University of West Bohemia

Faculty of Applied Sciences

Doctoral Study

2020/2021

Pilsen July 2020

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1 Introduction

Doctoral study is one of the most important activities at the Faculty of Applied Sciences (FAS), University of West Bohemia (UWB), Pilsen. In agreement with the Czech Higher Education Act, doctoral study programmes at the Faculty are focused on scientific research and creativity. Ph.D. students contribute significantly to the successful fulfilment of the research objectives of both the Faculty and its research centre, Centre of Excellence "NTIS – New Technologies for the Information Society". They also participate in many national as well as international research projects.

The purpose of this brochure is to provide brief information on doctoral study programmes and study fields, Ph.D. Study Boards, courses, study rules, Dean´s Office, departmental and Faculty websites. A complete list of the Ph.D. supervisors together with their research interests is also included. This information should especially be helpful to prospective doctoral students in choosing their Ph.D. thesis topics, courses and supervisors. Information concerning the research areas and study fields offered by the Faculty will also be useful for the academic staff, members of the Ph.D. Study Boards, supervisors and the professional public.

It is my pleasure to invite all potential doctoral study applicants to join the Faculty's research community and to wish all those already enrolled in our doctoral study programmes a lot of success in their demanding studies and their interesting as well as challenging research.

July, 2020

Doc. Dr. Ing. Vlasta Radová
Dean

2 Basic Information

Study on doctoral study programmes (hereinafter referred to as "DSP") is governed by the effective Higher Education Act (hereinafter referred to as the "Higher Education Act"), Part 3 of the valid Study and Examination Regulations of the University of West Bohemia (hereinafter referred to as "SER") and Dean's Decree 11D/2017 (hereinafter referred to as the “Decree”). The duration and organization of study on a DSP depends primarily on the selected form of study (full-time or part-time) and by the student´s individual study plan (hereinafter referred to as "ISP"), which also sets submission deadlines for application to the state doctoral examination and defence of the dissertation. The maximum period for both forms of study is seven years from the start of study. This maximum period is given in SER by the student's obligation to submit an application for the defence of the dissertation.

The credit system is not used for Doctoral studies at FAS. The organization of studies in Doctoral study programmes and fields of study at FAS is ensured by the guaranteeing department, which is usually also the student's workplace (this department may have finalised a contract on the training of students with another partner workplace). DPS students are registered with the guaranteeing department; this department is subsequently classified in the information system as their workplace. The Head of the guaranteeing department (or the head of a section of the department), as a senior employee, ensures conditions are met for fulfilling the study requirements of DSP students in cooperation with the supervisor. These conditions may vary depending on the form of study.

Doctoral studies take place under the professional supervision of a supervisor, with whose consent the student determines, inter alia, his/her working mode and holiday terms. The supervisor is responsible to the Study Field Board for his/her activities. Each Study Field Board has its own chairman who is responsible for the execution of the Board’s decisions. A specialist consultant may be appointed to the student at any time during his/her study at the suggestion of the supervisor to address specific problems related to the dissertation topic; the consultant must be a renowned expert in the given field.

Study obligations also include adequate participation in lessons provided by the department which is the student's registered workplace. This participation in the lessons takes place in accordance with the student's individual study plan based on an agreement between the supervisor and the Head of the guaranteeing department. The form and scope reflect both the needs of the training workplace, updated annually, and other student activities that are prescribed for him/her in the individual study plan for the given year (usually 4-6 hours a week at FAS for each semester). The student's teaching duty is posted in the normal way for academic staff of the department, typically before the beginning of the academic year via the information system. Changes to the extent (i.e. increase or decrease) of the teaching obligation are agreed between the management of the department and the supervisor.

Full-time students can be employed on a particular project by the workplace Faculty up to a maximum of half-time. Employment consisting of work on a project is subject to the approval of the supervisor and the Head of the guaranteeing department. For part-time students, the workload is not limited.

The Dean decides on matters not regulated by the Decree, the SER, the Higher Education Act and related regulations.

2.1 Form of Study

Doctoral studies at FAS can be either full-time form or part-time. The form determines how the study will be organised.

The main differences between the forms of study are shown in the table below:

<table>
<tr><th>Full-time</th><th>Part-time</th></tr>
<tr><td colspan="2">Length of study</td></tr>
<tr><td colspan="2">standard length of study is four years; the application submission for the defence of the dissertation is within six years of the commencement of study (there is the possibility of a one-year extension)</td></tr>
<tr><td colspan="2">The maximum period of interruption is 24 months
(there is the possibility for the Dean to grant an extension in exceptional circumstances)</td></tr>
<tr><td colspan="2">Scholarships</td></tr>
<tr><td>• the possibility of receiving a scholarship awarded to Doctoral students during the standard length of study (only for study in Czech)
• possibility of receiving an extraordinary scholarship
• possibility of receiving accommodation and low-income scholarship during the standard length of study</td><td>• possibility of receiving an extraordinary scholarship</td></tr>
<tr><td colspan="2">Payment of health insurance
Applies only to Czech citizens</td></tr>
<tr><td>the state pays health insurance until the age of 26. Since 1 January 2018, the state may pay even longer; however, it is necessary to contact the appropriate authorities</td><td>Health insurance is paid by students themselves</td></tr>
<tr><td colspan="2">Attendance at University</td></tr>
<tr><td>after consultation with the supervisor, students must attend consultations or lectures on courses in their individual study plan; they are present at the training workplace to the extent determined by the Head of the training workplace, and, they are involved with teaching according to the needs of the workplace. Further details are communicated to students when they arrive at the relevant training workplace</td><td>after consultation with the supervisor, students must attend consultations or lectures on courses in their individual study plan; they are usually employees of an external organization or UWB workplace</td></tr>
</table>

2.2 Study Programmes, Fields of Study, Standard Length of Study

This academic year, the Faculty of Applied Sciences of UWB opens its studies in the following study programmes and fields. The standard length of study is shown in the table.

Study programmes divided into Fields

Study programme	Study Field	Standard length and language of study
Applied Sciences and Computer Engineering	**Plasma Physics and Physics of Thin Films**	4 years / CZ, EN
	Cybernetics	
Geomatics	**Geomatics**	4 years / CZ, EN

Study programmes not divided into Fields

Study programme	Standard length and language of study
Applied Mechanics	4 years / CZ
Computer Science and Engineering	4 years / CZ, EN
Mathematics	4 years / CZ, EN

CZ – Czech, EN – English

2.3 Scholarships

DSP students may receive scholarships during their studies. For this purpose, it is the responsibility of each student to fill in the bank account number in their personal information in IS/STAG.

During the study, it is possible to receive scholarships listed in the following table:

Type of scholarship	Period of receipt	Amount [CZK]	Regulations for awarding scholarships
Doctoral (12 instalments per year, including holidays), the amount of the scholarship is set out in Annex 3 of the Decree 9D/2017	1st year of study 2nd year any time since passing the state doctoral examination	9,000 10,500 13,500	• is paid out by the Dean's Office **only** during the standard period of study; • application for the scholarship is part of the application to study • **it is relevant only for study in Czech**
Extraordinary	individual (stated in the decision when the scholarship is awarded)	without limit	• is paid out at the discretion of departments, the Dean or the Rector

Accommodation (four instalment per year– without holidays)	on a quarterly basis (every three months retroactively)	the amount is set by the Rector (approx. 2,000 CZK per quarter)	• electronic application (must be submitted at every change of personal number during full-time study) • for detailed information see http://ubytstip.zcu.cz/
Low-income family (four instalments per year – without holidays)	on a quarterly basis (every three months retroactively)	The amount is given in the relevant decree	• electronic application (must be submitted at every change of personal number during full-time study) + submission of the original decision on child allowance • for detailed information see http://socstip.zcu.cz/

Any scholarship awarded is paid after enrolment for study (chapter 3.1).

Failure to complete an individual study plan may result in the suspension or total cessation of payment of the Doctoral scholarship.

Detailed information can be found in the Doctoral study section at:
http://www.fav.zcu.cz/

2.4 Accommodation

Each full-time doctoral student is entitled to dormitory accommodation during the standard period of study provided that he/she complies with the accommodation rules of the Accommodation and Catering Administration.

Applicants for dormitory accommodation can apply for it electronically at: http://skm.zcu.cz.

Mature Students on DSP should proceed according to the instructions given at: http://skm.zcu.cz

2.5 Health Insurance

Only students with Czech citizenship are covered by state health insurance, other students must take out health insurance independently.

Applicants – Applicants under 26 years of age are covered by state insurance in the two months following their successful completion of a Master's degree when they are no longer students but have already been admitted to DSP (i.e. from passing the final state examination in June until the admission to study on 1 September)).

Students – Students' health insurance is covered by the state only while they are studying full-time and only until the age of 26 years. Since 1.1.2018, the state may extend payment of health insurance if certain conditions are met; it is necessary to contact the relevant authorities and report any changes in situation. Otherwise, insurance is paid by each student individually.

2.6 Double Supervision

Double supervision means that a student has, in fact, two supervisors: one from UWB and the other from a cooperating foreign university during the time the student is completing part of his Doctoral study at that foreign partner university (not an internship, but proper full-time study). Study on DSP is then carried out in accordance with an individual agreement between the two workplaces in which specific conditions are agreed, such as prescribed courses, prescribed stays at both workplaces, representation of members on the Dissertation Defence Committee, etc.

Upon successful completion of such a study, students receive two diplomas: one granting the title of Ph.D. by UWB in the Czech Republic and the other from the partner university.

2.7 Foreign Students

Health insurance – information on how to pay health insurance must be checked with the relevant authorities. It varies according to the students´ home country therefore this is an individual matter.

Foreign students studying in Czech language – these students are in the same position at FAS as any other student studying in Czech (they have the same possibility to obtain dormitory accommodation, to receive a scholarship, etc.)

Foreign students studying in English language – Study in English is paid for from the students' own resources. The fee for studying in a foreign language is determined by the Rector's decision for the academic year in question. More information about accommodation and study in the Czech Republic and at UWB is available at the UWB International Office. Information on the admission procedure can be found on the Faculty website https://fav.zcu.cz/en/.

2.8 Study Fee for study in English

The study fee for study in doctoral study programs in English in academic year 2020/2021 is set 4000 EUR/year. The amount of the fee is determined by the Rector’s decision 6R/2020. The deadline for the payment of the fee is set by Dean’s decision about admission to study.

3 Organization of Study

3.1 Entry to Study

Study on a Doctoral study programme begins with enrolment.

Registration for Study – Participation in registration is obligatory for every new DSP student. Registration is usually held in the first week of September (1st round of admission procedure), October (2nd round) and April (3rd round); the exact date and place are given in the information on admission to study.

If a student is unable to be present at registration due to some serious problem, it is necessary to inform the Office of Academic Studies as soon as possible, apologize in writing and give the relevant reasons for absence.

Registration consists mainly of implementing administrative procedures associated with the commencement of studies and obtaining information on the organization of Doctoral studies at FAS.

Full-time study – Immediately after enrolment, applicants are obliged to contact their supervisor and the management of the training workplace to which they are, for organization purposes, assigned, and to agree on the course of study, attendance at the workplace and other (e.g. teaching) duties. Within the space available at the workplace, a full-time student will be assigned an individual working place.

Part-time study – Applicants are obliged to contact their supervisor immediately after enrolment and agree on the course of study and other obligations.

3.2 Study Obligations and the Individual Study Plan (ISP)

Individual Study Plan

Study obligations and activites that the student has to complete during the doctoral study are defined in his/her ISP. The fullfillment of ISP is checked by the annual evaluation every year. The number and composition of component examinations for PhD students is suggested by their supervisor. The final examination in the study is the state doctoral examination (usually at the end of the second or beginning of the third year of study), then only the defence of the PhD thesis follows (at the end of the study, usualy at the end of the fourth or during fifth year).

The credit system is not used for Doctoral studies at FAS. In compiling ISPs, the following structure of prescribed course is generally followed.

The block of compulsory general study units includes mainly subjects that DSP students must learn regardless of the formal classification of these subjects in study courses. They include the basics of scientific work and principles of scientific ethics,

familiarization with the methodology of dissertation writing and presentations at seminars. They also include the State Doctoral Examination and the preparation of the dissertation and its defence. Another compulsory course is a foreign world-wide language (most often English), which is not the student's native language, the output level of the course being C1. For full-time students, this also includes adequate participation in the teaching activities of the department if this is the student's training workplace.

Students have to register at least three specialized courses in the block of compulsory professional study; their specific number is appropriate to the focus and scope of the dissertation topic. Courses can either be selected from the list of DSP courses offered (see Chapter 7), or they are created ad hoc according to the focus of the Doctoral thesis. Other compulsory professional study units may include, but are not limited to, creative activities and internships (see below).

After approval by the supervisor, students also have the right to enrol on any course taught at UWB, which then becomes part of their individual study plan.

When drawing up the plan, it is necessary to take into account that all the prescribed examinations must be completed before submitting the application for the State Doctoral Examination and the schedule must be drawn up accordingly.

As the credit system is not used for Doctoral studies at FAS, the courses are not listed in the IS/STAG information system. Abstracts of courses can be found in this brochure or on the Faculty website in the Doctoral study section: http://fav.zcu.cz/studium/doktorske/seznam-predmetu/, or, for English versions, at http://fav.zcu.cz/en/study/doctoral/list-of-courses/.

Requirements for Creative Activity

In addition to specialized courses, the ISP also includes the general topic of scientific research and independent creative activities. This topic is the basis for the development of the Doctoral thesis.

In addition, the ISP establishes ongoing responsibilities related to creative activities, in particular publishing activities (in conference proceedings, peer-reviewed journals, IF journals), participation in professional seminars, domestic and international conferences, and presentations of their own results in domestic and international forums. These obligations reflect the practices of individual scientific disciplines in the given field and the specific study programme.

The prescribed outputs are monitored continuously and during the Doctoral student's annual evaluation by the Field Board. The maintenance of set standards is verified during the dissertation defence; the documentation is a mandatory prescribed supplement of the dissertation itself.

Requirements for Attending Internships

Completion of short-term/medium-term study internships at a foreign workplace, other forms of student mobility (summer schools, workshops, etc.), foreign language teaching lectures, or participation in an international project are also other possible parts of Doctoral studies. If these activities are prescribed in the ISP, they become a mandatory component which is also taken into account in the dissertation defence.

Supervisors and teachers of individual Doctoral programmes/fields are key members of research teams in NTIS departments and research programmes. They cooperate intensively and long term with many universities and research institutions around the world. Students of Doctoral study programmes at FAS are thus

automatically and naturally involved in this international cooperation, including short-term and long-term stays at partner workplaces abroad.

Other Duties

For full-time students, an additional study obligation is adequate involvement in the teaching process (or other teaching activities) of the department in which the student is based. Full-time students participate in teaching activities on the basis of an agreement between the supervisor and the department management. The form and extent of a student's involvement in teaching (i.e. their teaching obligation) reflects both the annually updated needs of the training workplace and the student's other activities which are prescribed in their individual study plan for the given year. Students are involved exclusively in courses where the core part consists of professionally led lectures, and ensure the part of exercises. Changes in the extent (i.e. increase or decrease) of a student's teaching duties are agreed upon with the management of the department by the supervisor, who determines the working mode of the Doctoral student.

Full-time students may also be involved in a Faculty project up to a maximum of half-time. Work on the project is subject to the approval of the supervisor and the head of the guaranteeing department. For part-time students, the workload time is not limited.

Generally, no duties outside those on the ISP may be delegated to students at the expense of completing their study plan and preparing the dissertation for defence.

3.3 Annual Evaluation

At the beginning of each academic year (usually during September), the Field Board meets to discuss annual student evaluations. Evaluations include the completion of ISP by the student, i.e. study, publication and all other prescribed duties and activities for the student in the previous academic year.

The conclusion from the Field Board meeting is a proposal to the Dean to allow either continuation of study according to the ISP without any change, or specification of some required change in the ISP, or even a suggestion to terminate the study due to failure to meet the requirements.

3.4 State Doctoral Examination (SDE)

SDE is the last examination taken by a Doctoral student. Students can apply to take the SDE only after they have successfully fulfilled all the study obligations set out in the individual study plan. Usually, this is at the end of the second or the beginning of the third year of study. **The updated application form** is available in the Doctoral study section at http://www.fav.zcu.cz/.

The SDE serves to verify a student's knowledge in the given field of study with regard to the defined topic of the dissertation. The student should demonstrate deep professional and theoretical knowledge, mastering the methods of independent scientific work and the ability to apply new knowledge where appropriate. This examination completes the initial phase of the Doctoral study in which the student passes the prescribed component examinations and elaborates the assigned dissertation topic. A necessary condition for filing an application to take the SDE is,

in addition to fulfilling all the stipulated study obligations, also submitting a written thesis (the so-called dissertation proposal), whose defence is part of the SDE. The dissertation proposal contains, in principle, a summary and evaluation of knowledge in the studied area, a list of related publications and an outline of the goals of the prepared dissertation. The level of this work is assessed by an opponent whose main task is not only to evaluate the student's work to date, but also to comment on the work in progress and further direction of the topic.

The application for the State Doctoral Examination must be accompanied by a statement from the supervisor. The State Doctoral Examination is held in front of an examination committee consisting of a chairperson, a vice-chairperson and minimally three members; at least one member of the examination committee must be from outside the academic community of UWB.

After passing the SDE, the student, in the next period of his/her Doctoral study, is mainly engaged in research activities focused on the objectives of his/her dissertation; then, he/she processes the results obtained into the form of a dissertation.

3.5 Dissertation/Doctoral Thesis (DT) and Its Defence

The dissertation is the final thesis for Doctoral students. After a successful defence, which is public, the student is awarded the academic title Doctor (abbreviated to Ph.D. after the name).

The list of basic Ph.D. dissertations topics is approved by the FAS Scientific Board and made public in the public part of the website every year: http://fav.zcu.cz/pro-uchazece/prijimaci-rizeni/doktorske-studium.

In addition to the main text of the dissertation, there are other parts which must be included in the dissertation, in particular: **the summary in Czech and English, possibly also in another world language, and the list of the author's publications with any possible feedback given**. The list of compulsory sections of the dissertation and form of the summary are given in the Study and Examination Regulations of UWB, Articles 98 and 105.

When writing a dissertation, it is necessary to observe the content of the introductory pages as prescribed at FAS. DT information is stored in IS/STAG, the DT text must be uploaded in electronic form. It is also necessary to provide one printed copy of the dissertation, intended for the UWB Library, with a bookmark, on the back cover, for inserting copies of opponent opinions.

List of Compulsory DT Pages with Prescribed Content

These are:

- DT cover,
- the first page,
- the second page, which is a translation of the first page into English,
- affidavit confirming compliance with usual procedures in scientific work,
- summary (résumé) in Czech and English, and possibly also in another world language,
- list of published works.

Current sample templates are available in the PhD study section at: http://www.fav.zcu.cz/

Upload of DT into IS/STAG – Before submitting the application for defence, it is necessary, based on the Rector's Directive 33R/2017 and its subsequent amendments, to upload a file with the complete dissertation text to IS/STAG at http://www.portal.zcu.cz/ in the section My study – End-of-study theses. In the case of any problems, contact the Office of Academic Studies.

Submission of the Application for Defence of the Dissertation

You can find the current application form for the dissertation defence in the Doctoral study section at:
http://www.fav.zcu.cz/

This form must be completed and delivered to the Office of Academic Studies together with all required annexes.

Dissertation Defence (DD) - The defence of the dissertation is usually held two to three months after submission of the application. This period is variable and cannot be considered as fixed. Immediately after successful completion, students are awarded the Ph.D. title. The Ph.D. Diploma is handed to graduates at the graduation ceremony.

If necessary (annex to the application for POST-DOC project or as requested by the employer, etc.), it is possible, upon agreement with the Office of Academic Studies, to receive the Diploma earlier.

3.6 Graduation Ceremony

The DSP Graduation Ceremony is held once a year. Graduates are given the Diploma and the Diploma Supplement from the Dean in person. At the same time, they give the Oath of the Graduate directly to the UWB Rector.

4 Ph.D. Study Programmes

4.1 Applied Mechanics

Doctoral study in the Department of Applied Mechanics is directly connected to the Master study programme “Applied Mechanics” offered by the Faculty. Applicants interested in research and development in Applied Mechanics who have graduated from other engineering faculties are also eligible for admission to the Ph.D. programme supposing they have specialised in mechanics, physics, mathematics and/or design.

The Ph.D. study is focused on scientific research and creativity in various branches of mechanics of solid and flexible bodies and continua. The doctoral students gain a more profound knowledge especially in the analysis of motion, stress and strain, durability and failure prediction of mechanical and biomechanical systems subjected to static, thermal and dynamic loading. For solving these problems they use analytic, numerical and experimental methods.

By the end of their studies, the Ph.D. candidates have gained a good theoretical basis and a thorough knowledge in one of the following specialisations:

- **Kinematic and dynamic analysis and synthesis of mechanical systems** applied especially to rotor systems, screw machines, rail vehicle components and nuclear power facilities.
- **Damage and failure of structures from classical and composite materials** with focus on the analysis of the material characteristics influence and on the development of methods for the optimisation of composite structures.
- **Continuum mechanics, mechanics of microstructures and biomechanics** focused on modelling mechanical and physical interactions in multiphase structured media and on modelling living tissues at both cellular and macroscopic levels for selected human organs, depending on the load applied and on physiological conditions.

After finishing their doctoral studies, the graduates find career opportunities especially in research and development centres in various companies, in public research institutions (e.g. Academy of Sciences of the Czech Republic), in higher education institutions or in medical research centres.

4.2 Plasma Physics and Physics of Thin Films

The doctoral study is aimed at the solution of fundamental problems in discharge plasma physics, plasma chemistry, surface physics and engineering, and physics of thin films, which arise from the formation and investigation of a new generation of thin film materials with unique physical and functional properties. These materials (particularly amorphous and nanostructured nitrides and oxides) are prepared by unconventional processes in discharge plasmas of various types (mainly magnetron and microwave discharges in a continuous or pulsed mode).The main research topics cover the modelling and diagnostics of the nonequilibrium discharge plasmas (optical emission spectroscopy, energy-resolved mass spectroscopy and probe methods),study of film growth and surface modification processes,design and investigation of novel plasma sources for thin film, deposition and surface modification, characterisation of the formed films and modified surfaces (elemental composition, chemical bonds, structure, mechanical and optical properties) and study of thermomechanical processes in materials (modelling and diagnostics of temperature fields, and processes in laser technologies).

4.3 Geomatics

The doctoral study program Geomatics, which follows on from the master's study program, responds to increasing demands of using modern progressive methods of mass data collection by both direct geodetic methods (such as electronic tachymeters and combined GNSS stations) and indirect methods (such as laser scanning, aerial

photogrammetry and remote sensing). With the increasing amount of raw observation data, the complexity of their processing increases and large computer systems must be used to extract practically usable and relevant information from raw data. The quality of extracted information is important for their subsequent usability and authenticity, with which Geomatics must be able to work reliably. The optimization of the process of planning collection, processing, storage and provision of data depends on the use of appropriate data models. Data modelling brings completely new technological and methodological possibilities for data visualization in cartography and geoinformatics. Classical methods of processing and distributing cartographic works have gradually been replaced by their publishing in digital form and web technologies.
Depending on expertise of their supervisors, graduates of this doctoral study program profile themselves in one of several disciplines which include mathematical and physical geodesy, geodetic foundations, global navigation satellite systems, geodynamics, gravimetry, geomatics and geoinformatics, geospatial data modelling, and visualization techniques in cartography and geoinformatics with the emphasis on internet applications. All these disciplines are connected with mathematical statistics, numerical modelling and methods, graph theory, theoretical computer science and complexity theory, geometry and computer geometry. Graduates of this doctoral study program can be employed in various branches of public and private sectors.

4.4 Computer Science and Engineering

Ph.D. study leads to a professional research qualification. The research areas include but are not limited to:

Methods for development of distributed and embedded systems

- Methods of exact functionality specification of distributed systems using existing or newly developed abstract models. Research into and development of distributed systems architectures with emphasis on the utilisation of reusable HW and SW components. Methods and languages for the formal description of component interface and functionality, and architectural specifications (connection and communication of components).
- Distributed and parallel simulation, active networks, GRID and mobile computing.
- Abstract models of distributed systems architecture aimed at the evaluation of safety and reliability parameters. Construction of complex distributed systems, models that support decomposition into independent parts.

Models and methods for development of reliable modular software systems

- Methods for verifying software systems consistency, static verification of configuration consistency and update compatibility using a type representation of the components and service-based applications; methods for resource constrained devices and heterogeneous architectures.
- Models supporting testing automation, inspired by simulation-based (stochastic) software verification; methods for realistic test and test data generation with high code coverage, leveraging various system models and

information from static analysis of source code and traces of behaviour of the application under test.

- Software process modeling and improvement, automated detection of process (anti-)patterns in models and data of actual software development projects.

Intelligent methods for data processing

- Development of special methods of biomedical and/or biometric signal processing. Development of models and methods for knowledge representation including models learning directly from the already analysed biometric and biomedical signals. Knowledge extraction from signal waveforms analysed and saved in neuroinformatic and biometric databases.
- Development of new models and methods for knowledge representation and acquisition, including derivation of models from data and multilingual ontology infrastructure for the semantic Web. Utilisation of approaches from natural language understanding, artificial intelligence, mathematics, databases and agent technologies.
- Theoretical investigation of the concept of disinformation and its detailed analysis. Creation of models for passive problems – identification, measure of risk and decision-making. Creation of models for active problems – control and influence.

Geometric models, algorithms and visualization

- Development of algorithms and geometric models for computer graphics, data visualization and information visualisation, with respect to robustness and large data processing, applied computational geometry.
- Development of methods for virtual reality, human-computer interfaces for virtual and collaborative spaces, development of visual human-computer interaction techniques

The doctoral study programme “Computer Science and Engineering” is accredited by the Czech Ministry of Education, Youth, and Sports in both the full-time and combined forms. Applicants for admission to the Ph.D. programme must hold a Master´s degree in Computing or a related study field. After finishing their doctoral studies, the Ph.D. graduates find career opportunities especially in research and development centres in various industrial companies, in public research institutions (e.g. Academy of Sciences of the Czech Republic), in higher education institutions and in medical research centres.

4.5 Cybernetics

Doctoral study of Cybernetics is directly connected with the Master study of Cybernetics and Control Engineering within the study programme “Applied Sciences and Informatics”, accredited at the Faculty of Applied Sciences by the Ministry of Education, Youth, and Sports of the Czech Republic. Graduates of other engineering and natural science faculties, specialised in informatics, computer science, mechatronics, applied mathematics and similar fields are also eligible for this study. The programme is primarily based on the individual work of the students with focus on the scientific research documented by their publication activity. The courses are intended to broaden the students´ theoretical knowledge in selected scientific areas.

Doctoral study of Cybernetics is focused on the following **research areas:**

- design and development of methods for system identification, nonlinear filtration, fault detection, optimal decision-making or control, and adaptive systems covering adaptive control and adaptive signal processing,
- research into and development of new methods of industrial process control focused on robust and predictive control and on automatic design and tuning of industrial controllers,
- design and development of speech technologies, i.e. computer analysis, synthesis and speech signal recognition, design and construction of voice dialogue systems including development of speech understanding methods,
- development of decision-making methods with the support of artificial intelligence, integration of knowledge-based and attribute-based approaches (especially in technical and medical diagnostics),
- modelling, simulation and control of power distribution networks.

The ultimate goal of the doctoral study is to acquaint the Ph.D. students with methods of scientific research and to prepare them for highly qualified work in institutions conducting fundamental, applied and/or industrial research (universities, Academy of Sciences of the Czech Republic, industrial companies, hospitals and other institutions) or for specialist positions in company managements.

4.6 Mathematics

The doctoral study programme “Mathematics” is a continuation of the Master study programmes guaranteed by the Department of Mathematics. It reflects the scientific orientation of the Department. Applicants holding a Master´s degree in Mathematics or related study fields are also eligible for admission to this Ph.D. study programme.

The doctoral research topics cover the following areas:

- study of qualitative properties of nonlinear differential equations in one-dimensional and multi-dimensional cases,
- formulation of nonlinear mathematical models on time scales and their analysis,
- study of nonlinear eigenvalue problems, especially problems with degenerate and singular operators,
- bifurcations of solutions of nonlinear systems,
- effective methods of algebraic geometry for applications in geometric modelling;
- symbolic manipulations in computer-aided geometric design and symbolic-numerical computations,
- optimisation of the choice of models of random variables in lifetime theory and regression analysis,

- study of the properties of discrete structures (graphs, hypergraphs, matroids, codes); investigation of their mutual relations (colourings, homomorphisms) and existence of special substructures (cycles, paths, factors),
- study of graph operators, especially graph closures, and related methods for the investigation of the properties of graph structures,
- numerical analysis of problems of multi-phase flow and contact problems in biomechanics,
- development of new computational conservative schemes for numerical simulations in fluid mechanics.

The doctoral study programme "Mathematics" was accredited by the Czech Ministry of Education, Youth, and Sports in both the full-time and combined forms. After finishing their doctoral studies, the Ph.D. graduates find career opportunities especially in research and development centres in various industrial companies, in public research institutions (e.g. Academy of Sciences of the Czech Republic), in higher education institutions and financial institutions.

5 Ph.D. Study Boards

The Ph.D. Study Boards are responsible for the conceptual framework and evaluation of Ph.D. study. Their members are leading academic and research staff from the University of West Bohemia as well as from other universities and institutions.

5.1 Applied Mechanics

Prof. Ing. Vladislav LAŠ, CSc., chairman	KME FAV ZČU Plzeň
Prof. Ing. Jiří KŘEN, CSc.,	KME FAV ZČU Plzeň
Prof. Dr. Ing. Jan DUPAL	KME FAV ZČU Plzeň
Doc. Dr. RNDr. Miroslav HOLEČEK	ZČU Plzeň
Doc. Ing. Luděk HYNČÍK, Ph.D.	NTC ZČU
Doc. Ing. Jan PAŠEK, Ph.D.	KME FAV ZČU Plzeň
Dr. Ing. Pavel POLACH	VZÚ Plzeň
Prof. Dr. Ing. Eduard ROHAN, DSc.	KME FAV ZČU Plzeň
Prof. Ing. Josef ROSENBERG, DrSc.	KME FAV ZČU Plzeň
Prof. Ing. Milan RŮŽIČKA, CSc.	FS ČVUT Praha
Prof. Ing. Michal ŠEJNOHA, Ph.D.	FSv, ČVUT Praha
Prof. Ing. Zbyněk ŠIKA, Ph.D.	FS ČVUT Praha
Doc. Ing. Jan VIMMR, Ph.D.	KME, FAV ZČU
Prof. Ing. Vladimír ZEMAN, DrSc.	KME FAV ZČU Plzeň

Explanatory notes:
AV ČR = Academy of Sciences of the Czech Republic; ČVUT = Czech Technical University in Prague; FAV = Faculty of Applied Sciences; FS = Faculty of Mechanical Engineering; FSv = Faculty of Civil Engineering; KME = Department of Mechanics;

NTC = New Technologies – Research Centre; ÚT = Institute of Thermomechanics; VZÚ Plzeň = Research and Testing Institute Pilsen; ZČU Plzeň = University of West Bohemia

5.2 Plasma Physics and Physics of Thin Films

Prof. RNDr. Jaroslav VLČEK, CSc., chairman	KFY FAV ZČU Plzeň
Doc. Ing. Pavel BAROCH, Ph.D.	KFY FAV ZČU Plzeň
Doc. RNDr. Petr BARTOŠ, Ph.D.	ZF JU Č. Budějovice
Prof. RNDr. Jaroslav FIALA, CSc.	NTC ZČU Plzeň
Doc. Ing. Milan HONNER, Ph.D.	KFY FAV ZČU Plzeň
Doc. Ing. Jiří HOUŠKA, Ph.D.	KFY FAV ZČU Plzeň
Doc. RNDr. Milan HRABOVSKÝ, CSc.	ÚFP AV ČR
Doc. Mgr. Šimon KOS, Ph.D.	KFY FAV ZČU Plzeň
Prof. Ing. Jindřich MUSIL, DrSc.	KFY FAV ZČU Plzeň
Prof. Ing. Stanislav PEKÁREK, CSc.	FEL ČVUT Praha
Doc. RNDr. Karel RUSŇÁK, CSc.	KFY FAV ZČU Plzeň
Doc. RNDr. Jan SLAVÍK, CSc.	KFY FAV ZČU Plzeň
Doc. RNDr. Vítězslav STRAŇÁK, Ph.D.	PřF JU Č. Budějovice
Prof. RNDr. Petr ŠPATENKA, CSc.	PF JU Č. Budějovice
Doc. RNDr. Pavol ŠUTTA, Ph.D.	NTC ZČU Plzeň
Prof. RNDr. Milan TICHÝ, DrSc.	MFF UK Praha
Prof. Ing. Petr ZEMAN, Ph.D.	KFY FAV ZČU Plzeň

Explanatory notes:
AV ČR = Academy of Sciences of the Czech Republic; ČVUT Praha = Czech Technical University in Prague; FAV = Faculty of Applied Sciences; FEL = Faculty of Electrical Engineering; JU Č. Budějovice = University of South Bohemia in České Budějovice; KFY = Department of Physics; MFF = Faculty of Mathematics and Physics; NTC = New Technologies – Research Centre; PF = Pedagogical Faculty; PřF = Faculty of Science; ÚFP = Institute of Plasma Physics; UK Praha = Charles University in Prague; ZČU Plzeň = University of West Bohemia; ZF = Faculty of Agriculture

5.3 Geomatics

Prof. Ing. Pavel NOVÁK, Ph.D., chairman	KGM FAV ZČU Plzeň
RNDr. Ing. Petr HOLOTA, DrSc.	VÚGTK Zdiby
Doc. Ing. Václav ČADA, CSc.	KGM FAV ZČU Plzeň
Prof. Ing. Aleš ČEPEK, CSc.	FSv ČVUT Praha
Prof. Ing. Ján HEFTY, PhD.,	STU Bratislava
Prof. Dr. Ing. Ivana KOLINGEROVÁ	KIV FAV ZČU Plzeň
Prof. Ing. Jan KOSTELECKÝ, DrSc.	VÚGTK Zdiby
Prof. Dr. Ing. Karel PAVELKA	FSV ČVUT Praha

Explanatory notes:
ČVUT Praha = Czech Technical University in Prague; FAV = Faculty of Applied Sciences; FSv = Faculty of Civil Engineering; KIV = Department of Computer Science

and Engineering; KGM = Department of Geomatics; STU = Slovak Technical University; VÚGTK Zdiby = Institute of Geodesy, Topography and Cartography Zdiby; ZČU Plzeň = University of West Bohemia

5.4 Computer Science and Engineering

Prof. Dr. Ing. Ivana KOLINGEROVÁ, chairperson	KIV FAV ZČU Plzeň
Doc. Ing. Přemysl BRADA, MSc., Ph.D.	KIV, FAV ZČU
Prof. Ing. Adam HEROUT, Ph.D.	FIT, VUT Brno
Doc. Ing. Pavel HEROUT, Ph.D.	KIV FAV ZČU Plzeň
Doc. RNDr. Petr HNĚTYNKA, Ph.D.	MFF, UK Praha
Doc. Ing. Eduard JANEČEK, CSc.	KKY FAV ZČU Plzeň
Prof. Ing. Karel JEŽEK, CSc.	KIV FAV ZČU Plzeň
Prof. Ing. Antonín KAVIČKA, Ph.D.	KIT FEI Univerzita Pardubice
Doc. Dr. Ing. Jana KLEČKOVÁ	KIV FAV ZČU Plzeň
Doc. Ing. Pavel KRÁL, Ph.D.	KIV, FAV ZČU
Prof. Ing. Václav MATOUŠEK, CSc.	KIV FAV ZČU Plzeň
Prof. Ing. Ondřej NOVÁK, CSc.	ITE TU Liberec
Doc. Ing. Stanislav RACEK, CSc.	KIV FAV ZČU, Plzeň
Doc. RNDr. Petr STEHLÍK, Ph.D.	KMA, FAV ZČU
Prof. Ing. Jiří ŠAFAŘÍK, CSc.	KIV FAV ZČU Plzeň
Doc. Ing. Václav ŠEBESTA, DrSc.	UI AV ČR Praha
Prof. Ing. Pavel TVRDÍK, CSc.	FIT ČVUT Praha
Doc. Ing. Vlastimil VAVŘIČKA, CSc.	KIV FAV ZČU Plzeň
Prof. Ing. Tomáš VOJNAR, Ph.D.	FIT VUT Brno

Explanatory notes:
AV ČR = Academy of Sciences of the Czech Republic; ČVUT Praha = Czech Technical University in Prague; FAV = Faculty of Applied Sciences; FEI = Faculty of Electrical Engineering and Informatics; FIT = Faculty of Information Technology; KIT = Department of Information Technology; KIV = Department of Computer Science and Engineering; KKY = Department of Cybernetics; KMA = Department of Mathematics; ITE = Institute of Information Technology and Electronics; TU Liberec = Technical University of Liberec; Univerzita Pardubice = University of Pardubice; UI = Institute of Informatics; VUT Brno = Brno University of Technology; ZČU Plzeň = University of West Bohemia

5.5 Cybernetics

Prof. Ing. Josef PSUTKA, CSc., chairman	KKY FAV ZČU Plzeň
Doc. Ing. Eduard JANEČEK, CSc.	KKY FAV ZČU Plzeň
Ing. Miroslav KÁRNÝ, DrSc.	ÚTIA AV ČR Praha
Prof. Ing. Vladimír KUČERA, DrSc.	FEL ČVUT Praha
Prof. Ing. Vladimír MAŘÍK, DrSc.	FEL ČVUT Praha
Doc. Ing. Jindřich MATOUŠEK, Ph.D.	KKY, FAV, ZČU
Prof. Ing. Luděk MÜLLER, Ph.D.	KKY FAV ZČU Plzeň
Doc. Dr. Ing. Vlasta RADOVÁ	KKY FAV ZČU Plzeň
Prof. Ing. Miloš SCHLEGEL, CSc.	KKY FAV ZČU Plzeň
Doc. Ing. Ondřej STRAKA, Ph.D.	KKY, FAV, ZČU

Prof. Ing. Pavel VÁCLAVEK, Ph.D.	FEKT, VUT Brno
Doc. Ing. Miloš ŽELEZNÝ, Ph.D.	KKY, FAV, ZČU

Explanatory notes:
AV ČR = Academy of Sciences of the Czech Republic; ČVUT Praha = Czech Technical University in Prague; FAV = Faculty of Applied Sciences; FEKT = Faculty of Electrical Engineering and Communication; FEL = Faculty of Electrical Engineering; KKY = Department of Cybernetics; ÚTIA = Institute of Information Theory and Automation; VUT Brno = Brno University of Technology; ZČU Plzeň = University of West Bohemia

5.6 Mathematics

Prof. RNDr. Pavel DRÁBEK, DrSc., chairman	KMA FAV ZČU Plzeň
Doc. Ing. Marek BRANDNER, Ph.D.	KMA FAV ZČU Plzeň
Doc. Ing. Josef DANĚK, Ph.D.	KMA FAV ZČU Plzeň
Doc. Ing. Jiří FÜRST, Ph.D.	FS ČVUT
Doc. Ing. Petr GIRG. Ph.D.	KMA FAV ZČU
Doc. Ing. Gabriela HOLUBOVÁ, Ph.D.	KMA FAV ZČU Plzeň
Prof. RNDr. Tomáš Kaiser, DSc.	KMA FAV ZČU Plzeň
Prof. RNDr. Jan KRATOCHVÍL, CSc.	MFF UK Praha
Prof. Ing. Jiří KŘEN, CSc.	KME FAV ZČU Plzeň
Prof. RNDr. Vlastimil KŘIVAN, CSc.	BC ENTU AV ČR
Prof. RNDr. Miroslav LÁVIČKA, Ph.D.	KMA FAV ZČU Plzeň
Prof. RNDr. Bohdan MASLOWSKI, DrSc.	MFF UK Praha
Prof. RNDr. Zdeněk RYJÁČEK, DrSc.	KMA FAV ZČU Plzeň
Doc. RNDr. Petr STEHLÍK, Ph.D.	KMA FAV ZČU
Doc. RNDr. Tomáš VEJCHODSKÝ, Ph.D.	MÚ AV ČR

Explanatory notes:
AV ČR = Academy of Sciences of the Czech Republic; BC = Biology Centre; ENTU = Institute of Entomology; ČVUT = Czech Technical University in Prague; FAV = Faculty of Applied Sciences; KMA = Department of Mathematics; KME = Department of Mechanics; MFF = Faculty of Mathematics and Physics; MÚ = Institute of Mathematics; FS = Faculty of Mechanical Engineering; UK Praha = Charles University in Prague; ZČU Plzeň = University of West Bohemia

6 List of Supervisors

6.1 Applied Mechanics

Doc. Ing. Petr Brož, DrSc., Department of Mechanics, UWB
Mechanics of building structures, defects from both the physical and material standpoints

Prof. Dr. Ing. Jan Dupal, Department of Mechanics, UWB
Statistical mechanics, dynamics, vibration of rotor systems, vibroacoustics

Doc. Ing. Michal Hajžman, Ph.D., Department of Mechanics, UWB
Technical mechanics, dynamics of machines, vibration, system optimisation

Doc. Dr. RNDr. Miroslav Holeček, Department of Mechanics, UWB
Mechanics of microstructure, thermodynamics

Doc. Ing. Luděk Hynčík, Ph.D., New Technologies –Research Centre, Department of Mechanics, UWB
Biomechanics, theoretical mechanics, modelling and simulation

Prof. Ing. Jiří Křen, CSc., Department of Mechanics, UWB
Technical mechanics, continuum mechanics, biomechanics, interaction of continua of different phases, modelling and simulation

Prof. Ing. Vladislav Laš, CSc., Department of Mechanics,UWB
Stress and strain analysis, mechanics of composites, damage mechanics

Doc. Ing. Jan Pašek, Ph.D., Department of Mechanics, UWB
Civil Engineering

Prof. Dr. Ing. Eduard Rohan, DSc., Department of Mechanics, UWB
Continuum mechanics, structure optimisation, tissue models, homogenisation method in mechanics of microstructure

Prof. Ing. Josef Rosenberg, DrSc., New Technologies –Research Centre, Department of Mechanics, UWB
Continuum mechanics, theoretical mechanics, tissue models, nonlinear dynamics and chaos

Doc. Ing. Jan Vimmr, Ph.D., Department of Mechanics, UWB
Technical mechanics, fluid dynamics, modelling of turbulent fluid flow

Prof. Ing. Vladimír Zeman, DrSc., Department of Mechanics, UWB
Technical mechanics, dynamics of machines, vibration, system optimisation

Doc. Ing. Robert Zemčík, Ph.D., Department of Mechanics, UWB
composite materials, finite element method, structure health monitoring

6.2 Plasma Physics and Physics of Thin Films

Doc. Ing. Pavel Baroch, Ph.D., Department of Physics, UWB
Physics of discharge plasmas, surface physics and engineering

Doc. RNDr. Petr Bartoš, Ph.D., University of South Bohemia in České Budějovice
Physics of discharge plasmas

Prof. RNDr. Jaroslav Fiala, CSc., New Technologies - Research Centre, UWB
Solid state physics, film characterisation, X-ray diffraction

Doc. Ing. Milan Honner, Ph.D., New Technologies – Research Centre, UWB
Thermomechanical processes in materials, modelling and diagnostics of temperature fields

Doc. Ing. Jiří Houška Ph.D., Department of Physics, UWB
Surface physics and engineering, physics of thin films

Doc. RNDr. Šimon Kos, Ph.D., Department of Physics, UWB
Physics of thin films

Doc. Dr. Ing. Ján Minár, New Technologies – Research Centre, UWB
solid state physics, computer simulations of electronic structure of materials

Prof. Ing. Jindřich Musil, DrSc., Department of Physics, UWB
Plasma physics, surface physics and engineering, physics of thin films

Doc. RNDr. Vítězslav Straňák, Ph.D., University of South Bohemia in České Budějovice
Physics of discharge plasmas, surface physics and engineering

Prof. RNDr. Petr Špatenka, CSc., University of South Bohemia in České Budějovice
Plasma diagnostics, physics of thin films

RNDr. Jiří Vackář, CSc., Institute of Physics, Academy of Sciences of the Czech Republic
Computer simulation of solid states

Prof. RNDr. Jaroslav Vlček, CSc., Department of Physics, UWB
Physics of discharge plasmas, surface physics and engineering, physics of thin films

Prof. Ing. Petr Zeman, Ph.D., Department of Physics, UWB
Physics of thin films, thermal behaviour of thin film materials

6.3 Geomatics

Doc. Ing. Václav Čada, CSc., Department of Geomatics, UWB
Geodesy, digital cartography

Doc. Ing. Mgr. Otakar Čerba, Ph.D., Department of Geomatics, UWB
Computer cartografy, geoiniformation vizualization, ontologies, linked spatial data

RNDr. Ing. Petr Holota, DrSc., Research Institute of Geodesy, Topography and Cartography, Zdiby
Theoretical geodesy

Prof. Dr. Ing. Ivana Kolingerová, Department of Computer Science and Engineering, UWB
Computer graphics, computational geometry

Prof. Ing. Jan Kostelecký, DrSc., Research Institute of Geodesy, Topography and Cartography, Zdiby
Satellite geodesy

Doc. RNDr. Pavel Mentlík, Ph.D., Department of Geography, Faculty of Education, UWB
GIS, geomorphology

Prof. Ing. Pavel Novák, Ph.D., Department of Geomatics, UWB
Geodesy

Doc. Ing. Libor Váša, Ph.D., Department of Computer Science and Engineering, UWB
Information technologies and methods in geomatics

6.4 Computer Science and Engineering

Doc. Ing. Přemysl Brada, MSc. Ph.D., Department of Computer Science & Engineering, UWB
Software engineering and processes; software components, composition and substitutability in modular software systems; modelling and visualisation of software structures

Doc. Ing. Dalibor Fiala, Ph.D., Department of Computer Science & Engineering, UWB
data mining, information systems, information scence

Doc. Ing. Pavel Herout, Ph.D., Department of Computer Science & Engineering, UWB
Software testing; portable, robust, scalable and secure software systems; modern programming styles and methods

Prof. Ing. Karel Ježek, CSc., Department of Computer Science & Engineering, UWB
Textual and semi-structured data exploring; Web content and Web structure mining; semantic Web; information and knowledge extraction from large data collection; deductive systems

Doc. Dr. Ing. Jana Klečková, Department of Computer Science & Engineering, UWB
Database systems, XML, Web, data compression, data warehouses, document information systems, spontaneous speech recognition, multimedia databases

Doc. Ing. Josef Kohout, Ph.D. , Department of Computer Science & Engineering, UWB
Computer graphics, medical informatics

Prof. Dr. Ing. Ivana Kolingerová, Department of Computer Science & Engineering, UWB
Geometric algorithms, applied computational geometry

Doc. Ing. Tomáš Koutný, Ph.D., Department of Computer Science & Engineering, UWB
Bionformatics, glucose-dynamics modelling, control systems of glucose concentration

Doc. Ing. Pavel Král, Ph.D., Department of Computer Science & Engineering, UWB
Automatic speech processing, image processing

Prof. Ing. Václav Matoušek, CSc., Department of Computer Science & Engineering, UWB
Artificial intelligence, pattern analysis and recognition, human-machine communication in natural language, biometry and bioinformatics, neuroinformatics

Doc. Ing. Stanislav Racek, CSc., Department of Computer Science & Engineering, UWB
Verification of computer system properties (performance, reliability) - mathematical and/or simulation models, algebraic specification, evaluation nets, model checking

Prof. Ing. Václav Skala, CSc., Department of Computer Science & Engineering, UWB
Algorithms for computer graphics and data structures, algorithms and methods for data and information visualisation, Euclidean and projective spaces, geometry algebra

Doc. Ing. Josef Steinberger, Ph.D., Department of Computer Science & Engineering, UWB
Text summarisation and analysis in multilingual environment

Prof. Ing. Jiří Šafařík, CSc., Department of Computer Science & Engineering, UWB
Operating systems, distributed systems, active networks, distributed and parallel simulation

Doc. Ing. Libor Váša, Ph.D., Department of Computer Science & Engineering, UWB
Computer graphics, triangle mesh processing, geometry data compression

Doc. Ing. Vlastimil Vavřička, CSc., Department of Computer Science & Engineering, UWB
Digital system architecture, embedded systems, design methodology, reliability, testability, CPLD, PFGA

6.5 Cybernetics

Doc. M.Sc. et M.Sc. Daniel Georgiev,Ph.D., Department of Cybernetics, UWB
Biocybernetics, management systems in biology, genetic control systems, information systems.

Doc. Ing. Pavel Ircing,Ph.D., Department of Cybernetics, UWB
Search for information in text and spoken data, speech recognition, machine learning

Doc. Ing. Eduard Janeček, CSc., Department of Cybernetics, UWB
Modelling, diagnostics, machine and process control; stochastic models of complex systems and networks, estimation of their states and parameters

Ing. Miroslav Kárný, DrSc., Institute of Information Theory and Automation, Academy of Sciences of the Czech Republic
Decision-making under uncertainty, multiparticipant decision-making, adaptive control, optimal control, Bayesian approach, computational aspects

Doc. Ing. Jindřich Matoušek, Ph.D., Department of Cybernetics, UWB
Speech synthesis; text-to-speech synthesis; speech modelling & segmentation; phonetics; phonology; phonetic transcription; speech acoustics; speech prosody

Prof. Ing. Luděk Müller, Ph.D., Department of Cybernetics, UWB
Spoken language processing, voice dialogue systems, technical diagnostics

Prof. Ing. Josef Psutka, CSc., Department of Cybernetics, UWB
Speech analysis, synthesis and recognition, spoken dialogue systems; pattern recognition; artificial intelligence; technical and medical diagnostics

Doc. Dr. Ing. Vlasta Radová, Department of Cybernetics, UWB
Speaker recognition, speech signal processing

Prof. Ing. Miloš Schlegel, CSc., Department of Cybernetics, UWB
Linear systems, robust control systems, model based predictive control, process control, embedded control, industrial controller; mechatronics

Doc. Ing. Ondřej Straka, Ph.D., Department of Cybernetics, UWB
State estimation of nonlinear dynamical systems; filtering

Doc. Ing. Miloš Železný, Ph.D., Department of Cybernetics, UWB
Multimodal processing of human speech and sign language, gestures, emotions and non-speech expressions; machine vision, industrial and medical vision

6.6 *Mathematics*

Doc. Ing. Bohumír Bastl, Ph.D., Department of Mathematics, UWB
Geometric modelling, isogeometric analysis

Doc. RNDr. Jiří Benedikt, Ph.D., KMA
Mathematical analysis, quasilinear differential equations

Doc. Ing. Marek Brandner, Ph.D., Department of Mathematics, UWB
Numerical modelling

Doc., Ing. Radek Cibulka, Ph.D., Department of Mathematics, UWB
Variational analysis and non-smooth optimization, differential inclusions

Doc. Ing. Roman Čada, Ph.D., Department of Mathematics, UWB
Graph theory, theoretical informatics

Doc. Ing. Josef Daněk, Ph.D., Department of Mathematics, UWB
Numerical modelling

Prof. RNDr. Pavel Drábek, DrSc., Department of Mathematics, UWB
Functional analysis, nonlinear differential equations

Prof. RNDr. Eduard Feireisl, DrSc., Faculty of Mathematics and Physics, Charles University in Prague
Nonlinear fluid dynamics, partial differential equations

Doc. Ing. Petr Girg, Ph.D., Department of Mathematics, UWB
Mathematical analysis, quasilinear differential equations

Doc. Ing. Gabriela Holubová, Ph.D., Department of Mathematics, UWB
Mathematical analysis, nonlinear differential equations

Prof. RNDr. Tomáš Kaiser, DSc., Department of Mathematics, UWB
Graph theory, combinatorial geometry

Prof. RNDr. Milan Kučera, DrSc., Department of Mathematics, UWB, Institute of Mathematics, Academy of Sciences of the Czech Republic
Nonlinear analysis, variational inequalities

Prof. RNDr. Miroslav Lávička, Ph.D., Department of Mathematics, UWB
Geometric modelling, applications of algebraic geometry

RNDr. Šárka Nečasová, Ph.D., DSc., Institute of Mathematics, Academy of Sciences of the Czech Republic
Nonlinear fluid dynamics, partial differential equations

Prof. RNDr. Zdeněk Ryjáček, DrSc., Department of Mathematics, UWB
Graph theory, theoretical informatics

Doc. RNDr. Petr Stehlík, Ph.D., Department of Mathematics, UWB
Differential and difference equations, mathematical economics

7 List of Courses

7.1 Applied Mechanics

Computational Methods of Mechanics of Continuum

Výpočtové metody mechaniky kontinua

Prof. Ing. Vladislav Laš, CSc.

Virtual work principle and variational principles. Approximate methods for the solution of continuum mechanics problems. Finite element method and solution to elastostatic and dynamic problems. Boundary element method. Non-linear problem solution – physical nonlinearity, contact problem. Non-linear stress state, elastic and plastic stress waves propagation during body impact. Numerical solution to linear and non-linear fracture mechanics problems using computational systems (MARC, ANSYS, ABAQUS).

Computational Methods of Dynamics

Výpočtové metody dynamiky

Prof. Dr. Ing. Jan Dupal

Mathematical modelling of continuum dynamics problems. Approximate methods of discretisation. Eigenvalue investigation. Response calculation of continuum represented by selfadjoint and non-selfadjoint operators and by matrices (after discretisation). Discretisation of structures such as beams, rotating shafts, plates and shells by FEM. Modelling of structures consisting of the above types of continuum. Stress and stability analysis of non-symmetrical rotors and special multibody-beam systems. Numerical methods of direct integration of the equation of motion. Use of the MATLAB system in dynamics.

Damage and Failure of Composite Materials

Porušování kompozitních materiálů

Prof. Ing. Vladislav Laš, CSc.

Mechanics of composite materials. Unidirectional composites and determination of their material characteristics. Classical laminate theory. Macro- and micro-mechanical criteria of unidirectional composite failure. Modern interactive failure criteria (Direct mode) from the LaRC group (NASA). Progressive failure analysis. Numerical simulation of composite damage under static and dynamic loading using the finite element method. Laminate residual strength determination.

Design and Monitoring of Composite Structures

Návrh a monitorování kompozitních konstrukcí

Doc.Ing. Robert Zemčík, Ph.D.

Mechanics of anisotropic materials. Multiscale (micro, meso, macro) modelling of thin unidirectional and textile composite structures with nonlinear response (degradation, anisotropic plasticity). Nonstationary state of stress, stress wave propagation and impact problems. Identification of material characteristics using combination of experimental tests, numerical simulations, and optimization methods. Contactless optical methods (digital image correlation, stereophotogrammetry). Piezoelectric materials and measurements using piezoelectric transducers. Passive and active structural health monitoring for

reconstruction of unknown loading and identification (detection, localization) of defects.

Dynamics of Machines

Dynamika strojů

Prof. Dr. Ing. Jan Dupal

Modelling of multibody system motion using Lagrange´s equations. Discrete models of linear vibration systems in matrix form. Modal and spectral matrices. Modal methods for dynamic response investigation. Steady harmonic and periodic forced vibration. Modelling of large mechanical systems by modal synthesis method with condensation. Application – dynamics of rotors, vibroisolation of machines, torsional vibration of drives, vibration of shaft systems with gears, beam and piping system vibration, seismic vibration of structures.

Fracture Mechanics

Lomová mechanika

Prof. Ing. Vladislav Laš, CSc.

Griffith´s theory of brittle fracture. Linear fracture mechanics. Irwin-Orowan approach, intensity factor, fracture toughness, crack stability condition. Non-linear fracture mechanics, J-integral and crack opening methods. Two parameter fracture mechanics. Energy approach to fracture mechanics. Energetic principles. Combined loading mode. Numerical modelling of fracture mechanics problems and their solution using FEM. Fracture mechanics in relation to fatigue. Fracture mechanics of composite materials. Progressive failure of composite laminates. Delamination in Composite Structures.

Impact Biomechanics

Impaktní biomechanika

Doc. Ing. Luděk Hynčík, Ph.D.

History of impact biomechanics. Definition of terms of impact biomechanics. Impact biomechanics and its relation to traffic. Statistics, databases and their exploitation for impact biomechanics. Injury mechanisms and injury criteria. Injury scales. Prevention. Mechanical dummies. Legislation and its trends. Tests and their evaluation. Numerical models and their exploitation for impact biomechanics. Impact biomechanics and virtual testing.

Interaction of Continua of Different Phases

Interakce kontinuí různých fází

Prof. Ing. Jiří Křen, CSc.

Classification of continuum interaction problems (weak and strong coupled systems) and basic formulation of the problem of fluid-flexible body interaction. Lagrange´s and Euler´s description of interacting continuum characteristics, linear and non-linear problems of continuum interaction. Conjugated and non-conjugated methods of interaction problems solution, basic mathematical models. Laws of conservation in ALE description and application of ALE description to continuum interaction problems. Numerical methods for the solution of linear problems of continuum interaction.

Mathematical Modelling of Fluid Flow

Matematické modelování proudění tekutin

Doc. Ing. Jan Vimmr, Ph.D.

Finite volume formulation of modern numerical schemes for numerical solution to inviscid and viscous laminar flow problems of compressible Newtonian fluid. Basic characteristics of turbulent flow, numerical solution to the system of Favre-averaged Navier-Stokes equations including an appropriate turbulence model. Application to problems of internal and external aerodynamics. Mathematical modelling of incompressible viscous fluids flow. Application in biomechanics, e.g. modelling of cardiovascular problems.

Mechanics of Heterogeneous and Multiphasic Continua

Mechanika heterogenních a vícefázových kontinuí

Prof. Dr. Ing. Eduard Rohan, DSc.

The course is intended as an introduction to the continuum description of heterogeneous materials consisting of interpenetrated solid and fluid phases. Continuum models of such media are indispensable for solving engineering problems in acoustics, tissue biomechanics, civil engineering, and environmental multiphysics. Main topics: basics of the phenomenological theory of porous multiphase media, volume fractions, chemical potentials and effective stresses, development of balance equations and constitutive laws; methods based on representing the microstructural volume elements, averaging methods, homogenisation method and two-scale modelling. Methodology of numerical modelling for multiscale computations.

Mechanics of Stochastic systems

Mechanika Stochastických systémů

Prof. Dr. Ing. Jan Dupal

Instruments of statistical mechanics. Random variable function moment and characteristics. Random processes. Stationarity, time averages, ergodicity, correlation, power spectrum, normal processes. Response of linear discrete and continual systems to random excitation, statistical output characteristics of the above mentioned systems with random structural parameters. Nonlinear mechanical systems, statistical characteristics of nonlinear system outputs using various linearization and Fokker-Planck-Kolmogorov equation. Random process generating. Regression and identification of mechanical systems. Damage determination and durability estimation.

Modeling of biomechanical systems

Modelování biomechanických systémů

Prof. Ing. Jiří Křen, CSc.

Biomechanics of human muscular-skeletal and cardiovascular systems. Bioviscoelasticity of solids tissues, soft tissues and fluids. Rheology of viscoelastic materials and biological systems. Mechanics of skeletal and smooth muscles, biomechanics of the heart muscle. Hill´s and Huxley´s muscle models. Living tissue properties identification. Human blood and viscometers. Mechanical properties and models of blood vessels. Biomechanics of artificial replacements, biotolerance, artificial joint replacements. Biomechanics of syndesmus and cartilages, fundamentals of lubrication theory and synovial fluids. Lungs biomechanics. Tissue engineering. Urinary system biomechanics. Biomechanics of the human motion system. Tissue and organ modelling based on the non-linear continuum. Tissue models based on mixtures.

Modelling and Description of Microscopic Structures for Purposes of Biomechanics and Nanomechanics

Modelování a popis mikrostruktur pro biomechaniku a nanomechaniku

Doc. Dr. RNDr. Miroslav Holeček

Fundamentals of the microcontinual description for the generation of generalised continuum theories, basic principles of statistical description of microstructures and general conditions of transition to macroscopic continuum description (averaging). Illustrative examples of general thermodynamic connections from biomechanics (modelling of living tissues starting with the microscopic level) and nanomechanics (the Cauchy-Born rule).

Multiple body systems

Soustavy více těles

Prof. Ing. Jiří Křen, CSc.

Basic motion transformation matrix, point and body velocity and acceleration. Matrix formulation of simultaneous body motion. Structure and typology of multibody mechanical systems (MMS), structure description, vector and matrix methods of kinematic relations solution. Spatial MMS with lower and higher kinematic pairs. Numerical solution of MMS kinematic relations. Bivector, recursive method and mixed mode Lagrange´s equations application in matrix methods for MMS dynamic analysis, numerical solution of motion equations. MMS dynamic analysis considering body compliances and kinematic pairs, kinematically driven systems.

Multibody Analysis, Synthesis and Optimisation

Analýza, syntéza a optimalizace vázaných mechanických systémů

Prof. Ing. Jiří Křen, CSc.

Matrix methods for the solution of kinematic relations of multibody mechanical systems. Lower and higher kinematic pair transformation matrices. Numerical kinematic analysis of mechanisms. Kinematic analysis of mechanisms with higher kinematic pairs. Bezier-Berstein polynomials application. Geometric-kinematic synthesis of multibody systems. Structural equations of the geometrical and kinematic synthesis of lead and transmission mechanisms, function generators. Synthesis as an optimisation problem. Accuracy and sensitivity of mechanisms and kinematic chains.

Nonlinear Dynamical systems and Chaos

Nelineární dynamika a chaos

Prof. Ing. Josef Rosenberg, DrSc.

Nonlinear oscillators, introduction to the theory of dynamic systems, point attractors and limit cycles in autonomous systems, bifurcations, Floquet theory, method of multiple scales, quasiperiodic solutions, periodic and chaotic attractors of excited oscillators, stability and bifurcations of iterative mapping, deterministic chaos in discrete dynamic systems, types of transitions to chaos, chaos in the Hamiltonian system, applications.

Non-linear Mechanics of Continuum

Nelineární mechanika kontinuaí

Prof. Dr. Ing. Eduard Rohan, DSc.

Introduction to nonlinear problems in continuum mechanics, survey of nonlinearity types. Principles of indifference and objectivity, the incremental form of

constitutive relations. Lagrange and Euler (rate) formulations of continuum equilibrium conditions in incremental form, conjugate stresses and strains in the principle of virtual works in the context of different incremental formulations. Constitutive relations of non-linear continuum, concept of stability and quasi-convexity, hyperelastic and elasto plastic materials, influence of viscosity. Formulations of the initial-boundary value problems of the continuum mechanics, selected types of interactions between the solids and the fluids. Signorini's problem formulation and models with dry-friction contact. Elastodynamics and non-linear wave dispersion phenomena, Bloch waves in viscoelastic media, group velocity and transmission of energy. Approximation of quasi-static and dynamic problems for nonlinear continuum using the finite element method, numerical solution of non-linear equations in incremental form.

Optimization of Bodies and Structures

Optimalizace těles a konstrukcí

Prof. Dr. Ing. Eduard Rohan, DSc.

Criteria of the structural optimisation and choice of design parameters. Numerical methods in constrained extreme problems. Sensitivity analysis for static and dynamic problems for continua, adjoint system method. Truss optimisation, optimal topology and geometry of structures. Shape optimisation of elastic and inelastic bodies, problem formulation and solution strategies, contact shape optimisation. Methods for optimal topology design of solids, relaxation based on homogenisation of microstructures. Free material optimisation, optimisation of microstructures of composites, applications in structural design, functionally graded materials. Optimisation of conduits and geometrical profiles in flow problems.

Selected Chapters of Elasticity and Plasticity

Vybrané statě z pružnosti a plasticity

Prof. Ing. Vladislav Laš, CSc.

Mathematical modelling of linear-elastic continuum. Solutions to boundary problems. Rotary symmetrical problems. Approximate numerical methods, FEM, special elements. Solution to selected problems corresponding to the Ph.D. student´s study orientation. Plasticity conditions, plasticity surface, loading surface, theory of plasticity. Mathematical models of bodies in elastic-plastic state. Numerical solution to boundary problems by FEM.

Synthesis and optimization of mechanical systems

Syntéza a optimalizace mechanických soustav

Prof. Dr. Ing. Jan Dupal

Classification of dynamics synthesis problems of vibrating mechanical systems (condensation, tuning, optimization). Methods of dynamic condensation. Methods of spectral tuning. Sensitivity of eigenvalues on structural parameters. Problem formulation of parametric optimization in dynamics of machines and structures. Algorithms of the one-dimensional and multi-dimensional unconditioned minimization. Conditioned minimization. SW for optimization.

Theory of Vibration

Teorie kmitání

Prof. Dr. Ing. Jan Dupal

Mathematical models of discrete non-conservative linear systems, classification, spectral and modal properties. Modal methods for dynamic response investigation of

rotating systems. Displacement response spectrum method. Dynamic sensitivity analysis. Modelling of large non-conservative systems by the modal synthesis method. Analytical methods for free and forced vibration of one-dimensional continua. Classification of nonlinear systems, modelling of nonlinearities and approximative analytical methods for investigation of system vibration.

7.2 Plasma Physics and Physics of Thin Films

Physics of Discharge Plasmas

Fyzika výbojového plazmatu

Prof. RNDr. Jaroslav Vlček, CSc.

Basic equations of plasma physics (Maxwell equations, Boltzmann equation, Maxwell distribution function, Boltzmann relation, Debye length). Elastic and inelastic collisions. Motion of charged particles and propagation of electromagnetic waves in the plasma. Particle diffusion and transport. Low-temperature plasma diagnostics (Langmuir probe, optical emission spectroscopy, optical actinometry). Balance equations for particles and their energy in electric discharges. DC glow discharges (plasma sheath, Bohm velocity). Magnetron discharge model. Capacitively and inductively coupled high-frequency discharges. Microwave discharges. Interactions of ions with solid surfaces (target sputtering).

Physics of Surface Layers and Their Characterisation

Fyzika povrchových vrstev a jejich charakterizace

Doc. Ing. Jiří Houška, Ph.D.

Crystalline structure of solid materials, including its characterization (XRD). Bonds in solid materials. Vibrations of crystal lattice and thermal properties, including selected characterization techniques (Raman, FTIR). Electronic structure of solid materials (role of free electrons, band structure, semiconductors). Classical and quantum atomic-scale calculations. Mechanical, optical, photoinduced and other functional properties, including selected characterization techniques (ellipsometry, spectrophotometry). Thermodynamics and solid solutions. Magnetism. Superconductivity. Specifics of amorphous materials.

Physical processes in reactive deposition of thin films

Fyzikální procesy při reaktivní depozici tenkých vrstev

Prof. Ing. Petr Zeman, Ph.D., Doc. Ing. Pavel Baroch, Ph.D.

Initial stages of thin-film formation, process and parameters connected to the development of film microstructure, microstructure types from the point of view of structural phase diagrams, influence of different energy sources on the film growth, thermodynamical and kinetic aspects of the crystal texture development, development and sources of tension during film growth, atomistic processes connected to the texture and tension development. Reactive deposition of thin films and processes related to the working point control. Physical principle of the arc sputtering process. High-power impulse sputtering of thin films.

7.3 Geomatics

Geoinformation Technology

Geoinformační technologie

Doc. Ing. Václav Čada, CSc., Ing. Milan Talich, Ph.D.

Developments and trends in implementation of geoinformation technology (GIT). Role of geoinformatics in institutional control systems. Data management and data sharing in GIT. Processes of strategic planning inside an institution. GIT project and its implementation. Economic justification of GIT projects. Problems with GIT implementation. Legal and personal aspects of GIT implementation.

Geometry in Geomatics

Geometrie v geomatice

Doc. RNDr. František Ježek, CSc.

Differential geometry of curves and surfaces. Splines, Coons's and NURBS's description. Affine, projective and nonlinear transformation (TPS). Triangulation methods of surfaces and geometric tasks of geomatics on discretised surfaces (geodetics, visibility, etc.). Special geometries (non-Euclidean, Lager, etc.) and their applications.

Geospatial and Data Modelling

Geoprostorové a datové modelování

Prof. Dr. Ing. Ivana Kolingerová, Doc. Ing. Václav Čada, CSc., Ing. Milan Talich, Ph.D.

Database systems. Visualisation methods of geospatial databases. Methods of grid and vector computer graphics. Methods of the graph theory.

Methods for Collecting Geospatial Data

Metody sběru geoprostorových dat

Doc. Ing. Václav Čada, CSc., Ing. Jan Douša, Ph.D., Ing. Vojtech Pálinkáš, Ph.D.

Recent technologies in collection of geospatial data. Direct and indirect methods of data collecting. Development and applications of modern geodetic controls. Networks of permanent GNSS stations (CZEPOS project). Statistical and economic analyses and optimisation methods.

Mathematical Methods and Algorithms in Geomatics

Teoretická a výpočtová geodézie

Prof. Ing. Pavel Novák, Ph.D., RNDr. Petr Holota, DrSc.

Mathematical models of the Earth's gravity field, numerical modelling of equipotential surfaces. Methods for determination of geodetic reference surfaces. Software and algorithms of numerical mathematics. Modern numerical and statistical methods for analysis of geodetic data. Issues of stability and conditionality of computational systems. Quality assessment of geodetic control.

Pattern Recognition

Rozpoznávání obrazů

Prof. Ing. Josef Psutka, CSc.

Pattern recognition systems, introduction. Bayes decision theory, parameter estimation. Linear discriminant function, perceptron, support vector machine (SVM). Nonparametric classifiers. Context dependent classifiers, DTW, Markov models,

Viterbi algorithm. Decision trees, classification and regression trees (CART), pruning. Unsupervised learning (clustering). Sequential and hierarchical clustering algorithms. Optimisation techniques, K-means, Isodata. Extraction and selection of information features, feature decorrelation.

Theoretical and computational geodesy

Teoretická a výpočtová geodézie

Prof. Ing. Pavel Novák, Ph.D., Ing. Jakub Kostelecký, Ph.D.

Mathematical models of Earth's gravity field and principles of numerical modelling of equipotential surfaces. Methods for determining reference surfaces in geodesy. Software and algorithms of numerical mathematics used in geodesy. Advanced numerical and statistical methods for geodetic data processing. Problems of stability and conditionality in solving mathematical models. Quality assessment of geodetic controls.

Selected Topics in Theoretical Geodesy

Vybrané kapitoly z teoretické geodézie

Prof. Ing. Pavel Novák, CSc., Prof. Ing. Jan Kostelecký, DrSc.,
RNDr. Ing. Petr Holota, DrSc., Ing. Cyril Ron, CSc.

Satellite geodesy and geodynamics. Physical geodesy and gravimetry. Satellite dynamics.

7.4 Computer Science and Engineering

Advanced Methods of Polygonal Mesh Processing

Pokročilé metody zpracování polygonálních sítí

Doc. Ing. Libor Váša, Ph.D.

Algorithms for processing of triangle and polygonal meshes, discretization of common concepts from differential geometry and their application to problems related to discrete representation of surfaces. Discrete definition of surface curvature and Laplace-Beltrami operator, their alternative formulations and applications. Mesh smoothing and denoising, mesh subdivision, simplification and remeshing, discrete mesh parameterization. Basic algorithms of mesh compression, introduction to dynamic meshes – representation, skinning, compression.

Biomedical Information Systems

Biomedicinské informační systémy

Doc. Dr. Ing. Jana Klečková

Types of information systems - bioinformatics, medical informatics. The issue of processing and storing large volumes of heterogeneous data. Censored data. Standard data formats (HL7, DICOM, DASTA), metadata, ontology. Enterprice Architecture - possibilities of utilization in the field of medical information systems. Hospital information systems - operational part, clinical part. Security - special aspects of data protection in health,international legislation, valid acts.

Biomedical Visualization

Biomedicínské vizualizace

Doc. Ing. Josef Kohout, Ph.D.

The course focuses on providing the students with an introduction to methods and techniques specific to visualization of biomedical data sets of various kind and origin (e.g., CT and MRI scans, vector fields, ECG signals) so that they could design independently visualization solution to common problems in biomedicine such as coronal stenting, virtual colonoscopy, Alzheimer disease progression monitoring, etc.

Component Models and Architectures

Komponentové modely a architektury

Doc. Ing. Přemysl Brada, MSc., Ph.D.

Component and component model definitions and variants. Fundamental characteristics of components, their purpose and consequences. Component contract, means of its description, models and formal notations. Component composition, verification, deployment. Modelling and visualisation of component applications. Case studies and analyses of concrete component models.

Computational Geometry Algorithms and Applications

Algoritmy a aplikace výpočetní geometrie

Prof. Dr. Ing. Ivana Kolingerová

Selected algorithms of computational geometry, suitable, first of all, for computer graphics and its applications, but also for other specialisations in which geometric objects need to be handled (specialization is done according to the approximate student's theme). Analysis and synthesis of algorithms from the given area. Use of these algorithms in applications. Examples of themes: data structures for geometrical objects modelling, geometric search, convex hulls, triangulations, duality, motion planning, robustness and effectivity of geometric algorithms.

Communication in Computer Systems and Networks

Komunikace v počítačových systémech a sítích

Ing. Jiří Ledvina, CSc.

Trends in network technology (high-speed networks, wireless networks). Quality of service in data networks. Virtual networks, mobile networks and wireless networks. Modern Internet protocols, multimedia transmission protocols, peer-to-peer networks. Network management protocols, network security.

Computer Graphics, Data and Information Visualization

Počítačová grafika, vizualizace dat a informací

Prof. Ing. Václav Skala, CSc.

Data structures, object modelling techniques, methods for objects representation and manipulation in E3 geometric transformations, fundamentals of projective geometry and geometry algebra, algorithm design and verification in special computational architectures, scalar ad vector fields, methods for technical, medical and information data processing for visualisation in E3 and in virtual collaborative environment.

Design of Algorithms for Computer Graphics

Návrh výpočetních algoritmů počítačové grafiky

Prof. Ing. Václav Skala, CSc.

Data and information representation in En, Euclidean and affine spaces, stability and robustness of algorithms of computer graphics and visualisation. Algorithm design with respect to special architectures (CPU, GPU, CUDA, etc.). Geometry algebra principles and usage in computer graphics and visualisation algorithm design.

Distributed Computer Systems

Distribuované výpočetní systémy

Ing. Jiří Ledvina, CSc.

Models and characteristics of distributed systems, inter-process communication, reliable group communication. Distributed algorithms, synchronisation. Deadlock in distributed systems. Consistency. Transactions, distributed transactions. Distributed shared memory. Distributed file systems and their properties. Fault tolerance. Security in distributed systems. Distributed systems examples. New trends in distributed systems development, communication in distributed systems, distributed algorithm. Solving problems of time synchronisation, deadlock, fault tolerance, and security. Orientation to the distributed embedded systems.

Distributed Computing

Distribuované výpočty

Prof. Ing. Jiří Šafařík, CSc.

Distributed computation independent of the underlying computing system. Distributed algorithms for understanding computing systems in different areas, e.g. information systems, scientific computing. Specification of their required behaviour, correctness and performance. Problems of resource allocation, data consistency, deadlock detection, leader election, causality and time, scheduling, routing.

Documentographical Information Systems

Dokumentografické informační systémy

Doc. Dr. Ing. Jana Klečková

Documentary information systems, document format (text, acoustic recording, image record). Standard data formats, ontology, metadata. New ETL methods. Problem search, query definition, incompleteness and uncertainty of information. Storage and processing of large data (Big Data). Data models, development of database technology. Data security - standards, legislation, technical data security solutions.

Fault-tolerant Computer Systems

Výpočetní systémy odolné proti poruchám

Doc. Ing. Stanislav Racek, CSc.

Models of ageing and reliability for computer parts and systems. Methods of reliability prediction and evaluation for complex computer systems and nets. Methods of fault tolerance implementation (fault masking, fault detection, dynamic redundancy, SW implemented fault tolerance). Fault tolerant distributed systems. Computer control systems for safety critical applications (mission orientated, highly available) – principles of design and construction.

Human – Computer Communication in Natural Language

Komunikace člověk – počítač v přirozeném jazyce

Prof. Ing. Václav Matoušek, CSc.

Basic concepts of natural language processing and speech understanding, continuous and spontaneous speech recognition and speech synthesis system architectures; acoustic-phonetic and linguistic analysis of the speech, lexical-functional and generative grammars; natural language parsing methods, generative and interpretation semantics and internal sentence representation, continuous speech understanding, projection principle; natural language generation and synthesis; man-machine dialogue and dialogue system structures, principles of dialogue control, natural dialogue system design and alternatives of its implementation.

Knowledge Extraction from Large Data Sources

Extrakce znalostí z rozsáhlých datových zdrojů

Prof. Ing. Karel Ježek, CSc.

The aim of the course is to familiarize students with information and knowledge retrieval from large data sources with special emphasis on web and text data. Data preprocessing and text indexing. Filtering and classification. Cluster analysis. Association analysis. Document models for information retrieval. Query evaluation. Query expansion. Dimensionality reduction and text summarization methods. Web page preprocessing. Web search, crawlers and indexing. Web as a graph. Link analysis, methods and evaluation measures. Social network analysis tasks.

Knowledge Engineering and Knowledge-based Systems

Znalostní inženýrství a znalostní systémy

Prof. Ing. Václav Matoušek, CSc.

Principles of knowledge acquisition, representation and utilization, searching of problem solving and its control, development of new knowledge; fundamentals of production systems, resolution refutation systems and rule-based deduction systems; inference system and inference control, reasoning under uncertainty, optimized methods of problem solving; structure, function and components of knowledge system, inference nets and influence diagrams; development and implementation of knowledge system structure, creation and implementation of knowledge and data bases, processing of uncertainty in knowledge and data; learning in knowledge based systems, methods of inductive learning, decision trees, net methods, learning algorithms implementation, knowledge based systems in pattern recognition and natural language understanding.

Modelling of Performance and Reliability of Computing Systems

Modelování výkonnosti a spolehlivosti výpočetních systémů

Doc. Ing. Stanislav Racek, CSc.

The goal of the course is to provide survey of state of the art in the given area and to get knowledge of fundamental analytic and experimental methods used in construction and use of reliable and efficiency models of computing systems and programs. Probability based models of computer systems – Markov models, stochastic Petri nets, evaluation nets. Discrete-time simulation models – principles of

construction. Computer system performance and reliability prediction using models of various types.

Modern Programming Styles and Methods

Moderní programovací styly a metody

Doc. Ing. Pavel Herout, Ph.D.

Object orientated analysis, design and implementation of large software applications. Theory and practice of markup languages. Scripting languages. Programming of embedded systems. Fail-safe and fault-tolerant software applications.

Nonlinguistic Aspects of Speech

Nonlingvistické aspekty řeči

Doc. Dr. Ing. Jana Klečková

Suprasegmental features of the sound design of language and speech. Specific properties of prosodic phenomena; general principles of their description for computer speech processing; design of databases. Current approaches to the phenomenological description of intonation (metric theory, intonation systems). Application of the universal properties of speech production and perception from the point of view of sound variability; coding of the Czech pronunciation, speech samples. Possible application of nonverbal communication in the continuous speech processing system. Multimodal emotion recognition (facial expressions, linguistic and prosody analysis and expressivity analysis, gesture recognition.

Pattern Analysis and Understanding

Klasifikace a rozpoznávání objektů

Doc. Ing. Václav Matoušek, CSc.

Principal approach to pattern recognition, types of patterns, signal representation and preprocessing, segmentation methods, classification problem, general recognition strategies; data structures and databases for patterns, main control structures and their implementation, knowledge and learning in pattern recognition, learning concepts; neural net based recognition methods and systems.

7.5 Cybernetics

Adaptive Systems

Adaptivní systémy

Doc. Ing. Ondřej Straka, Ph.D.

The course deals with adaptive control systems and adaptive signal processing systems based on running system identification. These systems are applied in decision-making, control and signal processing under uncertainty. Main topics: self-tuning controllers and reference-model control, dual control, intelligent adaptive control, adaptive systems with implicit and explicit identification, adaptive prediction and filtering.

Artificial Intelligence

Umělá inteligence

Doc. Dr. Ing. Vlasta Radová

Problem solving, problem solving by searching, informed search. Adversarial search, games. Knowledge and reasoning, knowledge representation, logical agents.

Uncertain knowledge and reasoning. Learning, learning from observation, statistical learning methods, reinforcement learning, knowledge in learning. Planning, planning in the real word. Perception. Artificial intelligence in robotics.

Computer Speech Synthesis

Počítačová syntéza řeči

Doc. Ing. Jindřich Matoušek, Ph.D.

Phonetics and phonology, phonetic inventories, phonetic transcription, prosody. History of speech synthesis, source-filter theory. Concatenative speech synthesis, methods for prosodic and spectral modifications. Corpus-based speech synthesis, unit selection synthesis. Statistical parametric synthesis, generative deep neural network based speech synthesis. Text-to-speech synthesis, text processing, prosody generation. Evaluation of speech synthesis quality, intelligibility and naturalness tests.

Computer Vision

Počítačové vidění

Doc. Ing. Miloš Železný, Ph.D.

Contactless measurement based on processing of visual information. Overview of hardware for image acquisition. Image data formats, transmission and compression. Definition of computer vision, aims, terminology. Digital image processing. Description of objects, phenomena, scene. Recognition, motion analysis, three-dimensional vision. Applications of computer vision in the domain of human-computer interaction, technical diagnostics, medical vision, remote sensing.

Control of Linear Multivariable Systems

Řízení vícerozměrových lineárních systémů

Prof. Ing. Miloš Schlegel, CSc.

Multivariable systems, centralised and decentralised control. Interactive and non-interactive multi-loop control. Design of decoupling controllers. Diagonal dominance and pseudodiagonalisation of transfer function matrix. Decentralised control and stabilisation of large-scale systems with local static and dynamic controllers. Decentralised fixed modes. Multi-level hierarchical control. Model and goal coordination methods. Static and dynamic optimisation in two-level hierarchical control.

Diagnostics and Decision-making

Diagnostika a rozhodování

Doc. Ing. Luděk Müller Ph.D.

Statistical decision problems, statistical modelling and classification. Artificial intelligence methods appropriate for diagnostics – informative features extraction and selection, pattern recognition, decoding. Engineering approach to the implementation of technical and medical diagnostic systems, feasibility studies, implementation of diagnostic systems in industry. Examples of technical and medical diagnostic systems.

Fault Detection

Detekce chyb

Doc. Ing. Ondřej Straka, Ph.D.

Fault detection is based on fast and correct identification of such behaviour of the monitored system that is considered inadmissible for the required system

functioning. Main topics: specification of fault detection or change detection of monitored or controlled systems, detection quality requirements, approaches based on signal processing, approaches based on models, passive and active detection, optimal input signal, information processing strategy.

Knowledge Based Systems

Znalostní systémy

Prof. Ing. Luděk Müller, Ph.D.

Knowledge-based and expert system architecture. Rule-based and frame-based systems. Knowledge representation; inference techniques, nonmonotonic reasoning. Reasoning under uncertainty: Bayesian approach, certainty theory, fuzzy-logic, Dempster-Shafer theory. Knowledge acquisition. Inductive knowledge-based systems. Knowledge-based system development.

Model Based Predictive Control

Prediktivní řízení

Prof. Ing. Miloš Schlegel, CSc.

The model predictive control (MPC) strategy enables optimisation of the performance index with respect to some future control sequence, using predictions of the output signal based on a process model. The course presents an overview of the most important predictive control strategies, the theoretical aspects as well as the practical implications. Hands-on experience is gained through Matlab/Simulink simulation exercises.

Multiagent Systems

Multiagentní systémy

Doc.Ing. Pavel Ircing, Ph.D.

Definition of agent, holon and multiagent system. Agent interaction models, task and data distribution, ontologies, agent inaccessibility. Multiagent platforms (JADE, A-globe) and standards (XML, FIPA, OWL, Web Services). Common applications (simulation, planning, control, CIM, virtual organisations, web agents).

Natural Language Processing

Zpracování přirozeného jazyka

Doc. Ing. Pavel Ircing, Ph.D.

The course deals with the basic methods of natural language processing, especially in connection with automatic speech recognition. Attention is paid mainly to text normalisation, statistical language modelling, clustering of words into classes and morphological tagging. Fundamentals of the information retrieval methods are also introduced, again with emphasis on speech retrieval.

Navigation Systems

Navigační systémy

Ing. Jindřich Duník, Ph.D., Doc. Ing. Ondřej Straka, Ph.D.

Navigation deals with estimation of the position, velocity, and attitude of an object on the basis of indirect and noisy measurements coming from sensors tied with the object. The goal of the course is to introduce theoretical and practical aspects of navigation systems design and their implementation. The stress is laid on mathematical modelling of object dynamics and description and identification of the noises affecting the available measurements. Within the course, the standard navigation systems are treated including the inertial navigation (based on

accelerometers, gyroscopes, and magnetometers), satellite navigation (generally multi-constellation), terrain-aided navigation (based on maps and respective sensors), and integrated (or hybrid) navigation. In addition to the navigation system design, the approaches for objective assessment of navigation information quality in terms of accuracy, integrity, availability, and continuity are discussed as well.

Neural Networks

Neuronové sítě

Doc. Dr. Ing. Vlasta Radová

Multilayer networks. Probabilistic neural networks. Adaptive-structure neural networks. Evolutionary algorithms. Recurrent networks. Algorithms for neural networks learning. Supervised learning, unsupervised learning. Algorithm backpropagation, modifications. Complexity of learning, generalisation. Neural networks application. Neural networks for signal processing. Neural networks for pattern recognition.

Nonlinear Filtering

Nelineární filtrace

Doc. Ing. Ondřej Straka, Ph.D.

The course deals with the state estimation problem of linear and especially nonlinear stochastic systems. The estimation methods are applied in e.g. automatic control, tracking, navigation, fault detection, signal processing. Main topics: Bayesian approach, Kalman filtering, derivative-free filters, Gaussian sum method, sequential Monte Carlo method, point mass method, Cramér-Rao bound, continuous systems with discrete measurements.

Optimal Stochastic Control

Optimální stochastické řízení

Doc. Ing. Ondřej Straka, PhD.

Introduction to the theory of optimal control of dynamic systems. Review of static optimisation. Deterministic dynamic optimisation, design of time and linear-quadratic optimal automatic control systems. Design of optimal stochastic automatic control systems. Matrix games and their solution.

Pattern Recognition

Rozpoznávání obrazů

Prof. Ing. Josef Psutka, CSc.

Pattern recognition systems, introduction. Bayes decision theory, parameter estimation. Linear discriminant function, perceptron, support vector machine (SVM). Nonparametric classifiers. Context dependent classifiers, DTW, Markov models, Viterbi algorithm. Decision trees, classification and regression trees (CART), pruning. Unsupervised learning (clustering). Sequential and hierarchical clustering algorithms. Optimisation techniques, K-means, Isodata. Extraction and selection of information features, feature decorrelation.

Robust Control of Linear Systems

Robustní řízení lineárních systémů

Prof. Ing. Miloš Schlegel, CSc.

Robust control is a control which fulfills design specifications not only for a nominal system but also for a whole, exactly defined, family of controlled systems. Model uncertainty and robustness have been central topics in the development of

automatic control. First, an elementary explanation of these notions is given. Further, some basic methods (robust regions, robust pole placement, H-infinity) for the design of robust controllers are presented.

Signal Processing

Zpracování signálů

Prof. Ing. Josef Psutka, CSc.

Sampling and reconstruction. Sampling theorem, quantisation, D/A and A/D converters. Discrete Fourier Transform, DFT and FFT algorithms, inverse DFT, FIR and IIR filters, windowing. Power spectrum. z-Transform. Speech signal processing, processing in time and frequency domains. Linear predictive analysis, homomorphic signal processing, speech parameterisation techniques, vector quantisation, additive noise and convolutional distortion reduction. Information features extraction; NPS, PCA, LDA, HLDA transformations.

Spoken Language Processing

Počítačové zpracování mluveného jazyka

Prof. Ing. Luděk Müller, Ph.D.

Theory, algorithms and development of systems for human-machine communication. Statistical methods of speech recognition and understanding. Speech coding and processing. Acoustic and language models. Speech decoding. Large vocabulary continuous speech recognition. Robust speech recognition, adaptation. Speech synthesis. Speaker identification and verification. Voice dialogue systems control and development. Corpus collection.

Stochastic Models of Utility Networks

Stochastické modely energetických sítí

Doc. Ing. Eduard Janeček, CSc.

Analogy between electric power, gas and water-supply networks. Generalised stochastic loop current methods. Matrix and recursive stochastic models of tree structure network. Stochastic models of circle networks. Class parameters estimation of stochastic load models using customer consumption measurement and aggregate measurement in supply nodes. Estimation of network quantities and losses, VaR values.

System Identification

Identifikace systémů

Doc. Ing. Ondřej Straka, Ph.D.

The aim of system identification is to find a mathematical model using experimental data. Identification is an alternative to mathematical modelling, which is based on physical laws. Main topics: system, model structure, experimental conditions, identification methods, parametric models, stochastic model of uncertainty, linear and nonlinear parameter estimation, unbiased estimation.

Time-frequency Signal Processing for Diagnostics

Časo-frekvenční zpracování signálu pro diagnostiku

Doc. Ing. Eduard Janeček, CSc.

Sensors for detection of events. Methods for detection of events in stationary signals. Statistic characteristics, effective value, complex spectrum. Methods for detection of events with strong resonance background noise. Normed time-frequency

spectrum. Hilbert transform, spectrum of envelope, complex analytic signals. Hilbert-Huang transform, IMF decomposition. Kalman filter with resonance modules.

7.6 Mathematics

Algorithms and Problems of Combinatorial Optimization
Algoritmy a úlohy kombinatorické optimalizace
Doc. Ing. Roman Čada, Ph.D.

Integer optimization. Vector, semidefinite, cone optimization. Submodular functions and discrete convex optimization. Separation. Fenchel duality. Approximation schemes, interactive protocols and non-approximability. Randomized algorithms and derandomization. Parallel algorithms. Standard problems (flows in matroids, TSP, MAX-SAT, MAX-CUT, colouring, clustering, QAP) and extensions.

Bifurcation Theory
Teorie bifurkací
Prof. RNDr. Pavel Drábek, DrSc., Doc. Ing. Petr Girg, Ph.D.,
Prof. RNDr. Milan Kučera, DrSc. , Doc. Ing. Gabriela Holubová, Ph.D.

Fundamental theorems concerning bifurcation of solutions of nonlinear operator equations. Crandall-Rabinowitz, Krasnoselskij, bifurcation based on degree theory, potential bifurcation theorem. Bifurcation of periodic solutions – Hopf bifurcation, bifurcation of variational inequalities.

Coding Theory
Teorie kódů
Prof. RNDr. Tomáš Kaiser, DSc.

Recapitulation of the basic theory of error-correcting codes. Main code classes: linear codes, cyclic codes, perfect codes, BCH codes. Connections to combinatorics. Properties of Golay codes. Asymptotic properties of codes. The Shannon theorem and the inverse Shannon theorem. Algebraic geometry codes, convolutional codes, iterative decoding.

Combinatorial Geometry
Kombinatorická geometrie
Prof. RNDr. Tomáš Kaiser, DSc.

Convex sets. Recapitulation of basic properties, separation theorems. The Helly, Radon and Carathéodory Theorems. Lattices and Minkowski's Theorem, applications in number theory. Convex independence in the plane, connections to Ramsey Theory. Extremal problems. Tverberg's Theorem and its generalisations. Convex polytopes.

Dynamical Systems
Metody studia dynamických systémů
Prof. RNDr. Pavel Drábek, DrSc., Doc. Ing. Gabriela Holubová, Ph.D., Doc. Ing. Radek Cibulka, Ph.D.

Structural stability, bifurcation of finite-dimensional dynamical systems, semigroups, invariant sets, attractors. Dissipative evolution partial differential equations of the first order, wave equations. Ljapunov exponents and dimensions of attractors. Non-smooth dynamical systems and their stability,

Geometric Methods for Applications

Geometrické metody pro aplikace

Prof. RNDr. Miroslav Lávička, Ph.D.

Fundamentals of projective geometry (projective space, projective mappings). Projective differential geometry (curves, surfaces, duality, description of curves and surfaces). Applied algebraic geometry (definitions and algorithms, properties of algebraic varieties, duality). Sphere geometries (Laguerre, Möbius and Lie geometry, canal surfaces and cyclides). Line geometry (fundamentals of line geometry, using linear complexes, developable surfaces). Quaternions and dual quaternions. Fundamentals of Hermitian geometry.

Geometry and Geometric Modelling

Geometrické modelování

Doc. Ing. Bohumír Bastl, Ph.D.

Fundamentals of geometric modelling, geometric spaces. Geometric transformations (linear, TPS, reverse Coons patch). Modern algebra in geometric modelling (symbolic calculus, Gröbner bases, resultants). NURBS (Non-Uniform Rational B-Splines), special classes and their generalisation. Subdivision techniques for curves and surfaces. PH and LN objects and their generalisation. Offsets. Volume modelling, Euler's operators. Variational geometry (Chyz's graph, constructive sets). Geometric algorithms, invariance and relation to graph algorithms. Methods of geometric modelling in reverse engineering.

Hamiltonian Graph Theory

Hamiltonovská teorie grafů

Prof. RNDr. Zdeněk Ryjáček, DrSc., doc. Ing. Roman Čada, Ph.D.,
doc. RNDr. Přemysl Holub, Ph.D.

Properties of Hamiltonian graphs – connectivity, toughness. Fundamental sufficient conditions of hamiltonicity of a graph – Erdös-Chvátal theorem, degree conditions and the Bondy-Chvátal closure, closure operations based on structural conditions. Further Hamiltonian properties – traceability, uncyclicity, Hamilton-connectedness, Hamiltonian properties of graphs from special classes – planar graphs and Tutte's theorem, line graphs and their preimages, forbidden subgraphs and Hamiltonian properties.

Chromatic Graph Theory

Chromatická teorie grafů

Prof. RNDr. Tomáš Kaiser, DSc.

Graph colouring. Recapitulation of basic results (Brooks' Theorem, Vizing's Theorem). List colouring. Colouring of graphs on surfaces (plane graphs, Heawood Theorem). Duality and flows. Critical graphs. Polynomial graph invariants (chromatic polynomial, Tutte polynomial) and connections to knot theory. Algorithmic aspects of graph colouring

Matching Theory

Teorie párování

Prof. RNDr. Zdeněk Ryjáček, DrSc. , Doc. RNDr. Přemysl Holub, Ph.D.

Maximum matching in bipartite graphs, Hall's Theorem and Hungarian method. Matching in general graphs, alternating paths and Berge's Theorem, Tutte Theorem,

Edmonds algorithm, Edmonds-Gallai decomposition. Extendable matching, factor-critical graphs.

Methods of Computer Modelling

Metody počítačového modelování

Doc. Ing. Marek Brandner, Ph.D.,
Doc. Ing. Josef Daněk, Ph.D.

Mathematical and numerical modeling. Numerical methods for partial differential equations: finite difference method, Galerkin method, finite element method, finite volume method. Numerical methods for systems of linear algebraic equations.

Numerical Modelling of Conservation Laws

Numerické modelování zákonů zachování

Doc. Ing. Marek Brandner, Ph.D.

Hyperbolic partial differential equations, classical and weak solutions. Vanishing viscosity solution and entropy solution. Riemann problem. Finite difference method. Finite volume method, consistency, stability and convergence. Godunov type methods, high-resolution schemes. Approximate Riemann solvers. Finite element method, discontinuous Galerkin finite element method, residual distribution schemes.

Selected Chapters of Modern Algebra

Vybrané kapitoly z moderní algebry

Prof. RNDr. Roman Nedela, DrSc.

Selection is done according to student's theme.

a) Finite groups: group actions, simple groups, alternating and classical groups, composition series, Jordan-Holder theorem, Fundametal theorem on abelian groups, Smith form of a matrix, p-groups, Sylow theorems, nilpotent groups, solvable groups
b) Linear representations of groups: characters, irreducible representations, group algebra, applications of the character theory.
c) Algebraic structures with two operations and Galois theory: Rings, fields and vector spaces, Rings of polynomials, field extensions, rings of polynomials, solvability of polynomials in radicals, groups associated to polynomials, Galois theorem. Moduls, canonical decomposition of a module, Jordan form of a matrix, decomposition of abelian groups.

Selected Parts of Theoretical Numerical Analysis

Vybrané kapitoly z numerické analýzy

Doc. Ing. Josef Daněk, Ph.D.

Direct and iterative methods of numerical linear algebra and their applications to solving partial differential equations. Methods based on the matrix factorisations and iterative methods. LU factorisation, QR factorisation and other decompositions of matrices, their properties and their applications in computational methods. Classical iterative methods (Jacobi, GS, SOR), their properties and use. The conjugate gradients method, modern iterative methods for non-symmetric problems (e.g. GMRES). Preconditioning and construction of pre-conditioners. The multi-grid method, algebraic multi-grid. Methods and algorithms based on the domain decomposition principle. FETI and ADI methods. Splines and wavelets and their use in numerical analysis.

Selected Topics of Functional Analysis

Vybrané partie funkcionální analýzy

Prof. RNDr. Pavel Drábek, DrSc., Doc. Ing. Petr Girg, Ph.D.,
Doc. RNDr. Jiří Benedikt, Ph.D., Doc. Ing. Radek Cibulka, Ph.D.

Basic properties of linear and nonlinear operators in normed linear spaces, abstract integral and differential calculus, local properties of differentiable mappings, differential and integral calculus on manifolds. Non-smooth and multivalued mappings.

Selected Topics of Partial Differential Equations

Vybrané kapitoly z teorie parciálních diferenciálních rovnic

Prof. RNDr. Eduard Feireisl, DrSc., RNDr. Šárka Nečasová, CSc., DSc.

Fundamentals of modern methods. Introduction to Sobolev spaces, traces, compactness. Variational formulation of a boundary value problem for a linear elliptic 2nd order equation. Galerkin method. Spectrum. Generalized mixed problém for a hyperbolic equation. Introduction to compressible flow theory. Mathematical model, weak formulation. A priori estimates, compactness, approximative solutions.

Topology

Topologie

Prof. RNDr. Tomáš Kaiser, DSc.

Overview of basic general topology: topological space, connectedness, convergence and compactness. Homotopy. Elements of algebraic topology. Fundamental group. The Seifert-Van Kampen Theorem. Applications: the Jordan Curve Theorem, the Borsuk-Ulam Theorem. Classification of compact surfaces. Homology.

Topological Methods for Differential Equations

Topologické metody řešení diferenciálních rovnic

Prof. RNDr. Pavel Drábek, DrSc., Doc. Ing. Petr Girg, Ph.D.,
Doc. Ing. Gabriela Holubová, Ph.D.

Abstract implicit function theorem, theorem on local diffeomorphism, fixed point theorems. Monotone operators. Brouwer and Leray-Schauder degree of mapping. Method of upper and lower solutions and the link to the degree of mapping. Applications to the boundary value problems for ODEs and PDEs.

Variational Methods for Differential Equations

Variační metody řešení diferenciálních rovnic

Prof. RNDr. Pavel Drábek, DrSc., Doc. Ing. Petr Girg,
Doc. Ing. Gabriela Holubová, Ph.D., Prof. RNDr. Milan Kučera, DrSc.,
Doc. Ing. Radek Cibulka, Ph.D.

Local and global extrema. Weak lower semicontinuity and weak compactness. Ekeland variational principle. Palais-Smale condition and its modifications. Mountain Pass Theorem of Ambrosetti and Rabinowitz. Saddle Point Theorem of Rabinowitz. Applications to the boundary value problems for ODEs and PDEs.

8 Office of Academic Affairs and Dean´s Office

R&D and Ph.D. Study Administrator

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9 Information Sources

FAS websites, Doctoral Study section:
Websites for applicants:
http://www.fav.zcu.cz/en/study/
http://www.fav.zcu.cz (in Czech)

IS STAG: http://www.stag.zcu.cz/ (in Czech)
UWB Portal: http://www.portal.zcu.cz/ (in Czech)

Bursaries
http://www.fav.zcu.cz (in Czech)
Accommodation bursary: http://ubytstip.zcu.cz/ (in Czech)
Social bursary: http://socstip.zcu.cz/ (in Czech)