![unibz logo] Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Faculty of Engineering

Ph.D. Programme in ADVANCED-SYSTEMS ENGINEERING

Website: [PhD in Advanced-Systems Engineering / Free University of Bozen-Bolzano (unibz.it)](#)

Duration: 3 years

Academic year: 2024/2025

Start date: 01/11/2024

Official programme language: English

Programme contents

This international PhD program trains a new generation of researchers focusing on mechanical and industrial systems, automation, and electronic and information 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, computer engineering and computer science. They are supported by specific skills in mathematics and artificial intelligence.

Ph.D. student projects cover the following research areas, which are actively pursued by research groups at unibz on a long-term basis, and considered in the Ph.D. in Advanced-Systems Engineering:

Mechanical and Industrial Systems Engineering
- Mechanical and mechatronic systems
- Advanced manufacturing technologies
- Mechanical engineering design and optimization
- Production and management systems,
- 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 and biocompatible sensor systems
- Robotic systems
- Automatic control
- Intelligent sensor/actor networks

Computer Systems Engineering
- Development and maintenance of intelligent software systems
- Distributed Systems and Security
- Self-adaptive software systems

- Development and Operation of IoT Systems
- Quantum mechanics
- Dynamics on networks

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

In addition, students will have the opportunity to further improve their ability to communicate ideas and results clearly and effectively in oral and written form, as well as to work in research groups. The final thesis must be written in English and must include translations of its abstract in both German and Italian. Ph.D. students can benefit from the special multilingual opportunities offered by the University, which include activities/events in English, Italian, German or other languages (seminars, elective courses, social events, etc.). The Ph.D. program will include lectures and research activities that will take place at unibz, accompanied with experiences that may be carried out at other universities, in Italy and abroad. Each Ph.D. student must spend at least 3 months (and up to a maximum of 12 months) abroad carrying out part of his/her research activities.

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

- Students must develop and organize a research plan and conduct a thorough literature survey that includes a synthesis and state-of-the-art analysis of the research topic. The literature survey must be completed within the first 6 months of the course and must be carried out under the guidance of and in consultation with one's supervisor and any co-supervisors. After six months at the latest, students must present and defend their research plan before an internal committee consisting of the supervisor and two members, at least one of whom must be from the Faculty of Engineering.
- Students must present the results of their research at one or more international conferences in the form of a paper or poster presentation. The results must be available and published in the accompanying conference proceedings.
- Students will have to spend at least three months abroad to carry out research activities.
- Students will have to attend compulsory courses focused on analysing and writing of scientific articles, as well as other courses, workshops or summer schools that will expand their background and deepen their expertise on topics related to their PhD thesis. These additional courses must be approved by the Ph.D. Committee. Student must pass all the relevant exams to obtain credits.

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

Please note that the program is full-time only and for its duration students are expected to devote their efforts to the completing of their PhD project.

Ph.D. phases

The Ph.D. research activities are divided into five phases, which will be completed in months 2, 6, 12, 24 and 36 of the programme. At the end of each phase, each student will have to present his/her activity, project, and results in front of an internal Committee composed of the supervisor and two members, at least one of whom from the Faculty of Engineering. Based on the internal Committee's assessment, the Ph.D. Committee will examine and evaluate each student's work and make recommendations if necessary.

Phase 1 **(first 2 months):** The Ph.D. Committee meets the students and assigns them a supervisor. Together with the supervisor and possible co-supervisors, the student identifies his/her research topic (within the areas listed in this notice) and develops a study plan. The latter must then be approved by the Ph.D. Committee. Students may start attending courses relevant to their individual study plans.

***Phase 2* (2nd-6th month):** After an exhaustive literature review related to his/her research topic, as well as having completed the first steps in the research activity, each student will have to:
- prepare his/her own research programme;
- complete and/or attend courses relevant to his/her individual study plan;
- write a report on the state-of-the-art of his/her research topic;
- submit the research programme and the state-of-the-art report to the internal Committee for review.

***Phase 3* (6th -12th month**): Each student continues to carry out research activities on his/her own topic. He/she also attends courses, summer schools, seminars, or conferences. At the end of the phase, each student must:
- Present the research programme he/she intends to conduct abroad;
- Propose to the Ph.D. Committee a co-supervisor at the foreign university or research center;
- Draw up a report on the first year's activity;
- Submit the research programme and state-of-the-art report to the international Committee for review.

***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 part of this time will be spent abroad.
At the end of the phase, each student must:
- Write a report on the first year's activity;
- Submit the research programme and the state-of-the-art report to the internal Committee for review.

***Phase 5* (24th-36th month):** Each student must finish: his/her research; the planned and required activity abroad, if required; write and submit manuscript(s) for publication in international peer-reviewed journal(s); complete his/her thesis (draft).

In order to be admitted to the final exam, each student must submit a report on the activity of the third year and the final thesis to the internal Committee. On the basis of the evaluation of the internal Committee, the Ph.D. Committee will assess the admission to the final exam.

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 begin the preparation of the manuscript(s) for publication in peer-reviewed journals.

Admission Requirements - Evaluation criteria for examinations/qualifications
Degrees from the former Italian university system: all
Master's degrees of the new system (laurea specialistica/magistrale): all

Foreign degrees
Similarly, candidates who have obtained a foreign degree must have a university level education (or equivalent) of at least five years and fulfil the prerequisites listed below:

Other:
The requirements for admission to the Ph.D. programmes are related to an appropriate educational and/or scientific and/or working background in the research fields of the Ph.D. research programme.

Degrees in <u>engineering</u> and <u>computer science</u> will be preferred.

The assessment of candidates for admission will always be carried out by means of:
- Evaluation of the curriculum and academic qualifications;
- Evalutation of the letter of motivation explaining the student's motivation for applying to this Ph.D. programme;
- A personal oral interview.

During the interview, the knowledge of the English language will be verified.

The candidates' profile will be assessed on the basis of quality and potential synergy with the research areas of the Ph.D. programme.

To apply for the Ph.D. programme, applicants shall submit the following documents:
- A letter of motivation, written in English (max. 2 pages). **In this document, applicants must indicate which of the proposed research topics of this call for applications they are interested in and briefly justify their choices, proposing a detailed proposal.** They may also mention why they consider unibz and this Ph.D. programme suitable for their education and research activities.
- The curriculum vitae (CV), in English and preferably prepared according to the European format, download here https://europass.cedefop.europa.eu/en/documents/curriculum-vitae).
- A certificate of the master's degree/examination certificate or the equivalent degree obtained abroad, with an indication of the final grade and a list of the exams taken with the relative grade (transcript of records). In the case of an Italian university degree, the certification MUST be replaced by the substitute declaration or a diploma supplement.

Other documents to be included by applicants, if 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 the quality of the same. Instead of letters, the names, and institutional contacts of up to 2 professional references may be provided.
- A list of publications (published, in press, or submitted) and a digital copy of a maximum of 3 publications selected from the last 5 years (note that most weight is given to articles indexed in Scopus and/or the Web of Science).

The selection process consists of three steps:

1. Applications are first reviewed for completeness and eligibility by the competent unibz offices. Only those applications that are complete and meet the admission requirements at the time of the closing of the applications will move on to Stage 2 and will be evaluated by the Evaluations Committee.

2. Complete applications that meet the basic admission requirements are then evaluated by the Evaluation Committee, which will take into consideration: the applicant's curriculum, letter of motivation, qualifications (including publications, if any), and the alignment between the candidate's profile/interests and the research topic areas of the Ph.D. programme in the call. The Evaluation Committee will then draw up a list of applicants to be admitted to the 3rd stage of the selection interview process.

3. The selected candidates will be interviewed to assess their basic technical knowledge and skills in the research topics covered by this call, as well as their ability to communicate orally in English. The interview will be conducted by videoconference. The evaluation committee will rank the candidates on the basis of a comparative evaluation.

Separate rankings will be drawn up for each research topic covered by the call.

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

Examination dates

Description	Date	Place
Personal Interview	within 9th October 2024	Via Microsoft-TEAMS videoconferencing

Positions and scholarships:

Total number of positions available: 3

PhD scholarships bound to specific research topics/areas and financed by external organizations/Institutions:

3 scholarships linked to specific research topics:

1. Machine Learning and Artificial Intelligence methods applied to robotics for key alpine applications (financed by Eurac Research, supervisor Prof. Karl Dietrich von Ellenrieder, Dr. Abraham Mejia)
2. Improving High-Speed Data Transfer with Ultra-Thin PCBs (financed by Fondazione Bruno Kessler, supervisor prof. Luisa Petti, dr. David Novel, Prof. Philippe Velha)
3. From Prototypes to production: Leveraging Digital Twins for Improved Flexibility and Computer Vision in Packaging of Food Manufacturing (financed by Loacker Spa, supervisor Prof. Oswald Lanz)