

Cybernetics

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Faculty	Faculty of Electrical Engineering and Computer Science
Type of study	Doctoral
Language of instruction	English
Code of the programme	P0714D150002
Title of the programme	Cybernetics
Regular period of the study	4 years
Coordinating department	Department of Cybernetics and Biomedical Engineering
Coordinator	prof. Ing. Jiří Koziorek, Ph.D.
Key words	theory and transmission of information, control theory, control system with feedback, automatization, control and robotics, modeling and simulation of systems and processes

About study programme

Students who successfully completed their (follow-up) master's studies in the same field of study or a related one will be admitted to PhD studies. Applicants who have duly submitted their application and have attached all the required documents will be subjected to individual assessment of the submitted documentation (results of previous studies, CV, a list of published and unpublished works) and the opinion of the supervisor will be taken into account.

The study program Cybernetics follows up to existing master's study programs offered at the Faculty of Electrical Engineering and Computer Science (VŠB-Technical University of Ostrava): Control and Information Systems, Biomedical Engineering. Since cybernetic principles and findings can be as well applied in other application areas, as for example in natural sciences, physiology, systemic biology, etc., the program is also open to graduates of other master's study programs (computer mathematics, bioinformatics, etc.).

Professions

- Researcher in robotics
- Researcher in embedded systems
- Researcher in measurement and testing systems
- Researcher in automation
- Research team leader in area of cybernetics (automation, embedded systems, robotics)

Hard skills

- Biological signal processing
- Medical image processing
- Knowledge in the field of industrial automation
- Knowledge of measurement and regulation - revolution, torque, and position control structures of electric drives
- Knowledge of control units (CAN, LIN, Ethernet)
- NI LabVIEW programming language
- Knowledge of signal processing methods

Graduate's employment

The graduate will be able to carry out creative research activities on the boundary of cybernetics and other associated branches, using newest methodological tools and optimization techniques, recently developed in the area of mathematics, applied mathematics and artificial intelligence.

Examples of posts where the graduate can find employment:

Research worker, participating at a top research work within national as well as international projects and grants; manager in a corporate research, reacting to market needs and recent development in cybernetics and applied cybernetics; manager in the area of a new medical technique in faculty hospitals or medical institutes; lecturer and guarantor of corresponding university subjects, etc.

Study aims

The aim of the educational process is education of specialists being graduates of magister study that are able to pursue independent creative work in the area of research, development and technology improvement. Studying further theoretical subjects with applications according to individual study plan finishing with dissertation thesis oriented on cybernetics, PhD student proves his/her ability to creative extend previously obtained knowledge in given field of study.

The study program Cybernetics includes the use of cybernetic approach for analysis, modeling, simulation and design of systems. Further it applies theoretical knowledge from cybernetics to other fields. Technical cybernetics as a main area of application involves:

- Dynamic systems: control systems with feedback, stochastic and fuzzy description of systems, control algorithms, embedded control systems, etc.
- Transmission of informations: transmission and processing of signals, sensors, measurement and information systems, industrial networks, information entropy, communication channels, etc.
- Artificial intelligence: machine learning, multi-agent systems, robotics, neural networks modeling and design, expert systems, etc.
- Information technologies for control systems: real-time operation systems, software for real-time applications, SCADA systems, software for communication, etc.

The program is conceived so that to enable study in other application areas of cybernetics, being based on coexistence of electrical engineering with computer science and computational mathematics on the Faculty, as for example Biocybernetics: modeling and simulation of physiological phenomena, transmission, processing and sensing of biological signals, hardware and software design for medical systems, Bioinformatics, stochastic modeling based on advanced statistical methods, etc.

Graduate's knowledge

The graduate has an overview over the whole field of Cybernetics, at a width and depth exceeding the level of the master students. Primarily, the graduates has systematic and deep knowledge of cybernetic principles, approaches and procedures. Scope of the knowledge is in good accordance with recent state-of-the-art cognitions: he has deep and systematic knowledge of theory, concepts, and methods used in cybernetics, that are top findings on international level. He is able to understand scientific problems that are on the boundary between different cybernetic applications and other scientific fields and disciplines.

Graduate's skills

The graduate is able to design and use advanced scientific methods in cybernetics in such a way that enables to extend the cognition of the field on the basis of his original creative approach. He is capable of solving interdisciplinary problems requiring knowledge not only in cybernetics but also in the collaborative field (e.g., biocybernetics, bioinformatics, biomedical engineering, etc.). He is able to develop and evaluate new cybernetic methods and theories, including definition and differentiation of new focuses.

Graduate's general competence

The graduate is able to evaluate new knowledge and ideas of cybernetics in context with long-term social consequences of their use. He can do and manage own new creative research work, for which he is able to gain resources and financial means. He is able clearly and convincingly to communicate own findings in the field of cybernetics to the other members of scientific community (as well as to the general public) on international level. He can use his knowledge, professional skills and general competences in at least one foreign language.