Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Faculty of Science and Technology

PhD Programme in ADVANCED-SYSTEMS ENGINEERING

Website: https://www.unibz.it/en/faculties/sciencetechnology/phd-advanced-systems-engineering/

Duration: 3 years

Academic year: 2021/2022

Start date: 01/11/2021

Official programme language: English

Programme contents

This international PhD program trains a new generation of researchers who focus on Mechanical and Manufacturing Systems, Automation and Electronic Systems and Computer Systems to carry out independent research in the areas of Advanced-Systems Engineering and to give them the opportunity to transfer and exchange knowledge with national and international research centers and industries.

The three-year PhD programme focuses on the study and development of advanced and intelligent systems through an interdisciplinary approach that responds to recent technological developments (e.g., Cyber-Physical-Systems, Industry 4.0, Internet of Things) by integrating the disciplines of mechanical engineering, manufacturing engineering, information engineering and computer science. They are supported by specific skills in mathematics and artificial intelligence.

PhD student projects pertain to the following research areas, which are actively pursued by research groups at unibz on a long-term basis, and are considered in the PhD 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
Thin-film devices and sensors
Flexible and wearable electronics, smart textiles
Micro and nano technology
Soft biocompatible sensor systems

Robotic Systems
Automatic Control
Intelligent Sensor/Actor Networks

Computer Systems Engineering
Systems of Systems
Complex Networks
Distributed Systems and Security
Self-Adaptive Software Systems
Development and Operation of IoT Systems
Operations Research

The main features of the PhD are an interdisciplinary scientific approach and the participation of internationally renowned scientists on the Scientific Committee.

Students will further improve their ability to clearly and to efficiently communicate ideas orally and in writing, as well as to work in research groups. The final thesis must be written in English and shall include translations of its abstract in both German and Italian. PhD students will benefit from the special multilingual opportunities the University offers, which include activities/events in Italian, German and other languages (seminars, elective courses, social events, etc.). The PhD program comprises lectures and research activities that shall be completed at unibz, together with some components that may be performed at other universities, in Italy and abroad. Each PhD candidate is required to spend a minimum of 3 months (and up to a maximum of 12 months) abroad conducting a part of their research.

The PhD 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 PhD 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 PhD Course Committee. The student must pass any relevant exams to receive course credits.

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

Note that the program is full-time only and for its duration students are expected to devote their efforts to completing their doctoral project.

Industrial PhD Positions (*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 higher education programs, i.e., a doctoral course, when appropriate. The Industrial PhD 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 PhD

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.

PhD stages

The PhD 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 PhD Committee to present his/her project and results. The PhD Committee shall review and assess each student's work and provide recommendations, as needed.

Phase 1 **(first 2 months):** The PhD 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 PhD 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 PhD 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 ASE PhD 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.

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 PhD Committee.

During Phases 4 and 5, students are also expected to attend international conferences to present the results of the activities developed within the PhD 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 PhD Committee.

Proposed General Research topics	
Project	**Supervisor**
Dynamics on Complex Networks	Bertotti, Maria Letizia
Simulations of Ropeways	Bertotti, Maria Letizia
Development of a smart system to propose inspiration sources in engineering design	Borgianni, Yuri
Role of new technologies in favoring the identification of green products	Borgianni, Yuri
Stretchable, Implantable and Wireless Electronics	Cantarella, Giuseppe
Soft and Green Active Electronics	Cantarella, Giuseppe
Additive Manufacturing: Advanced materials characterization and modeling	Concli, Franco
Structural Health Monitoring of mechanical systems and sports equipment	Concli, Franco
Concept development of a Digital Twin for Smart Mobile Factories	Dallasega, Patrick
Development of Data-Driven Aid Systems to support Planning, Scheduling and Monitoring of Projects	Dallasega, Patrick
Secure and Trustworthy Edge Computing Architecture	El Ioini, Nabil
Combining Zero Trust and Blockchain for Edge Computing and IoT security	El Ioini, Nabil
Path and motion planning for intelligent vehicles and robots	Frego, Marco
Control and optimization in presence of uncertainties in gamification and game theory	Frego, Marco
Hybrid DNA nano-electronic devices	Garoli, Denis
Integrated memristors technology for self-powered computation	Garoli, Denis
Patterns and Antipatterns in Embedded Software Engineering	Janes, Andrea
End User Software Engineering	Janes, Andrea
Human to configurable robot skill transfer in industrial assembly	Matt, Dominik
Intelligent decision support system for the holistic optimization of manufacturing value chains towards sustainability and circular economy	Matt, Dominik
Flexible thin-film electronics for autonomous wearable systems	Münzenrieder, Niko
Interactive soft and biomimetic robots	Münzenrieder, Niko
Edge and Cloud Computing Architectures	Pahl, Claus
AI Techniques for Edge and IoT Systems	Pahl, Claus
Variable autonomy control for human-in-the-loop robotic systems	Peer, Angelika
Predictive neuromechanical simulations for human-robot interaction	Peer, Angelika
Green bioresorable printed sensor systems for plant in-vivo measurements	Petti, Luisa
Biocompatible printed polymers for active living cell stimulation	Petti, Luisa
Human Factors in Human-Robot Collaborative Manufacturing	Rauch, Erwin
Architecture for Data-Driven Cognitive Manufacturing Systems	Rauch, Erwin
Assurance of Collaborative AI Systems	Russo, Barbara
Performance of Systems in Edge-Cloud continuum	Russo, Barbara
Optimal motion planning for safe and ergonomic human-robot collaboration in industry	Vidoni, Renato
Agro-forestry mechatronics and robotics	Vidoni, Renato
Nonlinear control of mobile robots	von Ellenrieder, Karl
Trajectory tracking of underactuated mobile robots	von Ellenrieder, Karl
Design optimization of flexible multibody systems under uncertainty	Wehrle, Erich
Nonlinear topology optimization for lightweight compliant mechanisms	Wehrle, Erich

***** this is only a partial list of available projects, other topics dealing with the research activity of the members of the PhD Committee can be explored.

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 PhD 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 PhD programme.
- A technical interview.

During the interview, the knowledge of the English language will be also assessed.

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

To apply for the PhD Programme, 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 PhD programme 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's 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 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 out of 30 points.

Industrial PhD (*Dottorato Industriale*)
For those applying to the Dottorato Industriale positions, the following additional document is necessary:
- A copy of the contract of employment at the company or self-declaration.

Other documents to be included by applicants, when available:
- Up to a maximum of 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 its quality. In lieu of letters, the names and institutional contact information of up to 2 professional references can be provided.
- A 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 (note that most weight is given to articles indexed in Scopus and/or on the Web of Science).

The application process consists of three stages:

1. The applications are first reviewed for administrative completeness and eligibility.
2. Those complete applications, which fulfill the base admission requirements, are then evaluated by the ASE PhD Programme 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 PhD Programme research areas. The Evaluation Committee shall then create a list of applicants to be admitted to the 3rd stage of the selection process.
3. Each candidate will be interviewed to assess his/her basic/fundamental technical knowledge in one or more of the PhD 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 PhD programme,
- up to 20 points for the interview.

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

Scholarships financed by external institutions.

If interested in one of the scholarships financed by external institutions, the applicant must explicitly state his/her interest in the cover letter and application.

Separate rankings may be drawn up for such grants. In any case, these separate rankings will only include candidates who have already been included in the general ranking of merit and who have a scientific curriculum that is particularly appropriate to the project in question.

The final ranked list will be published on the unibz website www.unibz.it.

Examination dates

Description	Date	Place
Personal Interview	21-22 July 2021 23 July (if needed to accommodate a large number of applicants)	Videoconference – Microsoft TEAMS, if not otherwise communicated

Positions and scholarships

Total number of positions available:	**11**
Number of full general scholarships awarded by unibz:	6
Number of positions with other type of support:	2
Number of positions awarded without scholarship:	2
Industrial PhD position(s)	1

Industrial PhD Positions (*Dottorato Industriale*)			
Area/Topic	Positions	Company	Supervisor
Data-driven continuous improvement process for railway construction projects: An empirically validated framework.	1	Rhomberg Sersa Rail Group AG	Dallasega, Patrick

PhD scholarships bound to specific research topics/areas (funded 50%company/ 50% unibz):			
Topic	Positions	Funding Source	Supervisor
Innovative printed nanomaterials for selective gas sensing applications	0,5	Fondazione Bruno Kessler (FBK)	Petti, Luisa
Optoelectrical monitoring of autonomic modulation of cardiac cells and the implications for arrhythmogenesis	0,5	Eurac Research (Institute for Biomedicine)	Petti, Luisa
Smart functional materials for epidermal electronics	0,5	FLEXIBOTS/WISDOM II Projects	Münzenrieder, Niko
Thin-film electronics for robotic systems	0,5	FLEXIBOTS/WISDOM II Projects	Cantarella, Giuseppe