), and the alignment between the candidate's profile/interests and the Ph.D. program research areas. The Evaluation Committee shall then create a list of applicants to be admitted to the stage 3 of the selection process.
3. Each candidate will be interviewed to assess his/her basic/fundamental technical knowledge in one or more of the Ph.D. programme's research areas, as well as her/his ability to orally communicate in English. The interview may be conducted via live video-conference, if necessary. The Evaluation Committee shall rank the applicants via a comparative assessment.

The following scores will be awarded:

- up to 10 points for: the applicant's CV, cover letter and qualifications,
- up to 10 points for the appropriateness of the CV regarding the research areas of interest for the Ph.D. program,
- up to 20 points for the interview.

The final score is the sum of the points awarded for the 3 categories described above, with a max of 40. The final score shall be used to define the ranked list of candidates, and which candidates will be offered a research stipend. The lowest score to be admitted in the rank-list is 20/40.

In the case of scholarships financed by external institutions, the applicant must explicitly state, in the letter of motivation and if interested, his/her application.

Separate rankings may be drawn up for such grants. These rankings will in any case be made up of candidates who are usefully placed in the general ranking of merit and who have a scientific curriculum that is particularly appropriate to the subject in question.

The final ranked list will be published on the UNIBZ website (www.unibz.it) and on the notice boards of the Faculty of Science and Technology.

Examination dates

Description	Date	Place
Personal Interview	Between 22 to 26 July, 2019 (depending on the number of applications)	Main building of the Free University of Bolzano, Piazza Università 1, Bolzano

Positions and grants

Total number of positions available: 17

Number of scholarships awarded by UNIBZ: 8

Number of "Dottorato Industriale" positions: 2

Dottorato industriale – Industrial Ph.D.		
Area/Topic	Positions	company
Research Area: Mechanical and Mechatronic Systems, Human-in-the-loop systems, Robotic Systems Title: Task-based evaluation of novel wearable manipulation systems to optimize on-site assembly processes towards Construction-site 4.0	1	Fraunhofer Italia
Robotics and industrial automation, artificial intelligence, safety and security, monitoring and traceability	1	Röchling Automotive

Other types of position awarded:

2 covered with AR – assegni di ricerca (research fellowships)

1 Position awarded by Fondazione Bruno Kessler and UNIBZ

1 Position awardee by EURAC and UNIBZ

PhD scholarship bound to specific research topics/areas:		
Area/Topic	Positions	Founder
Research Area: Plasmonic nano-structures for optical sensors Title: Design, fabrication and characterization of plasmonic nano-structures for optical sensing	1	FBK (Fondazione Bruno Kessler) and unibz
Research Area: Textile sensor system for IoT applications in sport and mountain rescue activities	1	EURAC and unibz

Number of positions awarded without scholarship: 3