ANNUAL REPORT 2011

FACULTY OF ELECTRICAL ENGINEERING

AND COMMUNICATION

BRNO UNIVERSITY OF TECHNOLOGY

Contents

Introduction

History

Brno University of Technology (BUT) is the second largest and the second oldest technical university in the Czech Republic. It was founded in 1849 for technical, agricultural and commercial specializations. The languages of tuition were Czech and German. In consequence of political and national disputes Czech gradually ceased to be used as a language of tuition until in 1899 the Czech Technical High School was established in Brno. After World War I and the founding of Czechoslovakia this school merged with the German Technical School (originally bilingual) to form the High Technical School in Brno (later bearing the name of Dr. Edvard Beneš, the second President of Czechoslovakia). In the period between World War I and World War II the school was among the best technical high schools in Europe. During World War II the school was, as all other Czech high schools were, closed and the premises were used by German military institutions, and most equipment was destroyed. Immediately after the end of World War II the activities of the school were resumed. In 1951, at the beginning of Cold War, the Technical High School was closed and some

departments became parts of the newly established Military Academy. Tuition for civilians continued at the former Faculty of Civil Engineering only.

Electrotechnical disciplines were first taught at the university in 1905. Since the Faculty of Power Engineering was founded in 1959, and subsequently transformed into Electrotechnical Faculty, 24,000 students have graduated from the faculty. In 1993, the structure of the faculty was changed. It received a new name Faculty of Electrical Engineering and Computer Science (FEECS). The faculty was the third largest among the then existing seven faculties of BUT after, at the beginning of 2000, the Faculty of Technology and the Faculty of Management joined to establish Tomáš Baťa University in Zlín.

A number of historical decisions were taken at FEECS in 2001 in connection with the founding of a new faculty - Faculty of Information Technology (FIT) and transformation of the Faculty of Electrical Engineering and Computer Science (FEECS) into the Faculty of Electrical Engineering and Communication (FEEC).

The Faculty in 2011

Professor Karel Rais was the Rector of Brno University of Technology. One of the leading personalities of the Faculty of Electrical Engineering and Communication Professor Pavel Jura from the Department of Control, Measurement and Instrumentation was Vice-Rector for Information and Communication Technologies.

The Dean of the faculty in 2011 was Professor Jarmila Dědková and the four vice-deans were Professor Radimír Vrba (Vice-Dean for External Relations and International Affairs, acting dean), Associate Professor Petr Fiedler (Bachelor study programme), Professor Stanislav Hanus (Master study programme), Professor Vladimír Aubrecht, (research and doctoral study programme), Miloslav Morda was faculty bursar.

In 2011 EU funds were granted for building a centre of excellence – project CEITEC. This significant project has been carried out by the Central European Technology Institute of Brno University of Technology (STI). When Professor Radimír Vrba had been appointed its director, he resigned from his position as vice-dean of FEEC.

Therefore, in the middle of the year he was replaced by Associate Professor Jiří Háze, and Professor Vladimír Aubrecht became the new acting dean.

At the end of 2011 there were 222 academics at the faculty (professors, associate professors, lecturers and other pedagogical and research staff) and 3 921 students in all forms of governemnt supported programmes. Moreover, instruction was provided for 298 students of the Faculty of Information Technology, 51 students of

the Faculty of Mechanical Engineering, and 98 students of the Faculty of Management. On the other hand our faculty purchased tuition from the Faculty of Management for 18 students and from the Faculty of Information Technology for 5 students. Then the number of students educated at the faculty totalled 4 368. In 2011 education was provided in study programmes Electrical Engineering, Electronics Communication and Control Technology (EECR, accredited in 2001) and Biomedical Technology and Bioinformatics (BTBIO A, accredited in 2007) and Biomedical Engineering and Bioinformatics (BTBIO F, accredited in 2010) in accordance with the Bologna Declaration. The study programmes at FEEC are now fully compatible with the educational systems applied in the European Union, and thus participation of FEEC students in European mobility programmes has been facilitated. Among the FEEC graduates in 2011 there were 490 students who completed their studies in the Bachelor degree programme, 545 Master programme graduates and 34 doctoral students completed the Ph.D. programme. There were 1,104 students coming to the Faculty, 569 students started the follow-up Master programme, and 127 the doctoral programme. Tuition in English was provided to 2 international students paying their fees. Five academics were habilitated and appointed associate professors with the title Docent. There was one appointment to professorship.

Events and Activities

Numerous events and activities that have been organized and pursued for many years took place or continued in 2011.

- construction of the new premises at Technická 12 at the campus Pod Palackého vrchem which will accommodate departments now located at Kolejní 4, Purkyňova 118 and Technická 2.
- meeting of the deans of the Faculty of Electrical Engineering and Faculty of Information Technology with members of the club Elektron
- commencement of tuition in the new Master study programme BTBIO-F Biomedical Engineering and Bioinformatics
- courses for secondary school students interested in study at FEEC organized by Department of Mathematics to help them prepare for entrance examinations at FEEC
- Open Door Days (November, December 2011, January 2012), visits by students to secondary schools, secondary school advisors visiting FEEC
- presentation of new study programmes at 18th European trade fair of higher and lifelong education Gaudeamus 2011, November 1 - 4, 2011, to promote FEEC and arise interest of secondary school students in study at FEEC
- meeting of the leaderships of Czech and Slovak faculties of electrical engineering and associated faculties in Tatranská Javorina, 18-21 May 2011
- publication of the faculty yearbook 2010/11
- development of programmes leading to habilitations and professorship
- STUDENT EEICT 2011 Conference and Competition organized in cooperation with the Faculty of Information Technology and sponsored by Honeywell, ABB, ON Semiconductor, Freescale, Dribo, Olympus etc., with 63 Bachelor, 108 Master and 114 doctoral papers, and 5 papers by secondary-school students
- the Lifelong Learning Programme-Erasmus and other European programmes
- full operation of IS Apollo
- continuation of three research plans commenced in 2005 (scheduled 2005-2009 or 2011), with chief investigators Jiří Kazelle, Zbyněk Raida and Radimír Vrba, 2011), and another research plan commenced in 2007, with chief investigator Pavel Jura.

- two significant European projects funded by the Operational Programme Research and Development for Innovations, Priority Axis 2 – Regional Research and Development Centres 'SIX – Centre for Sensoric, Information and Communication Systems' and CVVOZE – 'Centre for Renewable Electric Energy Sources', investigators Zbyněk Raida and Vladimír Aubrecht
- activities of Academic Senate member Vlasta Krupková in her capacity as a member of the Higher Education Council
- activities of Academic Senate members, mainly the chairman Miloslav Steinbauer, focused on the development and economic interests of FEEC
- activities of Advisor for Equal Opportunities Naděžda Uhdeová focused on consultancy for female students and study opportunities for handicapped students
- recruitment and care of international students paying their fees. Education of these students is a valuable experience for participation of individuals and departments in mobility projects, and also a source of additional income for qualified teachers with language skills
- forty-fifth faculty ball at the Voroněž hotel

Achievements

Taking into account budget restrictions, the economic situation was satisfactory. The undesirable consequences of budget restrictions meant salary reductions and some unpopular measures in human resources management could not be avoided at the beginning of the new economic year. Stating that the trend in salaries and material supply has been favourable, we have to bear in mind that it is the result of outstanding pedagogical and research achievements of academic staff and faculty expenditure minimization. Economic stability of departments was mainly due to involvement in research projects of the Czech Science Foundation, Foundation of the Czech Academy of Sciences, Ministry of Trade and Industry, European Commission (FP6 and FP7) and Higher Education Development Fund and efforts of all those who under the leadership of chief investigators participated in four research plans and research centres SIX a CVVOZE.

All staff members and Ph.D. students deserve appreciation and my gratitude.

Jarmila Dĕdková
Dean

Faculty of Electrical Engineering and Communication

Dean
Prof. Ing. Jarmila Dědková, CSc.

Vice-Deans
Prof. Ing. Radimír Vrba, CSc. – until 30 June 2011
Acting Dean, Vice-Dean for External Relations and International Affairs

Doc. Ing. Petr Fiedler, PhD.
Vice-Dean for Bachelor Degree Programme

Prof. Ing. Stanislav Hanus, CSc.
Vice-Dean for Master Degree Programme

Prof. RNDr. Vladimír Aubrecht, CSc.
Acting Dean, Vice-Dean for Creative Activities and Doctoral Degree Programme

Doc. Ing. Jiří Háze, Ph.D. – since 1 July 2011
Vice-Dean for External Relations and International Affairs

Chairman of Academic Senate
Doc. Ing. Miloslav Steinbauer, Ph.D.

Faculty Secretary
Ing. Miloslav Morda

Student Advisor to the Dean
Tomáš Szöllősi

Advisor for Equal Opportunities
RNDr. Naděžda Uhdeová, Ph.D.

Trade Unions Representative
Prof. Ing. Vítězslav Hájek, CSc.

Departments

Department of Control and Instrumentation
Department of Biomedical Engineering
Department of Electrical Power Engineering
Department of Electrotechnology
Department of Physics
Department of Languages
Department of Mathematics

Department of Microelectronics
Department of Radioelectronics
Department of Telecommunications
Department of Theoretical and Experimental Electrical Engineering
Department of Power Electrical and Electronic Engineering

Scientific Board

Internal members

Prof. RNDr. Vladimír Aubrecht, CSc.
Prof. Ing. Lubomír Brančík, CSc.
Prof. Ing. Jarmila Dědková, CSc.
Doc. Ing. Petr Fiedler, Ph.D.
Prof. Ing. Eva Gescheidtová, CSc.
Doc. Ing. Luboš Grmela, CSc.
Prof. Ing. Stanislav Hanus, CSc.
Prof. RNDr. Jan Chvalina, DrSc.
Prof. Ing. Pavel Jura, CSc.
Prof. Ing. Jiří Kazelle, CSc.

Prof. Ing. Vladislav Musil, CSc.
Doc. Ing. Vít Novotný, Ph.D.
Doc. Dr. Ing. Miroslav Patočka
Prof. Ing. Ivo Provazník, Ph.D.
Prof. Dr. Ing. Zbyněk Raida
Prof. Ing. Zdeněk Smékal, CSc.
Doc. Ing. Petr Toman, Ph.D.
Prof. Ing. Radimír Vrba, CSc.
Doc. Ing. Jaroslav Zendulka, CSc.

External members

Doc. Ing. Ladislav Dušek, CSc.
Ing. Leoš Dvořák
Prof. Ing. Miroslav Husák, CSc.
Doc. Dr. Ing. Josef Lazar
Doc. Ing. Jiří Masopust, CSc.

Ing. Petra Peterková, Ph.D.
Ing. Jiří Potěšil
Prof. Ing. Aleš Richter, CSc.
Ing. Roman Schiffer
Ing. Robert Vích, DrSc.

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Accredited Programmes and Study Areas

Accredited Study Programmes

Bachelor Degree Programme Electrical, Electronic, Communication and Control Technology

Study areas: Automation and Measurement Technology

Electronics and Communications

Microelectronics and Technology

Power Electrical and Electronic Engineering

Teleinformatics

Bachelor Degree Programme Biomedical Technology and Bioinformatics

Study area: Biomedical Technology and Bioinformatics

Follow-up Master Degree Programme Electrical, Electronic, Communication and Control Technology

Study areas: Biomedical and Ecological Engineering

Power Electrical Engineering

Electronics and Communications

Electrotechnical Manufacturing and Management

Cybernetics, Control and Measurement

Microelectronics

Power Electrical Engineering and Power Electronics

Telecommunications and Information Technology

Follow-up Master Degree Programme Biomedical Engineering and Bioinformatics

Study area: Biomedical Engineering and Bioinformatics

Doctoral Degree Programme Electrical Engineering and Communication Technology

Study areas: Biomedical Electronics and Biocybernetics

Electronics and Communications

Cybernetics, Control and Measurement

Microelectronics and Technology

Power Electrical and Electronic Engineering

Teleinformatics

Theoretical Electrical Engineering

Physical Electronics and Nanotechnology

Mathematics in Electrical Engineering

Accredited Areas for Habilitation Procedures and Procedures for Appointment to Professorship

Biomedical Engineering

Electronics and Communications

Electrical and Electronic Technology

Power Electrical and Electronic Engineering

Technical Cybernetics

Teleinformatics

Theoretical Electrical Engineering

Study Programmes

Bachelor Degree Programme Biomedical Technology and Bioinformatics

In academic year 2007/08 a new Bachelor programme Biomedical Technology and Bioinformatics (BTBIO-A) was launched. The full-time form of study covers one study area Biomedical Technology and Bioinformatics (A-BTB). Also taking part in tuition in this interdisciplinary programme is the Faculty of Medicine at Masaryk University in Brno.

The study area Biomedical Technology and Bioinformatics in mainly focused on practice, but it also prepares graduates for further studies in the follow-up Master programmes at universities providing education in biomedical engineering, medical informatics and mathematical biology (Brno University of Technology, Czech Technical University in Prague, Charles University, Masaryk University). Students gain theoretical knowledge in mathematics, physics and chemistry, basic knowledge in biology, human anatomy and physiology, needed to understand the basic biological processes taking place in human organism, but also for communication with doctors and medical staff. They get acquainted with operation principles and use of medical technology and informatics, and gain ability to communicate with them. They are also offered information on medical legislative and learn how to apply it in practice. Emphasis is laid on general and professional language skills.

The Bachelor programme includes a four-week professional training in hospitals, health centres, institutions anad companies focused on running clinics, treatment, research and trade in biomedical technology and bioinformatics in the Czech Republic and abroad. The training is arranged by the students themselves and takes place outside scheduled tuition (mainly during the summer holidays) by the time of completion of the Bachelor programme.

The top limit approved by Academic Senate for admission to full-time study in the programme BTBIO-A in academic year 2011/12 was 150. Entrance examination took place on 28 June 2011. The written examination contained tests in mathematics and biology. Applicants who took their school-leaving examination with grade average of 1.25 were exempt from the examination. The maximum number of points to be achieved in each subject was 50 and the pass was 12 points for each subject. All applicants exempt from the examination and those who passed the examination with excellent results were admitted. In 2011 there were 220 paid applications for study in the programme BTBIO-A, 138 applicants were admitted and 116 registered. In 2011 there were 290 full-time students in the BTBIO-A programme.

Bachelor Degree Programme Electrical, Electronic, Communication and Control Technology

The Faculty has been providing education in the Bachelor programme Electrical, Electronic, Communication and Control Technology (EECR) in full-time format of study since academic year 2002/03 and in part-time format of study since academic year 2004/05.

In 2011, 1620 full-time students enrolled in the Bachelor programme EECR-B. The programme was completed by 403 students, 63 of them in the study area Automation and Measurement Technology (B-AMT), 105 in Electronics and Communications (B-EST), 54 in Microelectronics

and Technology (B-MET), 78 in Power Electrical and Electronic Engineering (B-SEE) and 103 in Teleinformatics (B-TLI).

In the part-time Bachelor programme EECR-BK there were 273 students in 2011. The part-time study programme was completed by 36 students, 10 of them in study area Automation and Measurement Technology (BK-AMT), 10 in Electronics and Communications (BK-EST), 5 in Microelectronics and Technology (BK-MET), 4 in Power Electrical and Electronic Engineering (BK-SEE) and 7 in Teleinformatics (BK-TLI).

Admission procedure is a priority at the Faculty. It took place on 28 June 2011. Applicantions for full-time and part-time Bachelor study were accepted. There was a written entrance test in either mathematics and physics or mathematics and the basics of informatics. Students who met one of the following requirements were exempt from the examination:

- passed their school-leaving examination in mathematics or physics with grade 1 or 2 in at least one of these subjects
- completed a preparatory course in mathematics or physics with grade 1 or 2
- achieved a secondary-school average better than 2,0 (arithmetical average of grades in final reports for 1st, 2nd and 3rd year and the first half of 4th year)
- passed National Comparative Examinations and Test of General Study Prerequisites (OSP Z) with a minimum of 60% in all three assessed parts, or 60% in the first three parts of the expanded test of general study prerequisites (OSP R)
- completed National Comparative Examinations with a minimum of 60% in mathematics

The maximum number of points to be achieved in entrance examination for each subject was 50 and the pass was 12 for each subject. All applicants who passed the entrance examination or who were exempt from it were admitted.

In 2011 there were 1456 applications, 1189 for full-time study and 267 for part-time study. Finally, 908 students were admitted, 743 students in full-time study and 165 in part-time study. A second round took place, with 80 applicants for full-time study and 16 applicants for part-time study. A total of 825 students enrolled, 696 in full-time study and 164 in part-time study. The statistics show lasting interest in part-time study programmes.

Graph 1 shows the numbers of applicants, admitted and enrolled full-time students since 2004. The decreasing trend in applicants is apparent, due to the demographic trend and students' interest in newly accredited Bachelor programmes at other universities. For the first time in academic year 2010/11 applicants were admitted directly to a selected specialization, while in previous years they selected their specializations during their studies. Statistics from academic years 2006/07 - 2009/10 and numbers of students enrolled in individual study areas in 2010/11 and 2011/12 are in Table 1.

The knowledge level of incoming students has been monitored for many years. An important factor is the percentage of admitted students who have taken their school-leaving examination in mathematics or physics, see Graph 2.

Another indicator are the percentages of students admitted in the EECR-B programme coming from different types of secondary schools. As in previous years the number of applicants coming from gymnasium-type secondary schools stagnates at 20%, while 80% students come from technical secondary schools, integrated secondary schools or training centres.

Preparatory courses were offered by departments of mathematics and physics to assist applicants preparing for entrance examinations and help them adapt to study at university.

Information on study programmes and qualifications such as Certificate of Electrotechnical Qualification, Certificate of Pedagogical Practice, Microsoft Certificate, Cisco Certificate are regularly presented in the media, on Open Door Days, at visits by teachers and students to secondary schools, and at the GAUDEAMUS fair.

Table 1: Interest of full-time students in Bachelor programme study areas – Automation and Measurement Technology (B-AMT), Electronics and Communications (B-EST), Microelectronics and Technology (B-MET), Power Electrical and Electronic Engineering (B-SEE), Teleinformatics (B-TLI)

Acad. year		B-AMT	B-EST	B-MET	B-SEE	B-TLI	Not given	Total
2006/07	Number	139	172	68	95	221	89	784
	%	20,0	24,7	9,8	13,7	31,8		
2007/08	Number	152	178	51	98	195	45	719
	%	22,6	26,4	7,6	14,5	28,9		
2008/09	Number	98	127	50	90	153	47	565
	%	18,9	24,5	9,7	17,4	29,5		
2009/10	Number	94	101	48	77	101	0	421
	%	22,3	24,0	11,4	18,3	24,0		
2010/11	Number	144	151	47	146	214	-	702
	%	20,5	21,5	6,7	20,8	30,5		
2011/12	Number	138	109	100	160	189	-	696
	%	19,8	15,7	14,4	23,0	27,2		
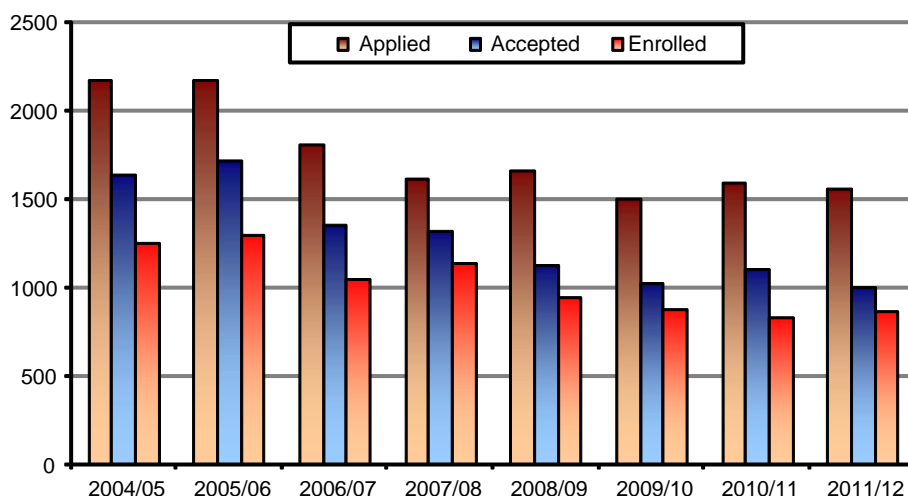
Graph 1: Applicants, admitted and enrolled in full-time and part-time form of study in EECR-B in academic years 2004/05 - 2011/12
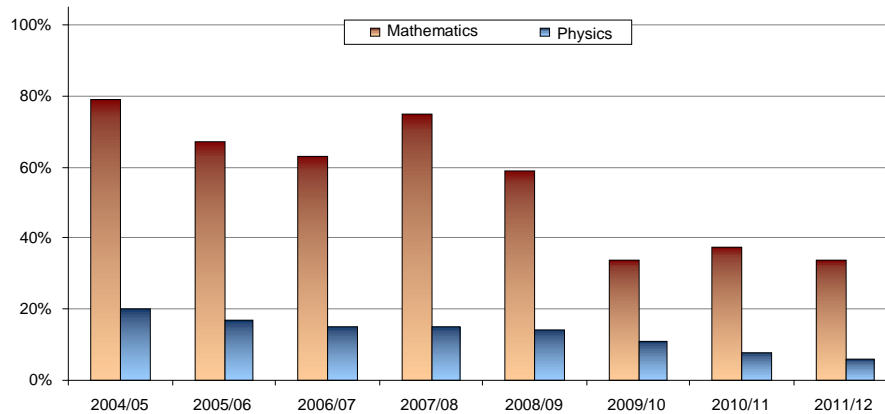
Graph 2: Percentages of admitted students who have taken school-leaving examination in mathematics or physics

Follow-up Master Degree Programme Electrical, Electronic, Communication and Control Technology

The Faculty has provided education in the follow-up Master programme Electrical, Electronic, Communication and Control Technology in full-time form of study since academic year 2005/06 and in part-time form of study since academic year 2007/08.

In academic year 2011 there were 844 full-time students in the follow-up Master programme EECR-M, 405 in the first year and 439 in the second year. There were 174 part-time students in EECR-ML, 98 first-year students and 76 second-year students.

In 2011 full-time programmes were completed by 508 students, 39 in study area Biomedical and Ecological Engineering (M-BEI), 27 in Power Electrical Engineering (M-EEN), 98 in Electronics and Communications (M-EST), 58 in Electrotechnical Manufacturing and Management (M EVM), 75 in Cybernetics, Automation and Measurement (M-KAM), 35 in Microelectronics (M-MEL), 26 in Power Electrical and Electronic Engineering (M-SVE) and 150 in Telecommunications and Informatics (M-TIT).

Part-time study programme was completed by 44 students, 2 in Power Electrical Engineering (ML-EEN), 4 in Electronics and Communications (ML-EST), 4 in Electrotechnical Manufacturing and Management (ML EVM), 11 in Cybernetics, Automation and Measurement (ML-KAM), 4 in

Microelectronics (ML-MEL), 2 in Power Electrical and Electronic Engineering (ML-SVE) and 17 in Telecommunications and Informatics (ML-TIT).

The total number of applicants for study in the EECR programme (with paid application) was 742. There were 592 applicants for full-time (EECR-M) programme and 150 applicants for part-time (EECR-ML) programme. For academic year 2011/12 the maximum numbers of admissions approved by Academic Senate were 750 (full-time study) and 250 (part-time study). The written entrance examination contained 10 tasks approved by the Council of Study Programmes for subjects Electrotechnical Engineering 1, Electrotechnical Engineering 2, Electronic Components, Signals, Structures, Systems and Measurement in Electrical Engineering.

As the number of applicants was lower than the number approved for admission, the Dean decided, in accordance with Admission Procedure Rules, about exemption from entrance examination and admission of all of them. On the announced date of entrance examination 24 June 2011 nearly all applicants enrolled. The second term of entrance examination 7 July 2011 and the Committee meeting scheduled for 25 August 2011 were cancelled. The total number of admitted was 698, 592 in full-time study and 106

in part-time study. All admitted were registered for the study areas they had selected. Numbers of applicants and admitted by study areas are in Table 2, 684 of them enrolled, 576 in full-time and 108 in part-time study.

Follow-up Master Degree Programme Biomedical Engineering and Bioinformatics

Since academic year 2010/11 the Faculty has offered full-time format of study in the follow-up Master programme Biomedical Engineering and Bioinformatics BTBIO-F. In 2011 there were 109 students in this programme, 66 first-year students and 43 second-year students.

There were 73 applicants (with paid application) for the BTBIO-F programme. The maximum number of admissions approved by Academic Senate for academic year 2011/12 was 250. The written entrance examination consisted of 10 problems from two thematic areas selected by the Council of Study Programmes.

As the number of applicants was lower than the above approved maximum number of admissions, the Dean decided, in accordance with Admission Procedure Rules, on exemption of entrance examination and admission of all applicants. On the announced date of entrance examination 24 June 2011 nearly all admitted students enrolled. The second term of entrance examination 7 July 2011 and Committee meeting scheduled for 25 August 2011 were cancelled. There were 76 admitted, 73 of them enrolled..

Lifelong Education and Self-Paid Study

Apart from a whole range of specialized courses for professionals, the Faculty offers paid study of subjects of the Bachelor and follow-up Master programme EECR. Having completed the courses, the graduates will be admitted in a study programme without being required to pass entrance examination, and earned credits will be recognized. In 2011 there were 47 students in the lifelong education programme.

In 2011 there was one international student paying his fees in the follow-up Master programme EECR-MN

Table 2: Numbers of applicants and admitted in study areas of follow-up Master programmes EECR-M and EECR-ML in 2011

Study area	Applicants	Admissions	Study area	Applicants	Admissions
M-BEI	50	50	ML-BEI	14	11
M-EEN	57	57	ML-EEN	18	11
M-EST	102	102	ML-EST	11	7
M-EVM	90	90	ML-EVM	26	21
M-KAM	78	78	ML-KAM	22	14
M-MEL	45	45	ML-MEL	9	4
M-SVE	33	33	ML-SVE	13	11
M-TIT	137	137	ML-TIT	37	27

Tuition Support

There has been a consistent effort at the FEEC to improve and use more extensively the information system for management of study affairs and to make relevant information accessible to students.

In 2011 regular assessment of the quality of teaching by students took place at the end of the winter and the summer semester using the BUT information system.

In support of tuition in full-time and part-time Bachelor and follow-up Master programmes new or innovated electronic texts (ET) and multimedia aids (MP) were created and are accessible on faculty websites.

Science, Research and Doctoral Study

Creative Activities, Science and Research

Growth in research continued in 2011, in terms of both the funds and quality of research. As compared with the previous year, the funds obtained for research and development (graph 4) increased by approximately 15%. The major sources were projects of Czech Science Foundation, projects conducted in cooperation with industrial companies and European Union projects.

Original scientific and research results were published in 8 international monographs and in 129 articles in impact journals. FEEC was granted 2 international and 8 national patents.
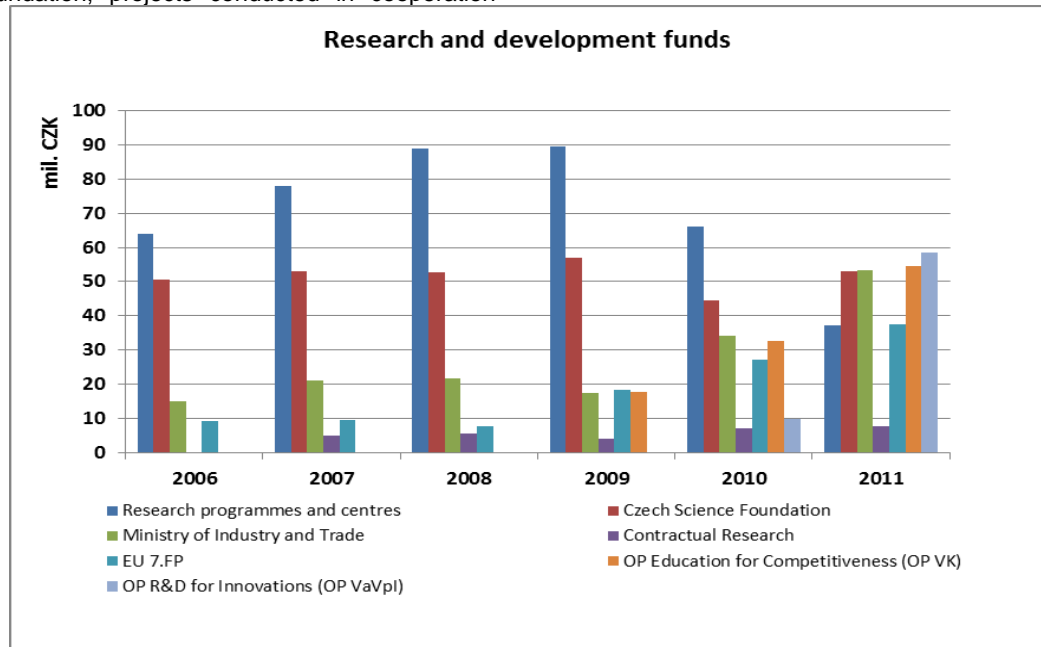
Graph 4: Research and development funding at FEEC in mil. CZK, 2006 - 2010

Research Plans, Research Centres

Outstanding development and research results were achieved by teams involved in four reseach plans and three research centres. A brief evaluation follows:

New Trends in Microelectronic Systems and Nanotechnologies (MIKROSYN)
(Investigator: Radimír Vrba)

The research plan deals with basic and applied research of microeletronic systems and technologies. The plan deals with integrated circuits and systems and their elements and technology. The research is based on and supported by modelling and simulation of circuits of semicondutor structures, their diagnostics and development of implementation technology.

Involved in the research plan in 2011 were academics and Ph.D. students from the Departments of Microelectronics, Physics, Control, Measurement and Instrumentation, Mathematics, Radioelectronics, Languages and the Faculty of Information Technology. There

were 78 investigators in all categories (D1, D2, D3), 12 professors, 24 associate professors, 18 senior lecturers, 24 technical and administrative staff and 32 full-time Ph.D. students.

The research plan covered five areas where the following major results have been achieved.

1. *Theory, design and diagnostics of low-voltage and low-power integrated circuits in submicron technologies*: Research was focused on systematic analysis of analog operating blocks for low-power integrated circuits, translinear circuits with strong inversion mode transistors, second gate control transistors, methods of increasing signal oscillation. Applications were selected with regard to implementation in low voltage and low noise microsystem structures. Prepared for manufacturing was a prototype of an integrated circuit for a novel bandpass sigma-delta modulator.

2. *Modelling and simulation of integrated circuits*: Application of delayed matrix exponential for solutions of partial linear differential equations and for representations of solutions of pulse differential equations. By means of integral representations and Lyapunov-Krasovskii functionals new results were achieved on the stability and non-stability including exponential stability of solutions of equations for stochastic control systems. There were new results on convergence of solutions of discrete equations at arbitrary discrete intervals. Algorithms were designed for solution of fiction functional equations in sense of the Riemann-Liouville derivation. Simulation of signal propagation on multi-conductor transmission structures and time-domain sensitivity analysis. To enhance the quality of transmitted signals and thus attain higher transmission velocities, an equalization technique of signal modification was designed and computer simulated, based on a combination of pulse width modulation and special shaping of transmitted pulses.

3. *Microsystems and nanosystems:* The possibilities of power-harvesting for low power microsystems and independent power sources were studied. Bonding at high temperature and voltage, the so called anodic soldering. Soldering equipment was manufactured and protected by utility sample. Fields of carbon nanotubes and cool emission. For measurements of modified sensor electrodes a laboratory workplace for measurement of emissions from the surface of materials was set up. Optimization of electrodes

and size of electrodes for the three-electrode TLV electrochemical sensor. Novel methods were developed for measurement of bound charge i.e. measurement of the passivation efficiency of dielectric layers.

4. *Advanced microelectronic and nanoelectronic technologies*: Development and implementation of a capacity probe for protection of objects, in the form of a hybrid integrated circuit. Research and development of an ultrasonic head for depositing viscose materials and its application in the apparaturs WRITING. Design of a thermodynamic sensor on the principle of thermal balance equilibrium. Research and development of 3D structures with new implementation concept of interconnecting substrates, organic and anorganic PCBs. Research of connecting semiconductor chips and measurement of appropriate output load. Development of a current source with 16 channels for measurement and testing of coherent characteristics of electronic components. Research and development of interconnecting layers in LTCC technology using the low-contractibility HERAEUS ceramics.

5. *Modern diagnostics of materials and components*: Characteristics of oxide layers from noble metals were studied in regard to the signal/noise ratio for cold-emission of electrons into vacuum. Design, implementation and testing of etching tips of cathodes 100 nm in diameter and with very good reproducibility. The last stage of CdTe detector research was completed, the causes of excess $1/f$ noise revealed and noise sources separated.

Research results achieved in 2011 were published in 2 monographs, 80 articles in international journals, 157 papers at international and national conferences. There were 5 habilitations and one procedure leading to appointment to professorship was started.

In connection with the research plan the team members were involved as investigators or co-investigators in 7 international projects, 13 GAČR, 3 TAČR, 8 MPO, 2 GAAV projects and projects for other institutions.

New Generation Electronic Communication Systems and Technologies (ELKOM)
(Investigator: Zbyněk Raida)

Research was centred on advanced communication systems, mainly physical layer, system layer, protocol layer and signal

processing. Also investigated was electromagnetic compatibility of operated facilities and their possible impact on living organisms.

Research activities were covered by 6 programs, where the following results were achieved:

1. Wireless and mobile communication systems

A combination of the multiple Kolmogorov-Smirnov test was designed as well as an optimization of OFDM parameters for application in cognitive radio systems. Operating application for simulation of digital TV transmission was designed for portable DVB-H/SH and DVB-T2 devices. In cooperation with TU Wien a simulator was designed for the uplink system LTE. The output balance of optical wireless communication in inner environment was analyzed.

2. Multi- and hypermedia services

There was developed a device for analysis of objects changing in space, a modular telephone exchange I -TEL with support of backup analog lines, a system for digital multicast real-time processing of acoustic signals, a software for automatic control of acoustic signal quality on personal computers.

3. High frequency and microwave structures

Following previous cooperation with US Naval Academy a narrowband satellite transponder-monitor was designed for transmission of PSK signal with multiple independent carriers. The transponder is to be incorporated in a CubeSat satellite.

4. Integrated communication systems

Artificial intelligence implementation in network elements and their control. Implementation of the MIB database in the simulation environment OPNET Modeler to enhance the quality of services. Development of a method of safe authentication for access to data storage sites, and the method of protected communication between data collection server and modules of data monitoring network.

5. Electronic circuits and operating blocks

An algorithm was designed for recovery of an optimal piecewise linear approximation of polynomial vector field Designed and implemented were emulators of mem-systems – analog on the basis of mutators and hybrid, microcontroller based. An original voltage conveyor with electronically controlled input impedance Y clip. Connections for piecewise linear approximation for rectifiers. Design of

a digital algorithm for jitter measurement without testing signal transmission.

6. Signal analysis, processing and transmission

Methods of longterm monitoring of trends in multicast digital signals using an electro-optical system for scanning of electrical effects in living organisms. Methods of collection, analysis and fusion of multimodal medical images from ultrasonic tomography and implementation of computations. Research of the methods of analysis of the characteristics of transmission channels including evaluation of the quality of digital TV transmission in accordance with the DVB-T standard.

The research plan solution represents seven years of fruitful cooperation of the Departments of Biomedical Engineering, Radioelectronics, Telecommunications and Theoretical and Experimental Electrical Engineering. This cooperation continues in the Centre of Sensoric, Information and Communication Systems (SIX) as it is described further in this annual report.

The investigation team is now preparing a monograph containing a detailed description of results yielded during the research plan solution. The Czech and English versions of this monograph will be available at

http://urel.feec.vutbr.cz.

Resources, Accumulation and Optimization of Electric Energy Exploitation in Conditions of Permanently Sustainable Growth
(Investigator: Jiří Kazelle)

The research plan was focused on four areas, chemical sources of electric energy, optimization of electrochemical energy conversion, optimization of energy conversion and exploitation in systems with ecological power sources, and alternative ecological transport.

Involved in the research plan were academics and Ph.D. students of the Departments of Electrotechnology, Electrical and Electronic Power Engineering, Electrical Power Engineering, Theoretical and Experimental Electrical Engineering, Languages and Mathematics.

The research team included 24 investigators in category D1 (5 professors, 15 associate professors and 4 lecturers). There were 57 investigators in category D2 (2 professors, 12

associate professors and 43 lecturers, 11 researchers, technical staff of 46 including 27 Ph.D. students). There were 17 memberss of the team in category D3.

Research plan funding totalled 14 859 000,- CZK.

During the seventh year of the research plan solution the following outstanding results were achieved:

1. Chemical sources of electric energy: Study of the impact of conducting and non-conducting additives in negative active mass of lead accumulators in the longterm regime of PSoC, evaluation of longterm tests on the impact of the type and amount of additives, the combination of the impact of pressure and additives. Study of the thermal effects in electrochemical systems with focus on the lead accumulator. Application of the method of current pulses under real conditions to define the level of charging (SoC) in the lead accumulator and in the spiral electrode system of the lead accumulator, optimization of current flags. Research and development of materials for lithium-ion accumulators with low combustibility, new gel polymer electrolyte. Research of liquid electrolytes with a higher inflammation point, i.e. increased resistance to inflammation, study of factors affecting conductivity and solidification point. In cooperation with BOCHEMIE studies of the stability of various modifications of materials for the positive electrode. Research and development of membranes and electrolytic formation of electrode layers in electrolyzers for hydrogen and oxygen generation. In cooperation with Institute of Instrument Technology, Czech Academy of Sciences research of signal electron detection in microscopes working at high pressure conditions in the specimen chamber (VPSEM), service monitoring of the surface structure of battery mass in VPSEM. Numerical modelling of the dynamic behaviour of the chemical cell in the process of charge and discharge.

2. Optimization of electrochemical energy conversion: Study of up-to-date optimization methods using artificial intelligence algorithms for design of electrical machines. In cooperation with industry development of software for application of the optimization algorithm SOMA ACTH in combination with the expert design software SPEED. In 2010 software for four variable parameters was developed and in 2011 it was expanded for ten parameters describing machine geometry, and another two parameters for design of winding. Machine winding was designed for ten poles and twelve slots. The first optimization program focused on the minimum size of magnets, the second one on maximum efficiency, required moment and minimum size of magnets. First optimization software was also developed for optimization of air/conditioning and heat removal.

3. Optimization of energy conversion and exploitation in systems with ecological power sources: Design and implementation of an alternative flickermeter working in the time-domain, with response in a wide range of interharmonic frequencies including high-frequency interharmonics. A universal mathematical system for processing of digital images was created, bringing about new possibilities of generation of brightness maps of several orders, which would not be possible by conventional processing of one image. Also created was a prototype of traffic signs tester based on digital photography analysis. A concept of active appliances was presented, capable of using their accumulation potential for consumption regulation in the network. Verification of the method of defective phase earthing at high-voltage network failures including analysis of the impact on contact voltage magnitude. The basic relationships and methods of computing the structure and thermodynamic characteristics of a closed heterogeneous system in the thermodynamic equilibrium at a constant pressure. Application of local light emission for fast and reliable non-destructive detection of defects and solar cells quality, reliability and service life tests. Software development for mathematical modelling of radiation energy transport by the method of partial characteristics in different types of thermal plasma. Numerical models with progressive and highly effective elements of electrical energy conversion into light were completed. Solar elements were designed and technological processes developed to substitute photovoltaic systems, with expected high solar energy exploitation. Work on this solution is in progress and national and international patent applications were submitted.

4. Alternative ecological transport: Longterm testing of the service life of Li-ion accumulator of electrical wheel were completed with positive results that proved that the concept of monitoring circuits and charging strategy were good.

A demonstration electric wheel with serial hybrid drive was being developed for single-track electromobiles. By suitable control of 'gas' in combustion engine and DC/AC converter control a very good engine efficiency was achieved in a wide range of wheel moment and revolutions.

The development of the synchronous engine 50 kW for the experimental electrically driven plane was completed in 2011. Output and control circuits for the three-phase DC/AC alternator for this engine were also completed as well as the monitoring and balancing accumulator electronic circuits.

Intelligent Systems in Automation

(Investigator: Pavel Jura)

The research plan deals with modern methods and tools constituting a design system for automation of processes focused on artificial intelligence methods. Research deals with modern methods and procedures of data scanning and verification, optimization process monitoring and diagnostics, modelling of systems and research of control algorithms using artificial intelligence methods. Emphasis is laid on new communication and internet technologies.

Involved in the research plan in 2011 were academics and Ph.D. students from the Departments of Control, Measurement and Instrumentation and Mathematics, FEEC, Department of Automation and Informatics, FME. At FME the investigating team included 4 professors, 6 associate professors, 13 lecturers, technical and administrative staff of 3 and 14 Ph.D. students. The research plan covered 5 study areas where the following results were achieved in 2011:

1.Smart control and identification algorithms: Design and simulation tests of algorithms for identification of nonlinear inductivities of the switching reluctance engine were conducted. Angular dependence of inductivity effect is used in the state estimator of revolutions in the development of sensorless control of switching reluctance engines. Research of robust and predictive control of DC electrical engines continued.

Some members of the group were involved in dynamical systems identification by the RBF artificial neural networks, defined by gradient methods and in predictive control research. Research was also focused on optimal control, mainly sensitivity analysis of the LQ controller in the position and the incremental form, incorporation

of the output saturation nonlinearity in the computation of the optimal action and modification of the LQ controller structures. Dynamic programming was mostly used.

In mathematical support design, new results on solution stability and non-stability were obtained including results on the exponential solution stability of equations for stochastic systems and estimations of perturbations of indirect non-linear interval control systems of neutral type. Delayed matrix exponential was used to solve linear partial differential equations and to represent solutions of pulse differential equations. Convergence of all solutions of discrete equations in arbitrary discrete intervals was proved. Generation of fuzzy implicators was generalized.

2. Control of complex systems:

Functionalities of optimization algorithms were verified and simulation experiments conducted for evolution generation of regulators for various types of regulated systems. Simulation tests and statistical evaluation of the methods for planning trips of mobile robots were carried out, and the methods of autonomous agents verified. Real implementation included the autonomous and the centralized model of control. Software applications and operating samples were completed. The international conference MENDEL 2011 was organized and focused on soft-computing (WoS index). The research plan received the Best Paper Award (World Congress on Engineering and Computer Science 2011, Berkeley, USA).

3. Artificial intelligence and robotics:

Designed, developed and implemented was the mobile robot SCORPIO with special caterpillar undercarriage, suitable for inside use. The robot was presented at two conferences and two reputable international exhibitions – MSV2011 and IDET 2011.

The system for control of a group of service robots CASSANDRA-WPF was completed and presented at conferences and exhibitions. In addition to the original plan we designed, developed and tested the so called wearable control system CASSANDRA-WEARABLE.

4. Communication networks and processing automatic systems:

First experiments with the wireless communication-localization technology Nanotron were conducted. In theoretical research we defined ontology for the AS-interface bus and started work on

the use of ontologies in diagnostics and sensoric data fusion.

5. Methods and tools for automated measurement:

Novel methods of measuring the mass and volume flux in a flux meter for measurement of gas and fuel flux. Implementation of a new NPL methodology of calibration of acoustic emission sensors started as well as development of methods and procedures for calibration of MEMS inertial sensors.

Methods of contactless measurements on the basis of photogrammetry were developed for transport and industry, software for reconstruction of planar and 3D objects. These methods were implemented and verified in laboratory (active and passive triangulation) and in industrial operation (optical distance meter with radar, vehicle profile scanner) owing to software for computation of photogrammetric problems in mathematical nucleus with abstract data types.

Research Centre of Applied Cybernetics

(Investigator: Petr Vavřín)

Research Centre of Applied Cybernetics (CAK) was established at the Faculty of Electrical Engineering and Communication, Brno University of Technology in 1999 as a co-investigating workplace. The chief investigator is Vladimír Kučera, the Czech Technical University in Prague. Other co-investigators are VŠB-TU Ostrava, University of West Bohemia Plzeň, Tomáš Bata University Zlín, Institute of Information and Automation Theory, Institute of Information Technology, Academy of Sciences Prague, Čerticin, a.s., Prague, Cygni, s.r.o. Prague, UniControls a.s., Prague, Neovision s.r.o., Prague, Camea s.r.o. Brno, UNIS, s.r.o. Brno, Siemens Automobilové systémy s.r.o., Frenštát pod Radhoštěm. The end user of the research results achieved at CAK FEL BUT is the company Freescale Polovodiče ČR. The activities of the centre originally scheduled for 10 years were extended for 2010 and 2011. The Brno workplace was involved in all four research areas covered by the center.

1. Automatic control algorithms

P. Vavřín, P. Blaha, P. Václavek, L. Veselý, P. Zbranek

The group focused on research of sophisticated control algorithms for sensorless drives. In 2011 the designed algorithms were tested on specific applications.

2. Artificial intelligence and robotics

F. Šolc, L. Žalud, F. Burian, L. Kopečný

In 2011 the novel mobile robot SCORPIO was completed, with the so called caterpillar undercarriage, which is able to operate in outer an inner environment including stairs. The robot was presented at two reputable exhibitions – IDET2011 and MSV2011, results were also presented at international conferences, e.g. SII2011 in Japan. Also designed and tested was the so called 'wearable' control station – a system for full telepresence control of reconnaissance robots, incorporated in the clothing and equipment of operators and therefore imposing no limitation to investigation.

3. Computer vision

K. Horák, P. Honec, S. Valach.

K. Horák became the leader of the group when I.Kalová went on maternity leave. The group continued research and testing of systems for road transport.

4. Control systems

F. Zezulka, P. Kučera, O. Hynčica

Research of real-time control systems continued. Results were presented at international conferences.

Financial support from sources of CAK at BUT for 2011 totalled 450 thous. CZK.

Research Centre of Quasioptical Systems and Terahertz Spectroscopy

Coordinator: High School of Chemistry and Technology (co-coordinator: Zbyněk Raida)

Research centre of quasioptical systems and terahertz spectroscopy (KVASTES) was established in March 2006 by the High School of Chemistry and Technology, J. Heyrovsky Institute of Academy of Sciences, Czech Technical University and Brno University of Technology.

The centre deals with basic research of the structure and dynamics of molecules, relaxation processes in gases and atmospheric response to electromagnetic waves. Research was conducted in frequency wideband covering centimetre-, milimetre- and submillimetre waves.

In December 2011 the activities of the KVASTES centre were terminated.

Research Centre 'Data, Algorithms, Decision-making'

Coordinator: Institute of Information and Automation Theory, Academy of Sciences Prague

Investigator: Jiří Jan

The Brno research team involving co-investigators R. Jiřík, R. Kolář and other investigators, mainly Ph.D. students has been involved in processing and analysis of medical images of various types in medical diagnostics since 2005. The main area of interest was processing of bulk measurement data in ultrasound tomography (USCT) and reconstruction of 2D and 3D images, simulation of ultrasound and computing calibration of the measuring USCT system. Research was conducted in longterm cooperation with KIT – Karlsruhe Institute of Technology (Helmoltz Gemeinde, Germany). Another area of interest was analysis of opthalmological images from digital imaging modalities including laser scanning tomography (SLT) and optical coherence tomography (OCT) aimed at evaluation of parameters significant to facilitate medical diagnostics, mainly glaucoma problems. This research was conducted in cooperation with the opthalmological clinic and institute of pattern recognition at University of Erlangen, Germany and with the opthalmological clinic in Zlín. Since 2007 a new area of interest has been magnetic resonance (fMRI) analysis for neurology research, in cooperation with First Neurological Clinic, Faculty Hospital in Brno and University of New Mexico, USA. Results achieved in 2011:

1. Analysis of opthalmological images: The database of opthalmological images was expanded with retina images with manually segmented detailed arterial tree and also available parallel OCT data. Research continued of the method of detecting a layer of neural fibres by telure analysis and consequent leasing classification. A positive result is evaluation of this approach by comparison with objective (but costly) measurement of the neural layer thickness using the OCT system. An article was received for publication in the prestigious journal CMIG (Elsevier) and another two articles were published in impact journals.

2. Reconstruction of tomographic data images in USCT

The final vision of the method of numerical reconstruction was completed, taking into account new procedures of regularization including verification of the parallelization of associated highly sophisticated algorithms on efficient parallel tools. This included development of USCT data simulator for testing of algorithms. An article was received for publication in World journal IEEE Trans. UFFC. An article on original computing calibration of USCT system geometry was accepted for publication in an impact journal.

3. (fMRI) data processing for neuroscience applications.

We continued seeking new relevant approaches to fMRI data analysis, in close cooperation with First Neurological Clinique, Faculty Hospital Brno and University of New Mexico. Verification and modification of multidimensional analysis methods. A dissertation dealt with the key problem of nonlinear inversion Bayes filtering for recovery of neural signals from BOLD fMRI data. Findings were published in two articles in the world journal Neuroimaging (IF > 5).

4. Advanced methods of 3D and 4D tomography data registration and fusion.

Work on 3D and 4D data registration continued in cooperation with Philips Medical Systems Nederland. The developed method is currently, besides 3D CT subtractive angiogramy, used in different medical applications in cooperation with Italian National Institute (Meldola) and other medical instutions abroad.

Closing statement:

The centre DAR finished its activities to 31 December 2011, according to the schedule. The achieved results were published in 10 articles in international impact journals, in 4 articles in reviewed international journals and in 40 papers presented at reputable international conferences. The results were also published in an extensive monograph (published by CRC Tailor and Francis, USA). The authorized software usable for further research published on internet contains 15 items. The major research interests of the centre were dealt with in one habilitation and two dissertations of our internal Ph.D. students, and another two dissertations at Masaryk University (external members of the team). Several members of the team have worked or are working at top workplaces abroad (Canada, USA, France, the Netherlands).

Regional Research Centres

The project of two regional centres continued in 2011. The centres will be financed by the Operational Programme Research and Development for Innovations (OP VaVpI).

Centre for Research and Exploitation of Renewable Energy Sources (CVVOZE)
(investigator Vladimír Aubrecht)

The centre will deal with research, development and innovation of renewable energy sources. The research team members are involved in research of chemical and photovoltaic sources of electrical energy, electrochemistry, electrotechnology, power electrical engineering, electrical drives, mobile robots and industrial electronics. The research centre CVVOZE deals with three programmes:

1. Electromechanical energy conversion,
2. Chemical and photovoltaic energy sources
3. Generation, transmission, distribution and exploitation of electrical energy

The project is focused on research, cooperation of a higher education institution with the industrial sector and acceleration of the transfer of new technologies into industrial use. The planned applications include ecological transport systems, development of ecological robots and innovation of cogeneration units for electrical energy generation.

The project CVVOZE received financial support of over 260 mil. CZK, 221 mil. CZK from the EU and 39 mil. CZK from the budget of the Czech Republic. More than 200 mil. CZK will be used to equip laboratories with top apparatus and devices, the remaining funds will be used to support the research team in the next four years. For more information visit http://www.cvvoze.cz.

Centre of Sensoric, Information and Communication Systems (SIX)
(investigator Zbyněk Raida)

The research centre SIX is focused on applied research of near-future communication systems. Involved in the research centre SIX are the Departments of Physics, Microelectronics, Radioelectronics and Telecommunications. The centre will continue research pursued by the completed research plans. At the same time, the centre SIX is an infrastructure project targeted at consolidation and top-quality equipment of research laboratories of involved departments in the period 2010-13.

While 2010 was a year of preparations, in 2011 and 2012 laboratory equipment is being purchased, installed and integrated in existing laboratories. Trial operation of the centre SIX is scheduled for 1 January 2013.

We also concentrate on building of research teams and on the most effective incorporation of the centre in faculty structure, and preparation of international competition for key positions in the centre. For more information go to

http://www.six.feec.vutbr.cz

Habilitations and Appointments to Professorship

In 2011 five new associate professors were appointed:

Doc. Ing. Jiří Petržela, Ph.D.
Electronics and Communications

Doc. Dr. Ing. Pavel Horský
Electronics and Communications

Doc. Ing. Pavel Šteffan, Ph.D.

Electrical and Electronic Technology
Doc. Ing. Josef Šandera, CSc.
Electrical and Electronic Technology
Doc. Ing. et Ing. Fabian Khateb, Ph.D. et Ph.D.
Electrical and Electronic Technology

Doctoral Programme

In academic year 2011/12 there are 419 students in the doctoral degree programme. Two of them enrolled in the study programme in English and one student receives government scholarship.

Numbers of Ph.D. students in individual years of study over the last five years are in Table 4

Table 5 shows numbers of doctoral programme graduates over the last five years. The list of 2011 doctoral programme graduates can be found on FEEC websites, links *Study, Doctoral study programmes, Doctoral programme graduates.*

Table 4: Numbers of Ph.D. students from 2007 to 2011

year	2007	2008	2009	2010	2011
1.	92	89	88	118	**85**
2.	72	84	80	76	96
3.	40	69	80	75	69
4.	43	20	60	64	71
5.	39	35	8	47	48
6.	27	35	18	7	43
7.	40	33	23	18	7
total	**353**	**365**	**357**	**406**	**419**

Table 5: Numbers of Ph.D. students by departments from 2007 to 2011

	2007	2008	2009	2010	2011	total
UAMT	2	3	8	1	0	**14**
UBMI	2	0	6	0	2	**10**
UEEN	0	2	4	0	4	**10**
UETE	0	4	4	1	2	**11**
UMAT	0	0	0	0	2	**2**
UFYZ	5	5	3	0	0	**13**
UMEL	6	4	11	0	3	**24**
UREL	7	9	12	7	8	**43**
UTEE	3	0	1	1	1	**6**
UTKO	6	9	10	3	4	**32**
UVEE	4	5	6	4	1	**20**
total	**35**	**41**	**65**	**17**	**27**	**185**

Student Creative Activities

The 17th FEEC STUDENT EEICT conference 2011 was jointly organized with the Faculty of Information Technology on 28 April 2011. The abbreviation stands for the English words Electrical Engineering, Information and Communication Technology indicating the priority

areas of research and education at the two faculties. Registered for the competition were nearly 350 papers and after the first round of reviews 290 were accepted – 63 Bachelor, 108 Master and 114 Ph.D. papers. In a special category there were 5 posters presented by students from 4 secondary schools. The competition was sponsored by Honeywell, ABB and ON Semiconductor.

The papers were evaluated by 32 expert committees including representatives of the sponsoring companies, academics and representatives of the club Students for Students. Ninety-eight top or outstanding papers were awarded at the closing ceremony. For more information see FEEC websites, links *Research, Conference, Student EEICT.*

External Relations and International Cooperation

International Cooperation

International activities have been focused on promoting FEEC by presenting results of research projects at international conferences and participation in international research and education projects, placements of FEEC students at partner universities abroad, and offering tuition in English to international students.

Among our priorities is student and teacher mobility involving universities cooperating within the framework of European Commission programmes. FEEC is one of the most active faculties of Brno University of Technology. There has been good cooperation with the BUT Department of International Relations responsible for organization and economic support of mobility programmes and the Lifelong Learning Programme (LLP)/Erasmus. As a result, 54 students were at placements of 224 months, and 26 teachers were on lecture stays of 32 weeks (Table 6). The extent of student and teacher mobility is stabilized. Reciprocally, the interest of international students in placements at FEEC has been increasing. Within the LPP programme, 76 students came for placements of 280 months, which represents an increase by 14% in the number of students and 26% in the length of placements in comparison with 2010. Mobility figures for incoming and outgoing students in individual programmes in 2011 are in Table 7. Existing agreements in the Lifelong Learning Programme-Erasmus were renewed. On the whole, the Faculty has concluded 54 bilateral agreements. The list of universities cooperating with the Faculty on the basis of Lifelong Learning Programme-Erasmus in academic year 2011/12 is in Table 9.

In 2011 funding for longterm international placements for students of all study programmes from the Mobility Development Programme of the Ministry of Education amounted to 550,000 CZK and 149,500 CZK was received from the BUT mobility fund. Within the framework of the Development Programme of Ministry of

Education there were 11 students in placements of the total length of 36.5 months.

Table 8 shows mobility figures for incoming and outgoing students for all mobility programmes over the past 5 years. The trend in incoming students is steadily increasing, the number of outgoing students for 2011 is comparable with the previous year. The length of placements of FEEC students is 276 months, which is a decrease of 4% in comparison with 2010, taking into account the increased number of students at the faculty. On the other hand, placements of international students at FEEC reached 298 months. This is an increase of 1% in comparison with 2010.

The Faculty supports cooperation of departments and academics with international institutions based on interfaculty and LLP-Erasmus agreements as well as newly made contacts. In 2011 the amount of 65,000 CZK was provided in support of such activities. Targeted international relations were financed by departments from projects of operational programmes. The funds were used to cover travel expenses of academics coming to short lecture stays at FEEC.

The Faculty of Electrical Engineering and Communication invites outstanding international experts to lectures, short-term lecture stays or short-term stays connected with research projects. Such visits help to increase the professional level of tuition and contribute to the general education of students and atmosphere of international environment in work on research projects.

Funding in the amount of 348,000 CZK for these activities was obtained from the Development Programme of Ministry of Education 25/16 'Support of international teachers' (stays at BUT).

Support was provided to 10 experts in all key areas of research at the Faculty – mathematics, biomedical engineering, power electrical engineering, microelectronics, radioelectronics,

telecommunications, power electrical and electronic engineering. There were 86 hours of lectures and seminars for 443 students in Bachelor, Master and Ph.D. study programmes. Discussed with some of the visiting experts was potential joint preparation of consortium research projects funded by European Commission or joint technology initiatives, e.g. ENIAC and ARTEMIS.

Table 6: Student and teacher placements at universities abroad in the Socrates-Erasmus and Lifelong-Learning Programme-Erasmus from 2007 to 2011

Socrates (LLP)-Erasmus	2007	2008	2009	2010	2011
Students	39	42	45	51	54
Months	182	168	167	167,5	224
Lecture stays	24	30	28	25	27
Lecture weeks	27	35	34	29	32

Table 7: Student placements at FEEC and abroad by programmes, 2011 - summary

Activity	Arrivals		Departures	
	Students	Months	Students	Months
Socrates(LLP)-Erasmus	76	280	54	224
Inter-university agreements	2	6,5	-	-
Development Programme of Ministry of Education	-	-	11	36,5
Other	8	11,5	6	15,5

Table 8: Student placements at FEEC and abroad in all mobility programmes from 2007 to 2011

		2007	2008	2009	2010	2011
Arrivals	Students	45	64	68	74	86
	Months	141	216	235	285	298
Departures	Students	68	68	62	67	71
	Months	264	248	238	230	276

External Relations

External relations are focused on increasing presentation of faculty activities and providing updated and specific information on the study opportunities offered by the Faculty, study programmes and study areas. The newly structured websites, presentations and videopresentations as well as the faculty profile on the social network Facebook are targeted at

the generation of our future students, secondary school and technical secondary school students. In this respect, an important role was played by the so called roadshow – visits by FEEC students at secondary schools. Increased attention was paid to giving information in the media on FEEC achievements in basic and applied research, development and cooperation with the industrial sector.

On FEEC websites, BUT portals and other subjects information is given on research and education at FEEC departments and workplaces, habilitations and appointments to professorship, research and development projects of the Czech Science Foundation, Ministry of Trade and Industry, Ministry of Education and other projects including EU framework programmes. Faculty websites are in Czech and English.

Faculty managemenet took part in the running race Strojařské schody organized every year, where our dean J.Dědková together with the deans of the Faculty of Management and the Faculty of Information Technology were members of dean relay and vice-deans S. Hanus, P.Fiedler and J.Háze were members of the VIP relay.

As every year, the management attended the annual meeting of the Czech and Slovak faculties of electrical engineering and associated faculties held in Tatranská Javorina, 18-21 May 2011. Exchange of experience and discussions on the current situation in education and research, solution of research projects, participation in European programmes and coordination of activities, research plans and centres and cooperation with universities in other countries were on the agenda.

Close contacts have been maintained with industrial companies in the Brno region and other parts of the Czech Republic. These contacts are mainly based on cooperation with FEEC departments in specific research tasks, expert's reports and consultancy. The major cooperating companies are E. ON Česká republika, a.s., ABB s.r.o., Veletrhy Brno, a.s., Siemens A. G., Honeywell s.r.o., T-Mobile Czech Republic, a.s., ON Semiconductor Czech Republic, Rockwell/Allen Bradley, Škoda Volkswagen Mladá Boleslav, Motorola Solutions, National Semiconductor, ČEZ, a.s., Linet, s.r.o., BD Sensors, s.r.o., Buchlovice, etc.

The cooperation intensified at the time of preparation and start of the two regional research centres CVVOZE – Centre for Research and Exploitation of Renewable Energy Sources and SIX – Centre of Sensoric, Information and Communication Systems. Cooperation was also intensified during the preparation and start of the project of the research centre of excellence CEITEC - Central European Institute of Technology, a joint project of six partners – four universities and two research institutes. Another recent and significant contribution to cooperation with industrial partners is the Partner Programme constituting a platform for presentation of industrial companies, increased cooperation with research teams and thesis projects.

Close cooperation of many years has been maintained with the Institute of Instrument Technology of Czech Academy of Sciences in Brno in research projects of joint interest. Members of the Institute's staff are part-time teachers at FEEC, in Master and Ph.D. programmes. On the basis of an agreement between FEEC and Academy of Sciences education is provided to Ph.D. students in Academy's institutes. Academic staff, mainly departments of mathematics and physics have cultivated long-term cooperation with secondary schools in the Brno region in preparing their students for studies at FEEC.

Table 9: Universities having Erasmus programme agreements with FEEC for academic year 2011/12

University	Country
Katholieke Hogeschool Limburg	Belgium
Технически университет-София	Bulgaria
Технически университет-София – Пловдив	Bulgaria
Aalborg Universitet	Denmark

Danmarks Tekniske Universitet Lyngby	Denmark
University of Eastern Finland	Finland
Tampereen teknillinen yliopisto	Finland
Aalto University	Finland
EPITA Paris	France
Groupe ESIEE Paris	France
Institut Catholique de Paris	France
Institut Polytechnique de Grenoble	France
Université Joseph Fourier – Polytechnique de l´Université Grenoble	France
ESIGELEC Rouen	France
Sekonda Universitá degli Studi di Napoli	Italy
Vilniaus Gedimino Technikos Universitetas	Lithuania
Hochschule Furtwangen – Furtwangen University of Applied Science	Germany
Hochschule Pforzheim – University of Applied Sciences Pforzheim	Germany
Fachhochschule Wiesbaden	Germany
Friedrich-Alexander-Universitat Erlangen	Germany
Hochschule für Technik, Wirtschaft und Kultur Leipzig	Germany
Technische Universität Dresden	Germany
Duale Hochschule Baden-Württemberg Lörrach	Germany
Universitat I Bergen	Norway
Politechnika Wroclawska	Poland
Universidade Católica Portuguesa – Escole Superior de Biotecnologia	Portugal
Instituto Politécnico de Lisboa – ISEL	Portugal
Instituto Politécnico do Porto	Portugal
Universidade do Porto	Portugal
Fachhochschule Oberösterreich	Austria
Technische Universität Wien	Austria
Universität für Gesundheitswissenschaften, Medizinische Informatik und Technik	Austria

TEI Κρήτης - Παράρτημα Χανίων	Greece
Žilinská univerzita, Elektrotechnická fakulta	Slovakia
Žilinská univerzita, Fakulta prírodných vied	Slovakia
Technická univerzita v Košiciach, Fakulta elektrotechniky a informatiky	Slovakia
Universidad de Cantabria	Spain
Universidad de Malaga	Spain
Modragon Unibertsitatea	Spain
Universitat Politécnica de Catalunya	Spain
Universidad Politécnica de Valencia	Spain
Universitat de Valéncia	Spain
Universidad de Zaragoza	Spain
Universitat Rovira i Virgili Tarragona	Spain
Högskolan I Halmstad	Sweden
Malmö högskola	Sweden
T.C. Dogus Universitesi	Turkey
Namik Kemal University	Turkey
Yeditepe University	Turkey
Zonguldak Karaelmas University	Turkey
Karadeniz Technical University	Turkey
T.C. Ankara Üniversitesi	Turkey
Bogazici University	Turkey
University of Huddersfield	Great Britan

Academic Senate

In 2011 elections were held on 10 to 12 October. Until elections the members of Academic Senate were (membership in legislative committee - LK, pedagogical committee - PK, economic committee - EK, and represented department):

Chair

Doc. Ing. Miloslav Steinbauer, Ph.D., LK, UTEE

Academic Staff Chamber

Doc. Ing. Jiří Kozumplík, CSc., EK, UBMI Chair
Doc. Ing. Petr Baxant, Ph.D., EK, UEEN
RNDr. Petr Fuchs, Ph.D., EK, UMAT
Ing. Ivana Jakubová, LK, UREL
Doc. Ing. Jiří Mišurec, CSc., EK, UTKO
PhDr. Ludmila Neuwirthová, Ph.D., PK, UJAZ
Ing. Radovan Novotný, Ph.D., LK, EK, UMEL
Ing. Helena Polsterová, CSc., PK, UETE
Doc. Ing. Miloslav Steinbauer, Ph.D., LK, UTEE
RNDr. Naděžda Uhdeová, Ph.D., EK, LK, UFYZ
Doc. Ing. Pavel Vorel, Ph.D., PK, UVEE

Student Chamber

Bc. Tomáš Szöllősi, PK, chair
Bc. Petr Bílek, LK, PK
Ing. Jan Dolenský, EK
Bc. Lubomír Friml, LK, PK
Bc. Pavel Hronek, LK, PK, EK
Ing. Marián Klampár, PK, EK
Lucia Spišiaková, LK

Academic Senate after elections, 25 October 2011:

Chair

Doc. Ing. Miloslav Steinbauer, Ph.D., EK, LK, UTEE

Academic Staff Chamber

Ing. Ivana Jakubová, EK, LK, UREL Chair
Doc. Ing. Petr Baxant, Ph.D., EK, UEEN
RNDr. Petr Fuchs, Ph.D., EK, UMAT
Ing Petr Honzík, EK, UAMT
Doc. Ing. Jiří Mišurec, CSc., EK, UTKO
PhDr. Ludmila Neuwirthová, Ph.D., PK, UJAZ
Ing. Radovan Novotný, Ph.D., EK, LK, UMEL
Ing. Helena Polsterová, CSc., EK, PK, UETE

Doc. Ing. Miloslav Steinbauer, Ph.D., EK, LK, UTEE
RNDr. Naděžda Uhdeová, Ph.D., EK, LK, UFYZ
Ing. Martin Vítek, EK, UBMI
Doc. Ing. Pavel Vorel, Ph.D., EK, PK, UVEE

Student Chamber

Bc. Lubomír Friml, EK, chair
Petr Jarchovský, PK
Tomáš Mejzlík, PK
Zuzana Moldříková, PK

Lucia Spišiaková, LK, PK
Bc. Tomáš Szöllősi, PK
Ing. Martin Zukal, EK

Academic Senate held 8 regular meetings, with an average attendance of 88.3%, Academic Senate dealt with legislative, economic and pedagogical issues. There was one irregular meeting dealing with FEEC budget for 2011. Discussions were always constructive, proposals were sent to members prior to the meeting for study and comments, using the central electronic storage system also used for archiving of documents.

Elections in Academic Senate took place on 10-12 October 2011. The voting was electronic in the BUT information system, the turnout was 11.96%.

Academic Senate discussed novels of internal guidelines and standards. Updating of the Longterm Intent of FEEC BUT for 2011-2015 for 2012 was dealt with. The economic issues discussed and approved included economic report for 2010, proposal for the distribution of financial means in 2011 and proposal on the distribution of funds earned by teaching.

The budget for 2011 was approved at an irregular meeting on 23 May 2011 and preliminary discussions were held on the distribution of financial means for 2012. The new rules completely change the system of covering faculty expenditure by departments in accordance with distribution criteria while all funding from projects will be transferred to departments which won the projects. The economic committee met twice to deal with the new rules and the budget. The new rules were approved at the September meeting.

The pedagogical committee discussed the proposal of vice-deans for study programmes on second resit examination terms.The proposal was incorporated in the Dean´s guideline amending The BUT Study and Examination Regulations and approved. The committee organized a pedagogical workshop for teachers of basic subjects from departments of mathematics, physics, theoretical and experimental electrical engineering and control, measurement and instrumentation on 27 January 2011. The workshop was focused on exchange of experience in teaching basic subjects, their interconnection and examining.

I.Jakubová was elected FEEC delegate in Higher Education Council for the period 2012 – 2014.

Campus Development

Construction of the new campus premises at Technická 12 continued in 2011. During the year the whole complex was built, including warming up and finish of facade.

The last steps connected with moving of faculty departments taken in 2011 were finalization of preparations, selection of supplier, and at the end of the year commencement of construction of the new FEEC building of the project Professor List Science and Technology Park. In terms of location this building is a free continuation of the northern part of Technická 12. Construction of this complex is scheduled for 10 to 12 months with completion at the end of 2012.

Computer Networks and Information Systems

Priority was given to:

- upgrading of servers and adaptation of facilities

- centralization of network administration services at Technická

- network backup

- restructuring, innovation and administration of two-language faculty websites

- full use of modern communication channels, start of faculty profile on social network Facebook

Information Systems and Services

The economic system SAP and the central information system Apollo are in operation. Negotiations and analyses of the Apollo system modules and setting the faculty information system in operation are in progress. The process was underway for the whole year of 2011 and continues in 2012.

Other

Equal Opportunities

The 'Consultancy and Information Gender Studies Centre' continued its activities in 2011.

The Centre provided professional and personal consultancy, under the management of Department of Physics, to female students, and organized information events for the public aimed at removing the barriers female students face when choosing careers in technical fields.

The centre concentrated on integration of handicapped students in full-time and part-time study programmes, promotion of study opportunities and their specific needs in terms of financial and other support.

The Centre cooperated with the Department of Physics, the club Students for Students and members of other departments.

Contact: uhdeova@feec.vutbr.cz

Institute of Experimental Technology

Institute of Experimental Technology centres its activities on innovation of education methods and quality of training of professionals for the industrial sector.

The Institute dealt with two projects in 2011 - Institute of Experimental Technology 1 (IET1) within the framework of a global project of South Moravian Region OP VK and Institute of Experimental Technology 2 (IET2), an individual project in category other, OP VK.

The project IET1 is targeted at increasing the interest of secondary school students in electrical engineering and improving conditions for teaching electrical engineering and physics, including exploitation of ICT in tuition. The goal of the project IET2 is creating a human resources system for training and profile of recruited employees.

Management:

Director
Doc. Ing. Pavel Fiala, Ph.D.
Coordinator IET1
Doc. Ing. Pavel Kaláb, CSc.
Coordinator IET2
Doc. Ing. Pavel Fiala, Ph.D.
Staff:
representatives of industrial partners
IET1 (Siemens s.r.o) and IET2 (SVS
FEM s.r.o., Prototypa a.s., ABB s.r.o.,
Eaton Moeller s.r.o.)

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Student Activities

Active at FEEC are two student organizations: Student Chamber of Academic Senate (SK AS) and the voluntary club Students for Students (SPS).

The Student Chamber is part of the Academic Senate of FEEC and has seven voted members. The Student Chamber acts as an intermediary between faculty management and students, contributes to exchange of information covering the whole spectrum of study and faculty life, solutions of students´ problems and instruction quality assessment by students. Activities of the club Students for Students are focused on leisure time. Its role is to enrich student life. The club issues the student magazine e-fekt (1500 copies every other month), publishes the First-year Student Handbook and organizes cultural, sports and entertainment events. The

membership is voluntary, every student can apply, not only FEEC students, but also all those interested in student activities at FEEC and BUT. In 2011 students co-organized the ball of FEEC and FIT. They also co-organized the EEICT 2011 Student Conference and helped with FEEC presentation at the trade fair GAUDEAMUS 2011 and Roadshow, visits to secondary schools. On 28 September 2011 the club organized the 4th festival of amateur groups Music from FEEC. The band Side Effect was the winner. The festival was attended by 2000 fans. Sport-loving students took part in the 4th year of the race Run to 53. The task was to run the distance from Kolejní 4 to the nearby no 53 bus stop. There were 40 runners and faculty management in categories men, women, relays and VIP relays. There were about 100 viewers. The project perFEKT assistance was prepared for first-year Bachelor students to help them cope with study affairs and getting round the city of Brno.

In February the 6th anniversary of the club was celebrated. Various events were organized for students, such as Startparty, BTBIO party, Trail of courage, Waste Harvest, sale of books,etc.

Department of Control, Instrumentation and Measurement

Doc. Ing. Václav Jirsík, CSc.

Head

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Professors

Prof. Ing. Pavel Jura, CSc.
Prof. Ing. Petr Pivoňka, CSc.
Prof. Ing. František Šolc, CSc.
Prof. Ing. Petr Vavřín, DrSc.
Prof. Ing. František Zezulka, CSc.

Associate Professors

Doc. Ing. Ludvík Bejček, CSc.
Doc. Ing. Petr Beneš, Ph.D.
Doc. Ing. Petr Blaha, Ph.D.
Doc. Ing. Zdeněk Bradáč, Ph.D.
Doc. Ing. Petr Fiedler, Ph.D.,
Doc. Ing. Václav Jirsík, CSc.
Doc. Ing. Pavel Václavek, Ph.D.
Doc. Ing. Luděk Žalud, Ph.D.

Lecturers

Ing. Miloslav Čejka, CSc., Ing. Marie Havlíková, Ph.D., Ing. Zdeněk Havránek, Ph.D., Ing. Radovan Holek, CSc., Ing. Petr Honzík, Ph.D., Ing. Stanislav Klusáček, Ing. Tomáš Macho, Ph.D., Ing. Jan Pásek, CSc., Ing. Miloslav Richter, Ph.D., Ing. Soňa Šedivá, Ph.D., Ing. Radek Štohl, Ph.D.

PhD.Students

Ing. Tomáš Babinec, Mgr. Radek Baránek, Ing. František Burian, Ing. Vladimír Burlak, Ing. Luděk Červinka, Ing. Pavel Číp, Ing. Michal Dobias, Ing. Jakub Dokoupil, Ing. Martin Dvořáček, Ing. Jiří Fialka, Ing. Tomáš Florián, Ing. František Gogol, Ing. Daniel Haupt, Ing. Tomáš Hynčica, Ing. Tomáš Jílek, Ing. Miroslav Juhas, Ing. Václav Kaczmarczyk, Ing. Vlastimil Kříž, Ing. Michal Kupčík, Ing. Marek Kváš, Ing. Petr Malounek, Ing. Karel Pavlata, Ing. Stanislav Pikula, Ing. Daniel Píši, Ing. Jan Pohl, Ing. Lukáš Pohl, Ing. Petr Polách, Ing. Peter Rášo, Ing. David Skula, Ing. Jaroslav Šembera, Ing. Michal Šír, Mgr. Martin Tůma, Ing. Miroslav Uher, Ing. Martin Vágner, Ing. Ivo Veselý, Ing. Libor Veselý, Ing. Miroslav Vomela, Ing. Dušan Zámečník, Ing. Pavel Zbranek, Ing. Jan Beran, Ing. Miloš Čábel, Ing. Jolana Dvorská, Ing. Leoš Dvořák, Ing. Petr Hliněný, Ing. Ondřej Hynčica, Ing. Luděk Chomát, Ing. Petr Kacz, Ing. Zdeněk Kaňa, Ing. Stanislav Klusáček, Ing. Martin Kopecký, Ing. Tomáš Kopecký, Ing. Miroslav Krupa, Ing. Vlastimil Lorenc, Ing. Vojtěch Mikšánek, Ing. Vojtěch Němec, Ing. Petr Nepevný, Ing. Věra Nováková Zachovalová, Ing. Petr Petyovský, Ing. Václav Sáblík, Ing. Michal Schmidt, Ing. Pavel Střítecký, Ing. Václav Veleba, Ing. Miloš Veselý.

Administrative and Technical Staff

Ing. Luděk Anděra, Ing. František Burian, Ing. Petr Fidler, Ing. Daniel Haupt, Ing. Ondřej Hynčica, Ing. Marek Kváš, Ing. Karel Pavlata, Lenka Petrová, Ing. Petr Petyovský, Mgr. Martin Tůma, Jan Vodička.

Centre of Applied Cybernetics

Ing. Luděk Anděra, Ing. Tomáš Babinec, doc. Ing. Petr Blaha, Ph.D., Ing. František Burian, Ing. Pavel Číp, Ing. Tomáš Florián, Bc. Miroslav Graf, Ing. Peter Honec, Ph.D., Ing. Karel Horák, Ph.D., Ing. Ondřej Hynčica, Ing. Ilona Kalová, Ph.D., Ing. Lukáš Kopečný, Ph.D., Ing. Pavel Kučera, Ph.D., Lenka Petrová, Ing. Lukáš Pohl, Ing. Jaroslav Šembera, Ing. Soběslav Valach, Ing. Libor Veselý, Ing. Pavel Zbranek, doc. Ing. Luděk Žalud, Ph.D.

Main Interests

The department provides tuition in the Bachelor degree programme Automation and Measurement Technology and the follow-up Master degree programme Cybernetics, Automation and Measurement. Tuition and research are conducted by five specialized groups.

The group involved in industrial automation concentrates on real-time embedded systems, wireless communication systems and industrial Ethernet with focus on operational safety and protection against internal errors, faults and attacks. Furthermore the group concentrates on fault-tolerant systems and research of decentralized and distributed control and communication systems. Research is particularly centred on building management, safety and authorization systems. The group closely cooperates with BD Sensors, Beta Control, Siemens, Škoda Auto, Rockwell Automation and other companies.

The group dealing with computer vision concentrates on applied research and cooperates with industrial and commercial companies and higher education institutions. Academics are involved in research projects and provide instruction in image processing and analysis, object recognition, modelling and reconstruction of 3D objects and specialized hardware design for real-time processing of extensive data files.

There were also projects centred on innovation of instruction (the European project 'Multimedia Interactive Didactic System' and equipment upgrading (FRVŚ grants).

The group involved in automatic control completed theoretical derivation of the recursive and batch type of optimal quadratic estimator dealing with a generally predetermined inconsistent system of linear equations. In order to secure numerical stability the Potter root filtering was included as well as techniques of sliding data horizon and variable regularization. A new form of the method of parametric updating was designed arising from exact recursification of the nonlinear Gauss-Newton method, significantly enhancing convergence characteristics as compared with the conventional solutions of pseudolinear problems.

The group continued cooperation with the company Freescale Semiconductor in design of robust and predictive algorithms for alternating electrical drives control.

The group of measurement technology focused on electrical and electronic measurements, virtual instruments in the LabView environment, sensors of non-electrical characteristics, measurements and evaluation of non-electrical characteristics with focus on vibrodiagnostics, thermodiagnostics, acoustic emission, flux and noise measurement.

The group of artificial intelligence and robotics was involved in research of service mobile robots. Research is mainly concerned with telepresence control of mobile robots in difficult terrain, self-localization in outer environment, in urban areas and inside buildings, design of highly reliable robotic systems for work under extreme conditions and automatic map-making. A heterogeneous robotic system for cooperative reconnaissance of unknown environment is being developed. Instruction covers introduction into stationary and mobile robotics and sections dealing with above mentioned research issues.

Major Achievements

Among outstanding achievements of the computer vision group are commercial products - a highly appraised international patent and several prototypes and verified technologies. The achieved results are closely associated with the completed project 'Applied Cybernetics Centre' to which the group contributed by nearly a thousand evaluated research results, the most important of them being a unique visual driving assistance system whose development produced numerous research products and publications

The group of automatic control continued work on the project 'Centre for Advanced Control and Sensoric Technology Research' focused on training of research workers. The organized seminars and courses have been increasingly attended by trainees from all parts of the country. Young researchers presented a paper on nonlinear predictive control at the DAAAM International Symposium and were awarded the Festo Prize for Young Researchers and Scientists.

The group of measurement technology involved in projects of the Operational Programme VaVPI invested in upgrading of research laboratories for measurement of noise, vibrations and temperature. A new course was launched on analog processing of sensor signals.

The group of artificial intelligence and robotics continued work on the visual telepresence system with high resolution and possibility to combine data from CCD sensors and termovision camera. The group presented their research results at several exhibitions and events such as IDET 2011, MSV 2011 and Gaudeamus 2011. The prototype of the reconnaissance robot Scorpio with caterpillar undercarriage for work in inaccessible or dangerous terrain was developed.

The group of industrial automation was involved in several significant projects. They worked on the AAA portal KAAPS, implementation of authentication server and demonstrator design. A methodology for testing parameters of wireless communication systems for use in vehicles in city traffic was developed as well as an application of database server and mobile client for monitoring of lifts. In cooperation with other research groups the laboratory of sensoric and control systems for robotics was equipped.

Major Research Projects

Intelligent Systems in Automation – MŠMT Research Plan MSM0021630529

Investigator: Pavel Jura

Research Centre of Advanced Control and Sensoric Technologies – MŠMT CZ.1.07/2.3.00/09.0031

Investigator: Pavel Václavek

MotorBrain - Nanoelectronics for Electric Vehicle Intelligent Failsafe PowerTrain -

ENIAC 2010-1 270693

Investigator: Pavel Václavek

Road Traffic Safety – GAČR 102/09/1897

Investigator: Petr Honzík

Complex and Intelligent Management of Apartments Buildings – MPO FR-TI1/528

Investigator: Zdeněk Bradáč

Selected Publications

DOKOUPIL, J.; PIVOŇKA, P. Adaptive Nonlinear Model Predictive Control Based on Wiener Model. *DAAAM International Scientific Book.* 2011. 10(11). p. 417 - 424. ISSN 1726-9687.

BURLAK, V.; PIVOŇKA, P. Nonlinear identification based on RBF neural network. *DAAAM International Scientific Book.* 2011. 10(11). p. 547 - 554. ISSN 1726-9687.

Bachelor Degree Programme

Číslicová řídicí technika (prof. Ing. Petr Pivoňka, CSc.)

Databázové systémy (Ing. Radovan Holek, CSc.)

Elektronické měřicí systémy (Ing. Miloslav Čejka, CSc.)

Měření fyzikálních veličin (doc. Ing. Petr Beneš, Ph.D.)

Měření v elektrotechnice (Ing. Miloslav Čejka, CSc.)

Mikroprocesory (Ing. Tomáš Macho, Ph.D.)

Modelování a simulace (doc. Ing. Pavel Václavek, Ph.D.)

Moderní prostředky v automatizaci (doc. Ing. Václav Jirsík, CSc.)

Použití PC v měřicí technice (Ing. Miloslav Čejka, CSc.)

Praktické programování v C++ (Ing. Miloslav Richter, Ph.D.)

Programovatelné automaty (Ing. Radek Štohl, Ph.D.)

Prostředky průmyslové automatizace (Ing. Radek Štohl, Ph.D.)

Řízení a regulace 1 (prof. Ing. Petr Vavřín, DrSc.)

Řízení a regulace 2 (doc. Ing. Pavel Václavek, Ph.D.)

Signály a systémy (prof. Ing. Pavel Jura, CSc.)

Subsystémy PC (Ing. Karel Horák, Ph.D.)

Výpočetní technika v automatizaci (prof. Ing. Petr Pivoňka, CSc.)

Základy robotiky (doc. Ing. Luděk Žalud, Ph.D.)

Zpracován a digitalizace analogových signálů (Ing. Zdeněk Havránek, Ph.D.)

Zpracování vícerozměrných signálů (Ing. Karel Horák, Ph.D.)

Master Degree Programme

Aplikace počítačového vidění (Ing. Ilona Kalová, Ph.D.)

Automatizace procesů (prof. Ing. František Zezulka, CSc.)

Distribuované systémy a sítě (doc. Ing. Petr Fiedler, Ph.D.)

Elektronická měřicí technika (Ing. Miloslav Čejka, CSc.)

Embedded systems for industrial control (doc. Ing. Petr Fiedler, Ph.D.)

Fuzzy systémy (prof. Ing. Pavel Jura, CSc.)

Inteligentní a polovodičové snímače (doc. Ing. Petr Beneš, Ph.D.)

Inteligentní regulátory (prof. Ing. Petr Pivoňka, CSc.)

Logické systémy (Ing. Radovan Holek, CSc.)

Měření neelektrických veličin (doc. Ing. Ludvík Bejček, CSc.)

Modelování a identifikace (doc. Ing. Petr Blaha, Ph.D.)

Operační systémy a sítě (Ing. Tomáš Macho, Ph.D.)

Operační systémy reálného času (Ing. Pavel Kučera, Ph.D.)

Optimalizace regulátorů (prof. Ing. Petr Pivoňka, CSc.)

Optoelektronické snímače (doc. Ing. Ludvík Bejček, CSc.)

Počítače pro řízení (doc. Ing. Zdeněk Bradáč, Ph.D.)

Počítačové vidění (Ing. Karel Horák, Ph.D.)

Robotika (doc. Ing. Luděk Žalud, Ph.D.)

Robustní a algebraické řízení (doc. Ing. Petr Blaha, Ph.D.)

Sběr, analýza a zpracování dat (Ing. Marie Havlíková, Ph.D.)

Senzory neelektrických veličin (doc. Ing. Ludvík Bejček, CSc.)

Strojové učení (Ing. Petr Honzík, Ph.D.)

Systémy diskrétních událostí (doc. Ing. Pavel Václavek, Ph.D.)

Teorie dynamických systémů (prof. Ing. Petr Vavřín, DrSc.)

Umělá inteligence (doc. Ing. Václav Jirsík, CSc.)

Doctoral Degree Programme

Vybrané kapitoly měřicí techniky (doc. Ing. Ludvík Bejček, CSc.)

Vybrané kapitoly řídicí techniky (prof. Ing. Petr Pivoňka, CSc.)

Laboratories

Laboratory of Automatic Control (instruction in automatic control, physical models of controlled processes, Pavel Václavek)

Laboratory of Electrical Measurement (second-year study areas B-AMT, B-MET, B-SEE and part-time second-year study areas BK-AMT, BK-SEE, Miloslav Čejka, Marie Havlíková)

Laboratory of Electronic Measurement (instruction in Measurement in Electrical Engineering for first-year study areas M-AMT, M-EST, Miloslav Čejka)

Laboratory of Intelligent Controllers (instruction in control algorithms, physical models, design and verification of control algorithms on principles of artificial intelligence, Petr Pivoňka)

Laboratory for Measurement of Non-Electrical Characteristics (instruction in Measurement of Non-Electrical Characteristics and Sensors of Non-Electrical Characteristics, Petr Beneš)

Laboratory of Pressure and Flux Measurement (pressure and flux measurements – air track, workplace for Ph.D. students, Ludvík Bejček)

Laboratory of Temperature Measurement (infratechnology and contactless temperature measurement, Ludvík Bejček)

Laboratory of Modern Methods (control systems Siemens – Schneider – Modicon, research and instruction in computer control of physical models, instruction and development of software for control by programmable automatics – PLC, instruction and development of communication via Profibus and Profinet, Petr Fiedler)

Laboratory of Optoelectronics (optical fibre sensors and methods of optical measurement of non-electrical characteristics, Ludvík Bejček)

Laboratory of Computer Vision (instruction, research and development of devices for image recording and methods of image processing and analysis for recognition and modelling of objects, Karel Horák)

Laboratory of Process Automation (CAK laboratory, research and development of communication technology for industrial applications including wireless communication technology, research of Real-Time control systems and Fault-Tolerant systems, František Zezulka)

Laboratory of Programmable Automatics (control systems Rockwell, instruction and development of software for PLC of Rockwell, instruction and development of communication via DeviceNet and Ethernet IP, Radek Štohl)

Laboratory of Robotics (research and development of non-conventional drives and robotic soccer, Lukáš Kopečný, Jakub Hrabec)

Laboratory of Drives Control (research of intelligent algorithms for control of electric drives, Pavel Václavek)

Laboratory of PC subsystems (instruction, research and development of advanced peripheral devices and elements based on FPGA/DSP for real-time processing of large volumes of data, Soběslav Valach)

Laboratory of Telepresence (research and development of autonomous and remote control robots, Luděk Žalud)

Laboratory of Embedded Systems (instruction in embedded control systems and real-time operation systems, Zdeněk Bradáč)

Laboratory of Vibrodiagnostics (acoustic emission sensors and measurement, calibration, laser vibrodiagnostics, Petr Beneš)

Department of Biomedical Engineering

Prof. Ing. Ivo Provazník, Ph.D.
Head

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Professors
Prof. Ing. Jiří Jan, CSc.
Prof. Ing. Ivo Provazník, Ph.D.

Associate Professors
Doc. Ing. Aleš Drastich, CSc.
Doc. Ing. Milan Chmelař, CSc.
Doc. Ing. Radim Kolář, Ph.D.
Doc. Ing. Jana Kolářová, Ph.D.
Doc. Ing. Jiří Kozumplík, CSc.
Doc. Ing. Jiří Rozman, CSc.

Lecturers
RNDr. Mgr. Michal Bittner, Ph.D., Ing. Vratislav Čmiel, Ing. Petr Fedra, Ing. Karel Jehlička, CSc., Ing. Radovan Jiřík, Ph.D., Ing. Vratislav Harabiš, Ing. Jiří Sekora, Ing. Martin Vítek, Ph.D.

Ph.D. Students
Ing. Layal Abo Khayal, Ing. Jaroslav Balogh, Ing. Michal Bartoš, Ing. Miloš Bělehrad, Ing. Karel Bubník, Ing. Jan Bukartyk, Ing. Petr Čech, Ing. Vratislav Čmiel, Ing. Jiří Dlouhý, Ing. Alena Drkošová, Ing. Jiří Gazárek, Ing. Vratislav Harabiš, Ing. Martin Havlíček, Ing. Jan Hrubeš, Ing. Jiří Janeček, Ing. Oto Janoušek, Ing. Martin Klimek, Ing. Jiří Kratochvíla, Ing. Vladimíra Kubicová, Ing. Zdeněk Kuna, Ing. Martin Lamoš, Mgr. Peter Langer, Ing. Pavel Leinveber, Ing. Ondřej Macíček, Ing. Denisa Maděránková, Ing. Miloš Malínský, Ing. Martin Mézl, Ing. Jan Odstrčilík, Ing. Pawan Kumar Pathak, Ing. Roman Peter, Ing. Petra Podlipná, Ing. Jiří Roleček, Ing. Marina Ronzhina, Ing. Milan Rychtárik, Ing. Jiří Sekora, Ing. Abduljalil Sireis, Ing. Vladimír Slávik, Ing. Lukáš Smital, Ing. Helena Škutková, Ing. Martin Valla, Ing. Petr Veselý, Ing. Petr Walek

Administrative and Technical Staff
Bc. Jan Fousek, Mgr. Dušan Hemzal, Ph.D., Miroslava Prášilová, Hana Rýznarová

Main Interests
The department provides tuition in processing of signals and images, ecology, biomedical and ecological engineering and bioinformatics in Bachelor and Master programmes. A number of bioinformatics subjects emerged in connection with recent accreditation of new study programmes in bioinformatics.

The department is involved in basic and applied research of engineering principles in medicine, biology, physiology, electrochemistry, botanics genetics, molecular biology and ecology. The main areas of interest are digital processing and analysis of especially cardiological signals and images, digital processing and analysis of ophtalmological and ultrasonographic data using

contrasting substances, phylogenetic, evolution and similarity analysis of genomic and proteomic data, mainly metallothionein protein and mitochondrial DNA.

The department closely cooperates with the Opthalmological Clinic of Friedrich-Alexander-University Erlangen, Forschungs-Zentrum Karlsruhe, University of Bergen, company Philips Česká republika, BLOCK, a.s., MIKRO s.r.o., Knitting Technology Research Institute a.s., Medical Faculty, Masaryk University in Brno, Mendel University in Brno, University Hospital U sv. Anny Brno, Faculty Hospital Bohunice, Brno.

The department is involved in research projects (modelling the origin and analysis of cardiological electrical signals, including development of apparatus for simultaneous optical and electrical recording of heart activity, research of nano-electro-biological tools for biochemical and molecular-biological study of eukaryotic cells, analysis of EEG and NMR imaging data in patients suffering from pharmacoresistant epilepsy, application of contrast MR and ultrasonography imaging techniques in medical diagnostics) in MPO TIP projects (technology of barrier-free insulators) and TAČR ALFA projects (development of artificial arteries). There was cooperation with the company Philips in the development of a system for automated CT subtraction angiography of lower limbs.

Major Achievements

In 2011 members of the department published a lot of articles in scientific journals and presented papers at international conferences, with favourable response within the scientific community. An article was published in the journal Sleep Medicine Reviews with IF 6,338 and a coauthored article in Proceedings of The National Academy of Sciences of The USA with IF 9,771. Members of the department were awarded a European patent in ultrasound tomography, 2 national industrial samples were registered, authorized sotware and operating samples were created, and 2 national patent applications were submitted.

Another outstanding achievement is participation in a project of ICRC (International Clinical Research Center Brno) in section Biomedical Engineering supported by the Operational Programme Research and Development for Innovations. The participating teams are Experimental electrophysiology (Ivo Provazník), Rehabilitation techniques (Jana Kolářová) and Ultrasonic imaging (Radim Kolář) including Ph.D. students.

In 2011 tuition started in the 2nd year of the newly accredited follow-up Master programme Biomedical Engineering and Bioinformatics whereby introduction of the pregradual interdisciplinary programme was completed. The Bachelor and the Master programme were accredited by the Ministry of Education for training of specialists in biomedical engineering in compliance with the law on non-medical healthcare.

The department has prepared accreditation materials for the follow-up Ph.D. programme Biomedical Technology and Bioinformatics approved at Brno University of Technology.

Major Research Projects

Nano-Electro-Bio-Tools for Biochemical and Molecular-Biological Studies of Eukaryotic Cells (NanoBioTECell) – GAČR P102/11/1068

Investigator: Ivo Provazník

Optical Methods of Recording Electrical Potentials and Calcium Concentrations in the Heart by Laser Stabilization – GAČR 102/07/1473

Investigator: Ivo Provazník

Optimization of the Methodology of Analysis and Evaluation of Simultaneous EEG-fMRI in Patients Suffering from Pharmacoresistant Epilepsy– GAČR P304/11/1318

Co-investigator: Jiří Jan

Technology for Transplantology – MPO FR-TI2/596

Investigator: Ivo Provazník

Increasing the Potential of MR and Ultrasonography Contrast Imaging Techniques of Magnetic Resonance and Ultrasonography in Medical Diagnostics – GAČR 102/09/1690

Investigator: Radovan Jiřík

Selected Publications

ZÍTKA, O.; ŠKUTKOVÁ, H.; ADAM, V.; TRNKOVÁ, L.; BABULA, P.; HUBÁLEK, J.; PROVAZNÍK, I.; KIZEK, R. A New Approach how to Define the Coefficient of Electroactivity of Adenine and Its Twelve Derivatives Using Flow Injection Analysis with Amperometric Detection. *ELECTROANALYSIS.* 2011. 23(7). p. 1556 - 1567. ISSN 1040-0397. (IF(2010)=2,721).

KEUNEN, O.; JOHANSSON, M.; OUDIN, A.; SANZEY, M.; ABDULRAHIM, S.; FACK, F.; THORSEN, F.; TAXT, T.; BARTOŠ, M.; JIŘÍK, R.; MILETIC, H.; WANG, J.; STIEBER, D.; STUHR, L.; MOEN, I.; RYGH, C.; BJERKVIG, R.; NICLOU, S. Anti-VEGF treatment reduces blood supply and increases tumor cell invasion in glioblastoma. *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA.* 2011. 108(9). p. 3749 - 3754. ISSN 0027-8424. (IF(2010)=9,771).

HAVLÍČEK, M.; FRISTON, K.; JAN, J.; BRÁZDIL, M.; CALHOUN, V. Dynamic modeling of neuronal responses in fMRI using cubature Kalman filtering. *NeuroImage.* 2011. 56(4). p. 2109 - 2129. ISSN 1053-8119. (IF(2010)=5,937).

ROP, O.; SOCHOR, J.; JUŘÍKOVÁ, T.; ZÍTKA, O.; ŠKUTKOVÁ, H.; MLČEK, J.; SALAŠ, P.; KRŠKA, B.; BABULA, P.; ADAM, V.; KRAMÁŘOVÁ, D.; BEKLOVÁ, M.; PROVAZNÍK, I.; KIZEK, R. Effect of five different stages of ripening on chemical compounds in medlar (Mespilus germanica L.). *MOLECULES.* 2011. 2011(16). p. 74 - 91. ISSN 1420-3049. (IF(2010)=1,988).

BABULA, P.; ADAM, V.; HAVEL, L.; PROVAZNÍK, I.; ŠKUTKOVÁ, H.; BEKLOVÁ, M.; KIZEK, R. Effect of fluoranthene on plant cell model: Tobacco BY-2 suspension culture. *ENVIRONMENTAL AND EXPERIMENTAL BOTANY.* 2012. 2012(78). p. 117 - 130. ISSN 0098-8472. (IF(2010)=2,699).

KŘÍŽKOVÁ, S.; RYVOLOVÁ, M.; GUMULEC, J.; MASAŘÍK, M.; ADAM, V.; MAJZLÍK, P.; HUBÁLEK, J.; PROVAZNÍK, I.; KIZEK, R. Electrophoretic fingerprint metallothionein analysis as a potential prostate cancer biomarker. *Electrophoresis.* 2011. 2011(32). p. 1952 - 1961. ISSN 0173-0835. (IF(2010)=3,569).

JIŘÍK, R.; STANDARA, M.; MALÁ, A.; BARTOŠ, M.; TAXT, T.; STARČUK, Z. Flow Phantom for Validation of Absolute Quantification in Dynamic Contrast-Enhanced MRI. *MAGMA – Magnetic Resonance Materials in Physics, Biology and Medicine.* 2011. 24(0). p. 247 - 248. ISSN 0968-5243. (IF(2010)=2,373).

JAN, J.; KOLÁŘ, R.; KUBEČKA, L.; ODSTRČILÍK, J.; GAZÁREK, J. FUSION BASED ANALYSIS OF OPHTHALMOLOGIC IMAGE DATA. *Kybernetika.* 2011. 47 (2011)(3). p. 455 - 481. ISSN 0023-5954. (IF(2010)=0,461).

MAJZLÍK, P.; STRÁSKÝ, A.; ADAM, V.; NĚMEC, M.; TRNKOVÁ, L.; ZEHNÁLEK, J.; HUBÁLEK, J.; PROVAZNÍK, I.; KIZEK, R. Influence of Zinc(II) and Copper (II) Ions on Streptomyces Bacteria Revealed by Electrochemistry. *INTERNATIONAL JOURNAL OF ELECTROCHEMICAL SCIENCE* . 2011. 2011(6). p. 2171 - 2191. ISSN 1452-3981. (IF(2010)=2,808).

SOCHOR, J.; ŠKUTKOVÁ, H.; BABULA, P.; ZÍTKA, O.; CERNEI, N.; ROP, O.; KRŠKA, B.; ADAM, V.; PROVAZNÍK, I.; KIZEK, R. Mathematical evaluation of the amino acid and polyphenol content and antioxidant activities of fruits from different apricot cultivars. *MOLECULES.* 2011. 16(9). p. 7428 - 7457. ISSN 1420-3049. (IF(2010)=1,988).

TRNKOVÁ, L.; FABRIK, I.; HÚSKA, D.; ŠKUTKOVÁ, H.; BEKLOVÁ, M.; HUBÁLEK, J.; ADAM, V.; PROVAZNÍK, I.; KIZEK, R. Paramagnetic antibody-modified microparticles coupled with voltammetry as a tool for isolation and detection of metallothionen as a bioindicator of metal pollution. *JOURNAL OF ENVIRONMENTAL MONITORING.* 2011. 2011(13). p. 2763 - 2769. ISSN 1464-0325. (IF(2010)=1,81).

BARTOŠ, M.; JIŘÍK, R.; TAXT, T. Precision of DCE-MRI parameter estimates using extended distributed capillary adiabatic tissue homogeneity model. *MAGMA – Magnetic Resonance Materials in Physics, Biology and Medicine.* 2011. 24(0). p. 18 - 18. ISSN 0968-5243. (IF(2010)=2,373).

ZÍTKA, O.; ŠKUTKOVÁ, H.; KRYŠTOFOVÁ, O.; SOBROVÁ, P.; ADAM, V.; ZEHNÁLEK, J.; HAVEL, L.; BEKLOVÁ, M.; HUBÁLEK, J.; PROVAZNÍK, I.; KIZEK, R. Rapid and Ultrasensitive Method for Determination of Phytochelatin2 using High Performance Liquid Chromatography with Electrochemical Detection. *INTERNATIONAL JOURNAL OF ELECTROCHEMICAL SCIENCE* . 2011. 2011 (6)(5). p. 1367 - 1381. ISSN 1452-3981. (IF(2010)=2,808).

RONZHINA, M.; JANOUŠEK, O.; KOLÁŘOVÁ, J.; NOVÁKOVÁ, M.; HONZÍK, P.; PROVAZNÍK, I. Sleep Scoring using Artificial Neural Networks. *SLEEP MEDICINE REVIEWS.* 2011. 2011(1). p. 1 - 13. ISSN 1087-0792. (IF(2010)=6,338).

MACEDO, P. G.; BRUGADA, J.; LEINVEBER, P.; BENITO, B.; MOLINA, I.; SERT-KUNIYOSHI, F.; ADACHI, T.; BUKARTYK, J.; VAN DER WALT, Ch.; KONEČNÝ, T.; MAHARAJ, S.; KÁRA, T.; MONTSERRAT, J.; SOMERS, V. K. Sleep-disordered breathing in patients with the Brugada syndrome. *AMERICAN JOURNAL OF CARDIOLOGY.* 2011. 107(5). p. 709 - 713. ISSN 0002-9149. (IF(2010)=3,681).

JIŘÍK, R.; PETERLÍK, I.; RUITER, N.; FOUSEK, J.; DAPP, R.; ZAPF, M.; JAN, J. Sound-Speed Image Reconstruction in Sparse-Aperture 3D Ultrasound Transmission Tomography. *IEEE Transactions on Ultrasonocs, Ferroelectrics, and Frequency Control.* 2011. 2012(1). p. 1 - 11. ISSN 0885-3010. (IF(2010)=1,462).

FILIPÍK, A.; JAN, J.; PETERLÍK, I. Time-of-Flight Based Calibration of an Ultrasonic Computed Tomography System. *Radioengineering.* 2011. 2012(1). p. 1 - 12. ISSN 1210-2512. (IF(2010)=0,503).

Bachelor Degree Programme

Algoritmizace a programování (doc. Ing. Jana Kolářová, Ph.D.)

Analýza biologických signálů (doc. Ing. Jiří Kozumplík, CSc.)

Bioelektrické jevy (doc. RNDr. Ing. Jiří Šimurda, CSc.)

Biochemie (prof. RNDr. Eva Táborská, CSc.)

Bioinformatika (prof. Ing. Ivo Provazník, Ph.D.)

Biostatistika (doc. RNDr. Ladislav Dušek, Ph.D.)

Číslicové zpracování a analýza signálů (prof. Ing. Jiří Jan, CSc.)

Číslicové zpracování signálů a obrazů (prof. Ing. Jiří Jan, CSc.)

Ekologie v elektrotechnice (doc. Ing. Jiří Rozman, CSc.)

Ekologie ve zdravotnictví (doc. Ing. Jiří Rozman, CSc.)

Lékařská diagnostická technika (doc. Ing. Radim Kolář, Ph.D.)

Modely v biologii a epidemiologii (Ing. Martin Vítek, Ph.D.)

Multimediální data v biomedicíně (prof. Ing. Jiří Jan, CSc.)

Obecná biofyzika (prof. MUDr. Vojtěch Mornstein, CSc.)

Patologická fyziologie (prof. MUDr. Anna Vašků, CSc.)

Počítače a programování 1 (prof. Ing. Ivo Provazník, Ph.D.)

Praktika z bioinformatiky (doc. Ing. Jana Kolářová, Ph.D.)

Praktika z biomedicínské a klinické techniky (doc. Ing. Milan Chmelař, CSc.)

Radiologie a nukleární medicína (prof. MUDr. Vlastmil Válek, CSc.)

Standardizace ve zdravotnictví (doc. Ing. Milan Chmelař, CSc.)

Terapeutická a protetická technika (doc. Ing. Jana Kolářová, Ph.D.)

Umělá inteligence v medicíně (doc. Ing. Jiří Kozumplík, CSc.)

Úvod do biologie člověka (prof. MUDr. Jindřich Vomela, CSc.)

Úvod do klinické medicíny (doc. MUDr. Miroslav Souček, CSc.)

Úvod do medicínské informatiky (prof. Ing. Ivo Provazník, Ph.D.)

Úvod do molekulární biologie a genetiky (doc. Ing. Petr Dvořák, CSc.)

Základy anatomie a histologie (doc. MUDr. Pavel Matonoha, CSc.)

Základy první pomoci (MUDr. Lukáš Dadák)

Zdravotnická etika (Mgr. Josef Kuře, Dr. phil.)

Zdravotnická legislativa a právo (doc. Ing. Jiří Rozman, CSc.)

Zobrazovací systémy v lékařství (doc. Ing. Aleš Drastich, CSc.)

Master Degree Programme

Analýza a interpretace biologických dat (doc. Ing. Jiří Kozumplík, CSc.)

Analýza biologických sekvencí (prof. Ing. Ivo Provazník, Ph.D.)

Analýza biomedicínských obrazů (prof. Ing. Jiří Jan, CSc.)

Analýza signálů a obrazů (prof. Ing. Jiří Jan, CSc.)

Bioetika (Ing. Iva Pipalová)

Biofyzika (doc. RNDr. Ing. Jiří Šimurda, CSc.)

Biologie člověka (prof. MUDr. Jindřich Vomela, CSc.)

Diagnostika bio- a ekosystémů (doc. Ing. Milan Chmelař, CSc.)

Ekologické inženýrství (doc. Ing. Jiří Rozman, CSc.)

Evoluční algoritmy (doc. Ing. Jiří Kozumplík, CSc.)

Klasické zobrazovací systémy v medicíně a ekologii (doc. Ing. Aleš Drastich, CSc.)

Klinická fyziologie (prof. MUDr. Jindřich Vomela, CSc.)

Laboratorní technika v genomice a proteomice (doc. Ing. Jana Kolářová, Ph.D.)

Medicínské informační systémy (Ing. Miroslav Dvořák, CSc.)

Mikroskopická zobrazovací technika (doc. Ing. Radim Kolář, Ph.D.)

Modelování biologických systémů (Ing. Martin Vítek, Ph.D.)

Molekulární biologie (doc. PharmDr. Petr Babula, Ph.D.)

Multitaktní systémy (doc. Ing. Jiří Kozumplík, CSc.)

Návrh a provoz komplexních systémů (doc. Ing. Jiří Rozman, CSc.)

Počítačová podpora lékařské diagnostiky (prof. Ing. Ivo Provazník, Ph.D.)

Pokročilá analýza biologických signálů (doc. Ing. Jiří Kozumplík, CSc.)

Pokročilé metody v biostatistice (doc. RNDr. Ladislav Dušek, Ph.D.)

Programování v bioinformatice (doc. Ing. Jana Kolářová, Ph.D.)

Speciální lékařská a ekologická technika (doc. Ing. Jiří Rozman, CSc.)

Systémová biologie (prof. Ing. Ivo Provazník, Ph.D.)

Tomografické zobrazovací systémy (doc. Ing. Aleš Drastich, CSc.)

Úvod do environmentalistiky (Prof. RNDr. Hana Librová, CSc)

Vizualizace biomedicínských dat (Ing. Radovan Jiřík, Ph.D.)

Vyšší metody zpracování signálů (prof. Ing. Jiří Jan, CSc.)

Základy metodologie výzkumu (doc. Ing. Radim Kolář, Ph.D.)

Zdravotní péče (prof. MUDr. Jindřich Vomela, CSc.)

Zdravotní péče v mimořádných situacích (doc. MUDr. Vladimír Šrámek, Ph.D.)

Zdravotnické informační systémy (Ing. Miroslav Dvořák, CSc.)

Doctoral Degree Programme

Vybrané problémy biomedicínského inženýrství (prof. Ing. Ivo Provazník, Ph.D.)

Vyšší metody zpracování a analýzy signálů a obrazů (prof. Ing. Jiří Jan, CSc.)

Laboratories

Laboratory of Diagnostic Technology (instruction in Medical Diagnostic Technology, Diagnostics of bio- and ecosystems, experimental part of research and student projects, Radim Kolář)

Laboratory of Biomedical Technology (instruction in Special Medical and Ecological Technology, Ecological Engineering, Design and Operation of Complex Systems, research and student project experiments, Jana Kolářová)

Laboratory of Bionics (instruction in Human Biology, Biophysics, Clinical Physiology, Health Analysis and Interpretation of Biological Data, experimental measurements for research and student projects, Jiří Kozumplík)

Laboratory of Ecological Engineering (instruction in Ecological Engineering, Ecoloy in Electrical Engineering, ecology in Healthcare, experimental measurements for research and student projects, Jiří Rozman)

Laboratory of Biomedical Electronics (instruction in Practice in Biomedical and Clinical Technology experimental parts of research and student projects, Jana Kolářová)

Laboratory of Information Systems (instruction in Medical Information Systems, Computer Support for Medical Diagnostics, Modelling of Biological Systems, Radovan Jiřík)

Laboratory of Signal Processing (instruction in Digital Signal Processing and Analysis, Multimedia Data in Biomedical Engineering, Analysis of Images and Signals, Advanced Methods of Signal Processing, Multicycle Systems, Ivo Provazník)

Laboratory of Imaging Technology (instruction in Microscopy Imaging Technology, experimental part of research and students projects, Radim Kolář)

Laboratory of Biophysics (research of electrophysiology of cells, evaluation of biological specimens by means of optical coherent tomography for oncological and implant applications, Ivo Provazník)

Laboratory of Functional Diagnostics (instruction in Human Biology and Biomedical and Clinical Technology, research of brain and muscle electrophysiology, Ivo Provazník)

Laboratory of Genomics and Proteomics (provils a clean environment for isolation and handling of biological samples, measurement and diagnostics of DNA, RNA and proteins, instruction if Laboratory Technology in Genomics and Proteomics and Bioinformatics, bioinformatics research, Ivo Provazník)

Laboratory of Ultrasonography (research of ultrasonographic images measurement, calibration of instruments and ultrasound probes, Radim Kolář)

Department of Power Electrical Engineering

Doc. Ing. Petr Toman, Ph.D.

Head

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Associate Professors

doc. Ing. Vladimír Blažek, CSc.
doc. Ing. Petr Baxant, Ph.D.
doc. Ing. Jiří Drápela, Ph.D.
doc. Ing. Evžen Haluzík, CSc.
doc. Ing. Ilona Lázničková, Ph.D.
doc. Ing. Petr Mastný, Ph.D.

Doc. Ing. Antonín Matoušek, CSc.
Doc. Ing. Jaroslava Orságová, Ph.D.
Doc. Ing. Jiří Raček, CSc.
Doc. Ing. Petr Toman, Ph.D.
Doc. RNDr. Oldřich Coufal, CSc.

Lecturers

Ing. Karel Katovský, Ph.D., Ing. Jan Macháček, Ph.D., Ing. Martin Paar, Ph.D.,

Ph.D. Students

Ing. Almabrok Abdoalhade Emhemed, Ing. Tomáš Bartošík, Ing. Branislav Bátora, Ing. František Bernáth, Ing. Martin Belatka, Ing. Jaromír Bok, Ing. Nail Khisamutdinov, Ing. Jan Novotný, Ing. Tomáš Pavelka, Ing. Drahomír Pernica, Ing. Jiří Pěcha, Ing. Michal Ptáček, Ing. Lukáš Radil, Ing. Jan Souček, Ing. Jan Šlezingr, Ing. Jaroslav Špaček, Ing. David Topolánek, Ing. René Vápeník, Ing. Jan Varmuža, Ing. Michal Závodný

Administrative and Technical Staff

Ing. Jan Gregor, CSc., Helena Karásková, Jitka Langerová, František Matoušek, Ing. Josef Šenk, CSc., Ing. Filip Koval

Main Interests

The department provides tuition in the Bachelor programme Power Electrial and Electronic Engineering (B-SEE) in cooperation with the Department of Power Electrical and Electronic Engineering, and in the Master programme Power Electrical Engineering (M-EEN). The offered courses are centred on conventional and renewable power sources, transmission and distribution of electric power and exploitation in light and heat sources, transient phenomena, solutions of system failures and liberalized energy market.

Research is focused on electrical power generation in conditions in permanently sustainable growth, that is search for new ways of power generation from renewable sources, increasing operation efficiency of power sources, reduction of losses and fast localization of network failures, impact of appliances, exploitation of hydrogen accumulation cycle in

solar systems, load optimization in small variable-output power sources, optimization of the structure of power sources for services in conditions of liberalized market, technological limits of inter-state power distribution, analysis of major system failures and appropriate measures, connection of wind-powered stations and design of outdoor and indoor illumination protection and evaluation systems.

The department cooperates in research and Ph.D. students training with a number of companies, e.g E. ON, Skupina ČEZ, ČEPS, a.s., ABB, s.r.o., EGÚ Brno, a.s., Teplárny Brno, a.s., Siemens, s.r.o. There has been close cooperation with departments of power electrical engineering at all Czech and Slovak technical universities.

Major Achievements

In 2011 members of the department were involved in the research plan 'Resources, Accumulation and Optimization of Electric Energy Exploitation in Conditions of Permanently Sustainable Growth', 1 GAČR, 1 NVP II, 5 FRVŠ and 14 industrial projects. Several staff members were involved in research programme 3 'Optimization of Electric Energy Conversion and Exploitation in Systems with Ecological Sources' of the research center CVVOZE.

The major results published in reputable journals and presented at international conferences included an algorithm of cost minimization in case of interrupted power supply by means of distribution network reconfiguration, design of new methodology of measuring voltage fluctuations, illumination control in smart electroinstallations, analysis of light sources resistance to short-term voltage drops and cut-offs, flickermeter implementation in the LabView environment, a utility sample was registered – A Device for Time Regulation of Camera Shutter Release, and first generation of LDA brightness

analyzer was developed for assessment of street illumination.

Cooperation with EGÚ Brno, a.s. centred on connecting photovoltaic and wind-.powered stations in the electrification system. Cooperation with Unicontrols-Tramex s.r.o. focused on development of railway signal lamps. We cooperated with ČEPS, a.s., Siemens, s.r.o., EGÚ HV Laboratory, a.s. and EG-Expert, s.r.o. and University of West Bohemia, Plzeň in project 'Increasing the Efficiency and Safety of the Electrification System' which included an experiment with a series of failures in the real high-voltage network aimed at safety in regard to contact voltage.

The department continued work on the project 'ePower – Innovation of instruction in power engineering and power electrical engineering based on e-learning and practical training'. Work on the project 'CENE-NET – Partnership in New Generation Nuclear Power Engineering' was commenced in 2011.

Major Research Projects

An Optimization of Operation of Cooperating Alternative Electric Energy Sources – GAČR 102/09/P529

Investigator: Petr Mastný

Increasing the Reliability and Safety of Electric Network– NPV II 2A-2TP1/051

Investigator: Petr Toman

Research and Development of a Modular System of Phytotron Low Power Consumption Chambers - FR-TI3/383

Investigator: Petr Baxant

Selected Publications

COUFAL, O. Comments on skin effect in solitary solid tubular conductor. *Advances in Mathematical Physics*. 2011. 2011(2011). p. 1 - 13. ISSN 1687-9139.

ŠKODA, J.; BAXANT, P. *Effect of directional reflectance in lighting. Przeglad Elektrotechniczny*. 2011. 87(4). p. 38 - 40. ISSN 0033-2097. (IF(2010)=0,242).

MACHÁČEK, J.; ŠLEZINGR, J.; DRÁPELA, J. *Electric and Nonelectric Quantities Measurement in Power Engineering Using LabView. In Labview - Modeling, Programming and Simulations*. 1. Printed in India, Published by InTech, Janeza Trdine 9, 51000 Rijeka, Croatia. 2011. p. 39 - 66. ISBN 978-953-307-521-1.

MASTNÝ, P.; RADIL, L.; MASTNÁ, Z. *Operating Characteristics of Multivalent Systems Using Renewable Energy Sources*. INTERNATIONAL JOURNAL of ENERGY and ENVIRONMENT. 2011. 5(6). p. 745 - 752. ISSN 1109-9577.

GREGOR, J.; JAKUBOVÁ, I.; ŠENK, J.; MAŠLÁNI, A. *The role of radiation losses in high-pressure blasted electrical arcs. Journal of Physics: Conference Series* . 2011. 275(1). p. 1 - 10. ISSN 1742-6588.

Bachelor Degree Programme

Distribuce elektrické energie (doc. Ing. Petr Toman, Ph.D.)

Ekonomika a ekologie elektroenergetiky (Ing. Jan Macháček, Ph.D.)

Jaderně energetická zařízení (doc. Ing. Jiří Raček, CSc.)

Ochrany a jištění zařízení (doc. Ing. Petr Toman, Ph.D.)

Počítačové modelování a simulace (doc. Ing. Petr Baxant, Ph.D.)

Projektování silových a datových rozvodů (Ing. Jan Macháček, Ph.D.)

Rozvodná zařízení (doc. Ing. Jaroslava Orságová, Ph.D.)

Strojní zařízení elektráren (doc. Ing. Jiří Raček, CSc.)

Technická mechanika (doc. Ing. Jiří Raček, CSc.)

Užití elektrické energie (doc. Ing. Jiří Drápela, Ph.D.)

Výroba elektrické energie (doc. Ing. Petr Mastný, Ph.D.)

Vysoké napětí a elektrické přístroje (doc. Ing. Vladimír Blažek, CSc.)

Master Degree Programme

Aplikace elektrického oblouku (Ing. Jan Gregor, CSc.)

Diagnostika v elektroenergetice (doc. Ing. Jiří Drápela, Ph.D.)

Distribuční a průmyslové sítě (doc. Ing. Jaroslava Orságová, Ph.D.)

Ekonomika elektroenergetiky (Ing. Jan Macháček, Ph.D.)

Elektrárny a teplárny (doc. Ing. Jaroslava Orságová, Ph.D.)

Elektrické stanice a vedení (doc. Ing. Jaroslava Orságová, Ph.D.)

Elektrotepelná technika (doc. Ing. Ilona Lázničková, Ph.D.)

Energetická zařízení (doc. Ing. Jiří Raček, CSc.)

Informační a řídicí systémy v elektroenergetice (doc. Ing. Petr Baxant, Ph.D.)

Integrované systémy chránění (doc. Ing. Petr Toman, Ph.D.)

Jaderné elektrárny (doc. Ing. Jiří Raček, CSc.)

Kvalita elektrické energie a EMC (doc. Ing. Jiří Drápela, Ph.D.)

Malé zdroje elektrické energie (doc. Ing. Petr Mastný, Ph.D.)

Nekonvenční přeměny (doc. Ing. Antonín Matoušek, CSc.)

Osvětlovací soustavy (doc. Ing. Petr Baxant, Ph.D.)

Power Systems (doc. Ing. Petr Baxant, Ph.D.)

Projektování silových a datových rozvodů (Ing. Jan Macháček, Ph.D.)

Přechodné jevy (doc. Ing. Vladimír Blažek, CSc.)

Přenosové sítě (doc. Ing. Vladimír Blažek, CSc.)

Řízení elektrizačních soustav (doc. Ing. Petr Toman, Ph.D.)

Světelná technika (doc. Ing. Petr Baxant, Ph.D.)

Doctoral Degree Programme

Matematické modelování v elektroenergetice
(doc. Ing. Evžen Haluzík, CSc.)

Vybrané problémy z výroby elektrické energie
(doc. Ing. Antonín Matoušek, CSc.)

Laboratories

Power Plant and Protection Laboratory (instruction in Systems Protection, Information and Control Systems in Power Electrical Engineering, Integrated Protection Systems, preparation for measurement in real network, research, Jaroslava Orságová)

Laboratory of Electrical Networks (instruction in Electric Power Distribution, Transmission Networks, Electrical Stations and Line Networks, Distribution and Industrial Networks, research projects, Vladimír Blažek)

Laboratory of Appliance-Electrical Network Compatibility (impact of appliances on the distribution network under different network conditions, Jiří Drápela)

Laboratory of Electric Power Quality and Electromagnetic Compatibility (instruction in Quality of Electric Power, EMC, Diagnostics in Power Electrical Engineering, Jiří Drápela)

Laboratory of Non-Conventional Energy Conversion (instruction Ecology in Power Engineering, Small Electric Power Sources, Non-Conventional Energy Conversion, diploma theses and dissertations, research of fuel cells, Petr Mastný)

Laboratory of Light Technology (instruction in Light Technology, Illumination Systems,Testing of Light Sources and Fittings, research projects, Petr Baxant)

Laboratory of Heating Technology (instruction in Electric Power Exploitation and Electric Heating Technology, Jiří Drápela)

Laboratory of Electric Power Generation (instruction in Electric Power Generation, Power and Heating Plants, Small Sources of Electric Power, diploma theses, research projects, Jaroslava Orságová)

Computer Laboratory (2) (instruction in Computers and Programming 1 and 2, planning in power engineering, steady states and transient phenomena in electrification systems, Petr Baxant, Petr Mastný)

Solar Energy Laboratory (research of full solar energy exploitation, development and verification of operating models in real operation conditions, Jan Gregor)

Department of Electrotechnology

Prof. Ing. Jiří Kazelle, CSc.
Head

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Prof. Ing. Jiří Vondrák, DrSc.

Associate Professors
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Doc. Ing. Josef Jirák, CSc.
Doc. Ing. Jiří Maxa, Ph.D.
Doc. Ing. Vítězslav Novák, Ph.D.
Doc. Ing. Marie Sedlaříková, CSc.
Doc. Ing. Jiří Vaněk, Ph.D.

Lecturers
Ing. Martin Frk, Ph.D., Ing. Petr Křivík, Ph.D., Ing. Helena Polsterová, CSc., Ing. Zdenka Rozsívalová, Ing. Jiří Starý, Ph.D., Ing. Jiří Špinka

Ph.D. Students
Ing. Pavel Abraham, Ing. Radek Bilko, Ing. Ondřej Čech, Ing. Pavel Čudek, Ing. Jan Dolenský, Ing. Petr Dvořák, Ing. Eva Flodrová, Ing. Chladi Ladislav, Ing. Ivan Jakubis, Ing. Michal Jašek, Ing. Tibor Jirák, Ing. Ondřej Kaválek, Ing. Tomáš Kazda, Ing. Tomáš Knotek, Ing. Miroslav Kunovjánek, Ing. Radek Lábus, Ing. Jiří Libich, Ing. Josef Máca, Ing. Tomáš Máca, Ing. Michal Musil, Ing. Jiří Neoral, Ing. David Pléha, Ing. Jiří Prchal, Ing. Marek Solčanský, Ing. Petr Stejskal, Ing. Radek Stojan, Ing. Silvie Svidenská, Ing. Lucie Šimonová, Ing. Petr Špičák, Ing. Zuzana Štichová, Ing. Jiří Šubarda, Ing. Jiří Tichý, Ing. Pavel Tošer, Ing. Karel Tonar, Ing. Aleš Veselý, Ing. Jiří Vognar, Ing. Jiří Vrbický, Ing. Petr Vyroubal

Administrative and Technical Staff
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Main Interests
The department provides instruction in electrotechnical materials, manufacturing processes and their control, printed circuit board and surface mount technology, diagnostics, testing and reliability of electrotechnical materials and processes, quality assurance, designs of systems and alternative electric power sources in the Bachelor and the Master programme Electrical, Electronic, Control and Communication Technology (EECR), in full-time and part-time form of study. The subject Materials and Technical Documentation is provided to all first-year full-time and part-time students in the Bachelor programme Electrical, Electronic, Control and Communication Technology.

The department continued upgrading and automation of instruction laboratories, internet connection with measuring workplaces and

extended use of computer rooms for self-study. Ten subjects in the specialization Electrotechnical Manufacturing and Management (EVM) in category free subjects were offered to students of other BUT faculties.

Research activities were centred on basic and applied research of electrochemical power sources (with focus on improving the characteristics of lead and alkaline accumulators for use in electric and hybrid vehicles), gel electrolytes and lithium-ion batteries, electrocatalysts and ion-exchange membranes for fuel cells, thin-layer electrodes for electrochromic systems, low combustibility materials for lithium-ion accumulators, potovoltaic systems, non-destructive diagnostics of defects, reliability and lifetime of solar cells, detection of signal electrons and methods of environmental scanning electron microscopy of atomic forces, lead-free soldering, quality and reliability of soldered joints, degradation and diagnostics of dielectric systems

Another area of interest was mathematical-physical modelling of blood flow in arteries, in cooperation with Institute of Instrument Technology, team engaged in Magnetic Resonance and Bioinformaticcs.

The department cooperates with a number of institutions - Technische Universität Wien, Padova University, Universität Ulm - Zentrum für Sonnenenergie - und Wasserstoff-Forschung, École Polytechnique de Montréal, surface analysis workplace Nanolytics in Feldkirchen,

Austria, the company Graphite AG Kropfmühl AG, Institute of Instrument Technology, Czech Academy of Sciences, Institute of Anorganic Chemistry, Institute of Physical Chemistry, Institute of Macromolecular Chemistry, Bochemie Bohumín, EPRONA Rokytnice nad Jizerou, Elmarco Liberec, Solartec Rožnov pod Radhoštěm, ERD Praha, LINET Slaný, ENERG-SERVIS Brno, ČeMeBo Blansko, Honeywell Brno, ALPS Electric Czech Sebranice. The department cooperated with INIFTA Universidad Nacional de La Plata, Argentina and Università degli Studi di Palermo, Italy in the programme KONTAKT.

In 2012 research in all above mentioned areas will continue, with focus on European research programmes and centres, GAČR, GAAV and FRVŠ projects.

Innovation of subjects of the study areas Microelectronics and Technology in the Bachelor programme and Electrotechnical Manufacturing and Management in the Master programme will be going on as well as upgrading of laboratories and computer rooms.

The department will co-organize the 33rd conference Nonconventional Electric Energy Sources in Černá Hora, May 2012 and the 13th international conference Advanced Batteries, Accumulators and Fuel Cells (A.B.A.F. – 13th) in Brno, August 2012.

Major Achievements

The department organized the 32nd international conference Nonconventional Sources of Electric Energy in Hrotovice, 5-7 September 2011. The conference was organized in cooperation with the Czech Electrotechnical Society, group for chemical sources of electric energy (Petr Bača, Petr Křivík).

The department also organized the international conference Advanced Batteries, Accumulators and Fuel Cells, 11-14 September 2011 – under the auspices of American electrochemical group The Electrochemical Society ECS and BUT (A.B.A.F.- 12th), (Marie Sedlaříková, Jiří Vondrák).

On the occasion of the 50th anniversary of the Department of Electrotechnology at the Faculty of Electrical Engineering in Brno the Department

hosted the meeting of Czech and Slovak colleagues, international conference Electrotechnology 2011 in Valtice, 14-16 September 2011 (Jiří Kazelle).

Our joint project with Argentina continued and Professor Visintin of National University of La Plata arrived for one month stay at our department and took part in lithium-ion battery research centred on increased safety, measurements of the characteristics of nickel electrodes for alkaline accumulators. Member of our department Ondřej Čech stayed at National University of La Plata from 2 November 2011 until 14 December 2011. He also works in the research centre INIFTA (CONICET) and in the Centre for Atomic Energy in Bariloche.

In 2011 the department was key investigator of the research plan 'Resources, Accumulation and Optimization of Electric Energy Exploitation in Conditions of Permanently Sustainable Growth', investigator or co-investigator of 2 GAČR projects ('Relationship of Local Light Emission with Stochatic Effects on PN Junctions of Solar Cells at Very Low Temperatures and 'Increasing of Li-Ion Batteries Safety'), 3 MPO projects ('Application of Modern Assembly Technologies and Materials in Electrical Engineering', 'Consortium for Research, Development and Manufacturing of Water Cooled Sources WHCLV with Medium-Frequency Inter-Circuit', 'Research of New Electrodes for Alkaline Accumulators'), 2 FEEC projects ('Materials and Technologies in Electrical Engineering', 'Impact of Current Density on the Spectrum of Electroluminescence Radiation of Solar Cell and Its Exploitation for Automatic Detection of Solar Cell Defects'), 9 FRVŠ projects and a mobile projects Czech Republic – Argentina ('Electrochemical Energy Storage').

In 2011 the department became co-investigator of the project 'Support of Human Resources and Knowledge Transfer in Conditions of International Cooperation of Reserarch Teams', Operational Programme Education for Competitiveness. The co-investigator was Institute of Instrument Technology, and the project was focused on reintegration of the Czech research worker on long-term stay in Germany into the newly built team of scanning electron microscopy.

In cooperation with Department of Microelectronics we continue work on the project Innovation and Upgrading of Bachelor study area Microelectronics and Technology and Master study area Microelectronics, Operational Programme Education for Competitiveness.

With University of West Bohemia, Plzeň we cooperate in the European project Partnership in Electrical and Mechanical Engineering, Operational Programme, Priority Axis 7.2 Tertiary Education, Research, Development. The department staff are also involved in the European project 'Centre of Research and Exploitation of Renewable Energy Sources' – (CVVOZE), Operational Programme Research and Development, Priority Axis 2 and in research programme 2 – 'Chemical and Photovoltaic Energy Sources'.

Results on the characteristics of scintillation detector of secondary electrons for microscopes operating under high pressure in the specimen chamber (VP-SEM), developed in cooperation with Institute of Instrument Technology were published in impact international journal European Microscopy and Analysis. European patent EP 2195822 was awarded to the jointly developed ionization detector for environmental scanning microscope.

Major Ressearch Projects

Research of New Electrodes for Alcalic Accumulators - MPO FR-T13/198

Investigator: Miroslav Zatloukal

Resources, Accumulation and Optimization of Electric Power Exploitation in Conditions of Permanently Sustainable Growth – SRČR MSM0021630516

Investigator: Jiří Kazelle

Significance of Carbon Additive in Negative Lead-Acid Battery Electrodes – ALABC C2. 2 RU1870010

Investigator: Petr Bača

Relationship of Local Light Emissions with Stochastic Effects on PN Junctions of Solar Cells at Very Low Temperatures – GAČR 102/09/0859

Investigator: Jiří Vaněk

Increasing the Safety of Li-Ion Batteries – GAČR P102/10/2091

Investigator: Marie Sedlaříková

Selected Publications

JIRÁK, J.; ČUDEK, P.; NEDĚLA, V. Detection *of secondary electrons by scintillation detector at VP SEM*. MICROSCOPY AND MICROANALYSIS. 2011. 2(17). p. 922 - 923. ISSN 1431-9276. (IF(2010)=3,259).

VALSA, J.; FRIEDL, M.; DVOŘÁK, P. *Network Model of the CPE. Radioengineering*. 2011. 20(3). p. 619 - 626. ISSN 1210-2512. (IF(2010)=0,503).

BAČA, P. Posibilities *of electric power storage from renewable sources*. Acta Montanistica Slovaca. 2011. 15(2010). p. 100 - 104. ISSN 1335-1788. (IF(2010)=0,134).

ŠPIČÁK, P.; SEDLAŘÍKOVÁ, M.; ZATLOUKAL, M.; NOVÁK, V.; KAZELLE, J.; VONDRÁK, J.; JIRÁK, T. *Preparation and properties of manganese dioxide studied by QCM (revised).* Journal of Solid State Electrochemistry. 2011. 15(3). p. 635 - 639. ISSN 1432-8488. (IF(2010)=2,234).

KŘIVÍK, P.; BAČA, P.; TONAR, K.; MICKA, K.; TOŠER, P. *Study of the influence of carbon on the negative lead-acid battery electrodes.* Journal of Power Sources. 2011. 196(2011). p. 3988 - 3992. ISSN 0378-7753. (IF(2010)=4,29).

VANĚK, J.; ŠTENCEL, J. System *for an automatic analysis of defective Solar cells in the Solar Module*. Acta Montanistica Slovaca. 2011. 15(2). p. 105 - 110. ISSN 1335-1788. (IF(2010)=0,134).

Bachelor Degree Programme

Diagnostika a zkušebnictví
(doc. Ing. Josef Jirák, CSc.)

Elektrotechnické materiály a výrobní procesy
(prof. Ing. Jiří Kazelle, CSc.)

Materiály a komponenty pro biomedicínu
(doc. Ing. Marie Sedlaříková, CSc.)

Materiály a technická dokumentace
(doc. Ing. Josef Jirák, CSc.)

Návrh a konstrukce elektrotechnických zařízení
(doc. Ing. Vítězslav Novák, Ph.D.)

Návrhové systémy plošných spojů
(doc. Ing. Petr Bača, Ph.D.)

Plošné spoje a povrchová montáž
(Ing. Jiří Starý, Ph.D.)

Počítačové projektování výrob, logistika
a ekologie výroby (doc. Ing. Jiří Vaněk, Ph.D.)

Počítačová podpora technických a manažerských
prací (doc. Ing. Jiří Maxa, Ph.D.)

Řízení a kontrola jakosti
(Ing. Helena Polsterová, CSc.)

Řízení jakosti a metrologie
(Ing. Helena Polsterová, CSc.)

Spolehlivost v elektrotechnice
(Ing. Helena Polsterová, CSc.)

Master Degree Programme

Alternativní zdroje energie
(doc. Ing. Jiří Vaněk, Ph.D.)

Diagnostické metody v elektrotechnice
(doc. Ing. Josef Jirák, CSc.)

Ekologie výroby (doc. Ing. Petr Bača, Ph.D.)

Elektroizolační systémy
(Ing. Helena Polsterová, CSc.)

Klimatotechnologie
(Ing. Helena Polsterová, CSc.)

Materiály pro biomedicínské aplikace
(doc. Ing. Marie Sedlaříková, CSc.)

Mechanical Desktop (doc. Ing. Jiří Maxa, Ph.D.)

Montážní a propojovací technologie
(Ing. Jiří Starý, Ph.D.)

Obnovitelné zdroje energie
(Ing. Petr Křivík, Ph.D.)

Počítačové návrhové systémy
(Ing. Vítězslav Novák, Ph.D.)

Properties and Production of Electrotechnic
Materials (doc. Ing. Josef Jirák, CSc.)

Řízení a správa dat (doc. Ing. Jiří Maxa, Ph.D.)

Spolehlivost a jakost
(Ing. Helena Polsterová, CSc.)

Struktura a vlastnosti materiálů
(doc. Ing. Josef Jirák, CSc.)

Technologické projektování a logistika
(doc. Ing. Jiří Vaněk, Ph.D.)

Třírozměrné modelování a simulace
(doc. Ing. Jiří Maxa, Ph.D.)

Výrobní procesy (prof. Ing. Jiří Kazelle, CSc.)

Základy spolehlivosti elektrotechnických výrob
(Ing. Helena Polsterová, CSc.)

Doctoral Degree Programme

Elektrotechnické materiály, materiálové soustavy
a výrobní procesy (prof. Ing. Jiří Kazelle, CSc.)

Vybrané diagnostické metody, spolehlivost,
jakost (doc. Ing. Josef Jirák, CSc.)

Laboratories

Laboratory of Alkaline Electrochemical Power Sources (research and development of modern alkaline accumulators (Ni-Cd, Ni-MH) and oxygen-hydrogen fuel cells with alkaline or polymer electrolyte, Vítězslav Novák)

Laboratory of Diagnostics of Photovoltaic Panels (testing of photovoltaic panels and system in precisely defined conditions, Jiří Vaněk)

Laboratory of Diagnostic Methods (diagnostics of materials and testing methods, experiments for semestral projects, Bachelor and Master theses, Martin Frk)

Laboratory of Electrical Diagnostic Methods (diagnostic methods in electrical engineering and climatotechnogy, experimental measurements of very small currents and diagnostics of electro-insulating fluids, Martin Frk)

Laboratory of Electrode Materials 1,3 (preparation of specimen and electrode mass for Li-ion, Ni-Cd, Ni-MH and Ni-Zn batteries and supercondensors, thin-film deposition by chemical methods preparation of polymer gel electrolytes, Marie Sedlaříková)

Laboratory of Electrode Materials 2 (research and measurement of materials for electrochemical sources, mainly Li-ion, Ni-Cd, Ni-MH and Ni-Zn batteries, supercondensors and polymer gel electrolytes for Li-pol batteries, Marie Sedlaříková)

Laboratory of Electrical Measurement (diagnostic analysis of properties of dielectric materials, material specimen from commercial suppliers and measured by commonly used instruments, Helena Polsterová)

Laboratory of Electrotechnical Materials 1 (analysis of electrotechnical materials, instruction in Materials and Technical Documentation and Electrotechnology for Faculty of Mechanical Engineering, Petr Křivík)

Laboratory of Electrotechnical Materials 2 (computer modelling and measurement of parameters of semiconductor and dielectric materials, instruction in Electrotechnical Materials and Manufacturing, Material Structure and Properties, Zdenka Rozsívalová, Martin Frk)

Laboratory of Photovoltaic Systems (testing of electrical properties of photovoltaic cells, Jiří Vaněk)

Laboratory of Microscopy Techniques (research of systems for detection of signal electrons, specimen observations in scanning electrode microscope under higher pressure in specimen chamber (VP-SEM) and microscope of atomic forces (AFM), Josef Jirák, Pavel Čudek)

Laboratory of Renewable Sources (testing of electrical and mechanical properties of photovoltaic cells, laboratory instruction in renewable Energy Sources and Alternative Energy Sources, Jiří Vaněk)

Laboratory of Lead-Acid Accumulators 1,2 (research and development of new applications of lead-acid accumulators for hybrid electromobiles and as renewable energy storage, Petr Bača)

Laboratory of Printed Circuit and Surface Mount Technology (instruction in Printed Circuit and Surface Mount Technology, Jiří Starý)

Laboratory of Soldering (research and development of lead-free soldered connections reliability and surface wettability , instruction in Interconnection and Assembly Technology, Jiří Starý)

Laboratory of Printed Circuits, PROTOCAD and Photoprocesses (laboratory production of printed circuit boards and microsections, chemical coating analysis, coating laboratory, instruction in Printed Circuits and Surface Mount Technology and Interconnection and Assembly Technology, Jiří Starý)

Department of Physics

Doc. Ing. Lubomír Grmela, CSc.
Head

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Prof. RNDr. Pavel Tománek, CSc.

Associate Professosrs
Doc. RNDr. Milada Bartlová, Ph.D.
Doc. Ing. Lubomír Grmela, CSc.
Doc. RNDr. Pavel Hruška, CSc.
Doc. Ing. Pavel Koktavý, CSc., Ph.D.
Doc. Ing. Karel Liedermann, CSc.
Doc. Mgr. Jan Pavelka, CSc., Ph.D
Doc. Ing. Vlasta Sedláková. Ph.D.

Lecturers
Ing. Jitka Brüstlová, CSc., RNDr. Pavel Dobis, CSc., Ing. Vladimír Holcman, Ph.D., RNDr. Eva Hradilová, Ing. Petr Sedlák, Ph.D., RNDr. Naděžda Uhdeová, Ph.D.

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Main Interests
The department provides tuition in basic courses of the Bachelor degree programme Physics 1 and Physics 2 (full-time and part-time study), Physics for Information Technology, Physics 1 and Physics 2 for the programme Biomedical Technology and Bioinformatics, Nanotechnology, Modern Physics, Solid Phase Physics and Non-Destructive Diagnostics, Physics of Dielectrics for FEEC, Physical Optics for Faculty of Information Technology. The subjects Junctions of Nanostructures and Spectroscopic Methods for Non-Destructive Diagnostics were offered in the doctoral study programme.

The tasks for Physical Practice and multimedia study materials were being updated for instruction in the computer room and for student self-study. Laboratory instruction for Master

students was innovated and upgraded within the framework of a FRVŠ project.

The department activities were centred on basic and applied research of the physical parameters of semiconductor and dielectric materials and components, and recently nanosensors. The main area of interest was noise spectroscopy, local characterization with nanodistinction, measurement of nonlinearities, design of quality and reliability indicators for non-destructive assessment of a given technological step and dielectric spectroscopy. Very good results were achieved in research of the characteristics of acoustic and electromagnetic emission sensors.

Research was also focused on local spectroscopy, topography, photoluminescence of semiconductor and photonic structures and dielectric relaxation spectroscopy of anorganic and organic materials. The department cooperated with European and Japanese laboratories in the field of noise spectroscopy and nanotechnology, extended cooperation with Augsburg University in research of dielectrics, with American universities in Orlando and Rapid City in metrology, and cooperation with leading Czech laboratories in the development and enhancement of the parameters of CdTe radiation detectors.

Cooperation with the industrial sector continued on the basis on three economic contracts. Our partners were also the world leaders ON Semiconductor and AVX Kyocera.

Research laboratories were equipped with a number of modern devices. A workplace for experimental study of semiconductor and dielectric samples at low temperatures (up to 10 K) was set up, optical spectroscopy by means of SNOM, spectral analyzers of signals for the entire technical frequency spectrum, the automatic meter Keithley 4200 and a vaccum system for research of autoemission cathodes in electron microscopy were purchased.

Major Achievements

The regional centre VaV CZ.1.05/2.1.00/03.0072 'Centre for Sensoric, Information and Communication Systéme' (SIX) continued its operations. Incorporated in the project SIX are two laboratories of the Department of Physics which were equipped with up-to-date apparatus - Laboratory of Noise, Dielectric Spectroscopy (Lubomír Grmela) and Laboratory of Nanometrology (Vladimír Holcman).

In 2011 the majority of the research staff participated in the research plan MSM 0021630503 – MIKROSYN, with co-investigator and leader of the team involved in Modern Diagnostics Lubomír Grmela. The project outcomes in 2011 are 19 articles in scientific, mostly impact, journals and several invited lectures at scientific and research international and national conferences, 1 patent application, 4 prototypes and 1 utility software.

In the project CEITEC (centre of excellence) the department participates in creating the top infrastructure of the programme Advanced Nanotechnology and Microelectronic Technology and is responsible for research of optoelectronic characterization of nanostructures (Lubomír Grmela).

In 2011 the department was involved in 6 GAČR, 5 FRVŠ, 2 MPO, 1 INGO and 3 Kontakt projects, 1 specific research project of Brno University of Technology and 4 commercial contracts with industrial companies.

The GAČR projects centred on stochastic processes in semiconductor structures MIS and MIM, CdTe emission detectors, service time of autoemission and Schottky cathodes based on noise analysis and transport spectroscopy, electromagnetic and acoustic emission in advanced composite materials and diagnostics of defects in materials by advanced defectoscopy.

The FRVŠ projects dealt with upgrading of laboratories for Bachelor and Master study.

The MPO TIP projects dealt with applications of laser technology in production of quartz crystal solar cells, in cooperation with Solartec s.r.o and with research and development of progressive tools for enhanced quality of billet, wires and bars, in cooperation with Třinec Iron and Steel Works.

Owing to the project INGO, Professor P. Tománek became member of Research Advisory Committee of European Optical Association.

Research of the methodology of increasing the quality of optoelectronic materials and components was supported by a BUT grant.

The commercial contracts dealt with DC-AC solar converters, characteristics of biophysical sensors and methods of non-destructive detection of technology defects in ceramic, tantalum and niobium condensers.,

In connection with the development of nanotechnologies the department received 2 projects for innovation and upgrading of instruction in physics from the Operation Programme Education for Competitiveness 2.3 CZ.1.07/2.3.00/09.0214 - IVEFEN 'Research team incubator for physical electronics and nanotechnology' and 2.2 CZ.1.07/2.2.00/15.0147 'Nanotechnology for electrical engineering', jointly financed by the European Social Fund and Czech Republic budget. As a result the department can extend its offer of courses on nanoscience, nanometrology, nanomaterials and nanosensors

We succeeded in presenting the new doctoral study programme Physical Electronics and Nanotechnology to Master students and arise interest in this study.

Major Research Projects

New Trends in Microelectronic Systems and Nanotechnologies (MIKROSYN) – MŠMT ČR MSM 21630503

Investigator at Department of Physics: Lubomír Grmela

Research Team Incubator for Physical Electronics and Nanotechnology – MŠMT 1.07/2.3.09.0214/S

Investigator: Petr Sadovský

Nanoscience in Electrical Engineering – Innovation of Study Programmes – MŠMT 1.07/2.2.00/15.0147

Investigator: Pavel Dobis

Research and Development of Progressive Tools for Increasing the Surface Quality of Cast Billets, Bars and Wires– MPO FR-TI2/536

Investigator: Lubomír Grmela

Center of Sensoric, Information and Communication Systems (SIX) – CZ.1.05/2.1.00/03.0072

Investigator at Department of Physics: Lubomír Grmela

Selected Publications

JENIŠTA, J.; TAKANA, H.; NISHIYAMA, H.; BARTLOVÁ, M.; AUBRECHT, V.; KŘENEK, P.; SEMBER, V.; MAŠLÁNI, A. A comparative numerical study of hybrid-stabilized argon-water electric arc. *COMPUTER PHYSICS COMMUNICATIONS.* 2011. 182(9). p. 1776 - 1783. ISSN 0010-4655. (IF(2010)=2,3).

PAVELKA, J.; ŠIKULA, J.; TACANO, M.; TOITA, M. Activation Energy of RTS Noise. *Radioengineering.* 2011. 20(1). p. 194 - 199. ISSN 1210-2512. (IF(2010)=0,503).

ŠKARVADA, P.; GRMELA, L.; TOMÁNEK, P. Advanced Local Quality Assessment of Monocrystalline Silicon Solar Cell Efficiency. *Key Engineering Materials.* 2011. 465(1). p. 239 - 242. ISSN 1013-9826. (IF(2005)=0,224).

JENIŠTA, J.; TAKANA, H.; NISHIYAMA, H.; KŘENEK, P.; BARTLOVÁ, M.; AUBRECHT, V. Computer Modeling of Radiative Transfer in Hybrid-Stabilized Argon-Water Electric Arc. *IEEE Transactions on Plasma Science.* 2011. p. 2892 - 2893. ISSN 0093-3813. (IF(2010)=1,076).

TOFEL, P.; ŠIKULA, J.; HÁJEK, K.; TROJANOVÁ, Z.; BUMBÁLEK, L. Cracks detection in Mg alloy by electro-ultrasonic spectroscopy. *Key Engineering Materials.* 2011. 465(1). p. 350 - 353. ISSN 1013-9826. (IF(2005)=0,224).

TRČKA, T.; KOKTAVÝ, P.; TOFEL, P. Electromagnetic and acoustic emission signals real-time measurement, processing and data evaluation. *Key Engineering Materials.* 2011. 465(1). p. 332 - 335. ISSN 1013-9826. (IF(2005)=0,224).

ŠIK, O.; GRMELA, L.; ANDREEV, A.; ŠIKULA, J.; BELAS, E. Influence of CdTe material ageing on relaxation time and noise. *NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH SECTION A-ACCELERATORS SPECTROMETERS DETECTORS AND ASSOCIATED EQUIPMENT.* 2012. 28(672). p. 1 - 4. ISSN 0168-9002. (IF(2010)=1,142).

JENIŠTA, J.; TAKANA, H.; NISHIYAMA, H.; BARTLOVÁ, M.; AUBRECHT, V.; KŘENEK, P.; HRABOVSKÝ, M.; KAVKA, T.; SEMBER, V.; MAŠLÁNI, A. Integrated parametric study of a hybrid-stabilized argon - water arc under subsonic, transonic and supersonic plasma flow regimes. *Journal of Physics D: Applied Physics.* 2011. 44(43). (20 p.). ISSN 0022-3727. (IF(2010)=2,109).

SEDLÁK, P.; MAJZNER, J.; ŠIKULA, J. Noise in Piezoelectric Ceramics at the low temperatures. *Radioengineering.* 2011. 20(1). p. 200 - 203. ISSN 1210-2512. (IF(2010)=0,503).

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PARAČKA, P.; KOKTAVÝ, P.; MACKŮ, R. PN junction defects detection in solar cells using noise diagnostics. *Key Engineering Materials.* 2011. 465(1). p. 359 - 362. ISSN 1013-9826. (IF(2005)=0,224).

ELHADIDY, H.; ŠIKULA, J.; FRANC, J. Symmetrical current–voltage characteristic of a metal–semiconductor–metal structure of Schottky contacts and parameter retrieval of a CdTe structure. *SEMICONDUCTOR SCIENCE AND TECHNOLOGY.* 2011. 27(1). p. 1 - 6. ISSN 0268-1242. (IF(2010)=1,333).

GRMELA, L.; ŠKARVADA, P.; TOMÁNEK, P.; MACKŮ, R.; SMITH, S. Thermal dependence of light emission from reverse-biased monocrystalline silicon solar cells. *SOLAR ENERGY MATERIALS AND SOLAR CELLS.* 2012. 96(1). p. 108 - 111. ISSN 0927-0248. (IF(2010)=4,746).

SEDLÁK, P.; TOFEL, P.; SEDLÁKOVÁ, V.; MAJZNER, J.; ŠIKULA, J.; HASSE, L. Ultrasonics spectroscopy of silicon single crystal. *METROL MEAS SYST.* 2011. 18(4). p. 621 - 630. ISSN 0860-8229. (IF(2010)=0,587).

KOKTAVÝ, P.; VESELÝ, V.; KERŠNER, Z.; FRANTÍK, P.; KOKTAVÝ, B. Utilization of electromagnetic and acoustic emission in monitoring of fracture of cementitious composites. *Key Engineering Materials.* 2011. 465(1). p. 503 - 506. ISSN 1013-9826. (IF(2005)=0,224).

Bachelor Degree Programme

Fyzika 1 (RNDr. Pavel Dobis, CSc.)

Fyzika 2 (doc. RNDr. Milada Bartlová, Ph.D.)

Fyzika pro informatiky (doc. Ing. Lubomír Grmela, CSc.)

Fyzikální seminář (RNDr. Eva Hradilová)

Master Degree Programme

Fyzika pevné fáze (doc. Ing. Lubomír Grmela, CSc.)

Moderní fyzika (doc. Ing. Karel Liedermann, CSc.)

Fyzikální optika pro informatiky (doc. RNDr. Pavel Hruška, CSc.)

Nanotechnologie (prof. RNDr. Pavel Tománek, CSc.)

Nedestruktivní diagnostika a fyzika dielektrik (doc. Ing. Karel Liedermann, CSc.)

Doctoral Degree Programme

Rozhraní a nanostruktury (prof. RNDr. Pavel Tománek, CSc.)

Spektroskopické metody pro nedestruktivní diagnostiku (doc. Ing. Karel Liedermann, CSc.)

Laboratories

Czech Electronic Noise Research Laboratory (low-frequency noise, noise spectroscopy, development of non-destructive diagnostic methods and indicators of the reliability of materials and microelectronic components, research of sensors and acoustic and electromagnetic emission methods, Josef Šikula)

Laboratory of Dielectric Relaxation Spectroscopy (dielectric relaxation spectroscopy, monitoring of molecular dynamics of dielectric materials, Karel Liedermann)

Laboratory of Physics (instruction in Physics 1, Physics 2 and Physics for Information Technology, laboratory exercises for Physics of Solids and Non-Destructive Diagnostics of Materials, Semiconductors and Physics of |Dielectrics, Pavel Dobis)

Laboratory of Optical Nanometrology - SIX (contactless investigation of local optical and electrical characteristics of optoelectronic and photonic structures with horizontal superresolution by optical scanning nearfield microsccopy, Vladimír Holcman)

Laboratory of Noise Diagnostics (research of fluctuation processes in solids, mainly electronic components, electroinsulation materials by partial charges or using electromagnetic and acousic emissions for diagnostics of fissures, Pavel Koktavý)

Laboratory of Noise Dielectric Spectroscopy and Electromagnetic Emission – SIX (experimental and theoretical research of stochastic processes and carrier transport as a basis for new advanced technologies, nanosensorics, development of non-destructive diagnostics and modern methods of electronic components and structures lifetime estimation, Lubomír Grmela)

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Lecturers

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Administrative and Technical Staff

Miroslava Purová

Main Interests

In 2011 Department of Languages submitted application for accreditation of a new Bachelor programme 'English in Electrical Engineering' which would equip the graduates with knowledge of linguistic theory of professional English together with language skills specific for the professional language of various disciplines of electrical engineering. The application was supported by habilitation in the study area Linguistics of Germanic Languages. The Department of Languages at FEEC is the only workplace among tertiary technical institutions in the Czech Republic that can provide such highly specialized subjects. The habilitation was received for the work 'Parameters of Professional Discourse'.

The project of the Operational Programme Education for Competitiveness 'Specific Linguistic and Methodological Qualifications of English Language Teachers at FEEC and FIT at BUT' was completed in 2011. The project was aimed at training of language teachers in professional language and discourse and preparing them for an innovated concept of language tuition increasingly focused on professional language skills. This will be the theoretical basis for purely professional English courses to be launched in academic year 2012/13. Another outcome of the project is an innovated syllabus of the course English for Ph.D. Students and electronic support materials. Tution in this course has already been based on innovated materials.

Research of English as a language of profession continued and its results have been gradually implemented in the teaching materials. Professional discourse analysis considered not only the pragmatic approach, but also the sociolinguistic approach taking into account the environment where English is used as a national or foreign language. The research results were presented at the international conference 'The Future of English in the Light of Globalization, Transculturalism, and Internationalization'. University of Southern Denmark, Kolding,

Denmark and at 'International Conference for Academic Disciplines', American University of Rome, Rome, Italy.

The economic section of the department innovated, in cooperation with the section of languages, the popular course Culture of Speech and Generation of Texts, and offered a number of economic and psychological courses focused on practice, and in the lifelong education programme the section offered the course of Supplementary Pedagogical Study.

Major Achievements

In 2011 the three-year project of the Operational Programme Education for Competitiveness was completed. The project was targeted at training of language teachers in the methodology of teaching professional English and providing them with the theory of professional discourse used in electrical engineering and information technology. It is a unique theoretical preparation based on research of professional English conducted at the department in the past decade. The project was concluded with a workshop with invited guests from Vilnius. The research of English as a professional language of electrical engineering and information technology resulted in habilitation in the study area Linguistics of Germanic Languages at Masaryk University in Brno. On this research we also based our application for accreditation of a new Bachelor study programme English in Electrical Engineering. In this academic year a new Master programme course English for Life was launched. It is focused on language functions and provides information on the cultural differences between European Union countries, United States and Canada. Emphasis is laid on basic language competences, and mainly on the socio-cultural aspects that must be taken into account when starting a professional career in the globalizing world.

Bachelor Degree Programme

Angličtina efektivní čtení anglických textů (PhDr. Marcela Borecká)

Angličtina pro bakaláře- mírně pokročilí 1 (Mgr. Šárka Rujbrová)

Angličtina pro bakaláře- mírně pokročilí 2 (Mgr. Marie Žouželková Bartošová)

Angličtina pro bakaláře- středně pokročilí 1 (Mgr. Agata Walek)

Angličtina pro bakaláře- středně pokročilí 2 (Mgr. Pavel Sedláček)

Angličtina pro Evropu (Mgr. Přemysl Dohnal)

Etika podnikání (Ing. Martin Jílek)

Inženýrská pedagogika a didaktika (Ing. Martin Jílek)

Kultura projevu a tvorba textů (Ing. Martin Jílek)

Kurs profesní angličtiny pro elektroinženýrství a informatiku (PhDr. Ludmila Neuwirthová, Ph.D.)

Laboratorní didaktika (Ing. Martin Jílek)

Manažerské účetnictví (Ing. Martin Jílek)

Němčina pro mírně pokročilé (Mgr. Pavel Sedláček)

Němčina pro pokročilé (Mgr. Pavel Sedláček)

Němčina pro začátečníky (Mgr. Pavel Sedláček)

Obchodní angličtina (PhDr. Dagmar Malíková)

Pedagogická psychologie (Ing. Martin Jílek)

Manažerské účetnictví (Ing. Martin Jílek)

Ruština pro mírně pokročilé (PaedDr. Alena Baumgartnerová)

Ruština pro začátečníky (PaedDr. Alena Baumgartnerová)

Španělština pro mírně pokročilé (PhDr. Marcela Borecká)

Španělština pro začátečníky (PhDr. Marcela Borecká)

Master Degree Programme

Angličtina efektivní čtení anglických textů (PhDr. Marcela Borecká)

Angličtina pro Evropu (Mgr. Přemysl Dohnal)

Angličtina pro pokročilé (M. A. Kenneth Froehling)

Angličtina pro středně pokročilé (Mgr. Přemysl Dohnal)

Angličtina pro život (Mgr. Přemysl Dohnal)

Etika podnikání (Ing. Martin Jílek)

Kultura projevu a tvorba textů (Ing. Martin Jílek)

Kurs profesní angličtiny pro elektroinženýrství a informatiku (PhDr. Ludmila Neuwirthová, Ph.D.)

Manažerské účetnictví (Ing. Martin Jílek)

Němčina pro mírně pokročilé (Mgr. Pavel Sedláček)

Němčina pro pokročilé (Mgr. Pavel Sedláček)

Němčina pro začátečníky (Mgr. Pavel Sedláček)

Obchodní angličtina (PhDr. Dagmar Malíková)

Manažerské účetnictví (Ing. Martin Jílek)

Ruština pro mírně pokročilé (PaedDr. Alena Baumgartnerová)

Ruština pro začátečníky (PaedDr. Alena Baumgartnerová)

Španělština pro mírně pokročilé (PhDr. Marcela Borecká)

Španělština pro začátečníky (PhDr. Marcela Borecká)

Doctoral Degree Programme

Angličtina pro doktorandy (PhDr. Dagmar Malíková)

Department of Mathematics

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Prof. RNDr. Václav Havel, DrSc.
Prof. RNDr. Jan Chvalina, DrSc.
Prof. RNDr. František Neuman, DrSc.

Associate Professors

Doc. RNDr. Jaromír Baštinec, CSc.
Doc. RNDr. Martin Kovár, Ph.D.
Doc. RNDr. Josef Zapletal, CSc.

Lecturers

RNDr. Petr Fuchs, Ph.D., Mgr. Irena Hlavičková, Ph.D., RNDr. Dana Hliněná, Ph.D., RNDr. Edita Kolářová, Ph.D., RNDr. Vlasta Krupková, CSc., Mgr. Michal Novák, Ph.D., RNDr. Zdeněk Svoboda, CSc., Mgr. Marie Tomšová, Mgr. Jiří Vítovec, Ph.D.

Ph.D. Students

Ing. Olga Archalousová, Mgr. Vladislav Biba, Ing. Jaroslav Klimek, Mgr. Blanka Morávková, Mgr. Alena Ryvolová, Ing. Petr Skorkovský, Mgr. Hana Balcarová, Alena Chernikava, Ganna Konstantinivna Piddubna, Štěpán Křehlík

Administrative and Technical Staff

Eva Šimečková

Main Interests

Department of Mathematics is responsible for tuition in subjects in full-time and part-time Bachelor programme (Mathematics 1, Mathematics 2, Mathematics 3), in full-time and part-time Master programme (Modern Numerical Methods, Matrix and Tensor Calculus, Differential Equations in Electrical Engineering, Probability, Statistics and Operations Research). The department provides tuition in two Ph.D. courses (Discrete Processes in Electrical Engineering, Probability, Stochastic Processes, Operations Research) and in a number of courses for the Faculty of Information technology.

Research was focused on several areas:

1.Weak feedback linear systems. The asymptotic description of the solution of Emden-Fowler discrete equations was given, describing micro- and nano- phenomena. Stability of new categories of linear and nonlinear neutral differential equations was proved by means of Lyapunov-Krasovskii functionals. The second Lyapunov method and the topological method were combined to define the solution characteristics on infinite time intervals. The topological method was applied to feedback processes, where the feedback is also dependent on the instantaneous rate of change of states, and to processes where the time variable can

change, continuously and by impulse, or by an arbitrary combination of changes.

2. The second area of interest was multiautomatic analysis based on change of the continuity space of continuos real functions and on a hypergroup of second-order linear differential operators with positive continuous coefficient in the first derivation consisting in expressing the automatic in the form of the sum of perfect semi-simple subautomatics-components also called the Letychevski layers.

3. The third area of interest is centred on investigation of general causal structures for quantum gravitation. The causal site defines canonically the associated compact T1-topological space that is super-connected and not Hausdorff's. This space was tested to find out whether the causal site was defined by the Minkowski four-dimensional spacetime. Then the canonical topology is de-Groot dualization of the general Eucleidan topology and the Minkowski spacetime. The result would indicie that the real 'topology around us' was created by a causal structure, apparently a primary structure of generalized spacetime, also carrying topological information.

Major Achievements

The department was involved in 2 GAČR projects, 2 ESF OPVK projects 1.3 and 2.2, 3 FRVŠ projects, 2 specific research projects, one of them inter-faculty project (Faculty of Electrical Engineering and Communication and Faculty of Mechanical Engineering).

The department participated in two research plans: MSM0021630503 - 'New Trends in Microelectronic Systems' and MSM0012630529 – 'Intelligent Systems in Automation'.

A contribution of our involvement in research projects was cooperation with renowned specialists (Professor Braverman, USA, Professor Khusainov, Ukraina, Professor Zacher, Turkey, Professor Berezansky, Israel, Professor Dzalladova, Ukraina, Professor Khan, China, Professor Nowak, Austria).

Major outcomes:

Integral representations and Lyapunov-Krasovskii functionals were applied to study the stability and non-stability of solutions, including results on exponential stability of solutions of equations for stochastic control systems and estimates of perturbation of nonlinear indirect interval regulator system of neutral type.

Delayed exponential matrix was used for solutions of linear partial differential equations and representation of solutions of differential equations.

New results were achieved on convergence of all solutions of discrete equations on arbitrary discrete intervals.

New algorithms for fractional functional equations were designed by modification of the Adomian decomposition method and homotopic perturbation method.

Some results were received for publication in impact journals Abstract and Applied Analysis, Advances in Difference Equations, Journal of Applied Mathematics.

The department coorganized international conferences:

ICSC - Seventh International Conference on Soft Computing Applied in Computer and Economic Environments, 21 January 2011, Hodonín.

XXIX International Colloquium on the Management of the Educational Process, 20 May 2011, Brno.

Major Research Projects

Training of Secondary-School Teachers Focused on Increasing Student Motivation to Take up Higher Technical Education – OPVK 1.3 CZ.1.07/1.3.00/14.0001

Investigator: Michal Novák

Innovation of Mathematics Instruction within Study Programmes at FEEC and FIT, BUT Brno – OPVK 2.2 CZ.1.07/2.2.00/15.0156

Investigator: Zdeněk Šmarda

Differential Equations and Dynamic Equations on Time Scales II – GAČR 201/07/0145

Investigator: Josef Diblík

Oscillatoric and Asymptotic Characterictics of Differential Equations – GAČR 201/08/0469

Investigator: Josef Diblík

Selected Publications

DIBLÍK, J.; BAŠTINEC, J.; ŠMARDA, Z.; BEREZANSKY, L. A final result on the oscillation of solutions of the linear discrete delayed equation $\Delta x(n)=-p(n)x(n-k)$ with a positive coefficient. *Abstract and Applied Analysis.* 2011. vol. 2011,(Article ID 58632). p. 1 - 28. ISSN 1085-3375. (IF(2010)=1,442).

DIBLÍK, J.; BAŠTINEC, J.; ŠMARDA, Z. An explicit criterion for the existence of positive solutions of the linear delayed equation $\dot x(t)=-c(t)x(t-\tau(t))$. *Abstract and Applied Analysis.* 2011. 2011(11). p. 1 - 10. ISSN 1085-3375. (IF(2010)=1,442).

DIBLÍK, J.; HLAVIČKOVÁ, I. Asymptotic behavior of solutions of delayed difference equations. *Abstract and Applied Analysis.* 2011. 2011(Article ID 67196). p. 1 - 24. ISSN 1085-3375. (IF(2010)=1,442).

DIBLÍK, J.; ŠMARDA, Z.; RŮŽIČKOVÁ, M.; ŠUTÁ, Z. Asymptotic convergence of the solutions of a dynamic equation on discrete time scales. *Abstract and Applied Analysis.* 2011. 2011(1). p. 1 - 20. ISSN 1085-3375. (IF(2010)=1,442).

DIBLÍK, J.; KHUSAINOV, D.; RŮŽIČKOVÁ, M.; BOICHUK, A. Boundary-value problems for weakly nonlinear delay differential systems. *Abstract and Applied Analysis.* 2011. 2011(1). p. 1 - 19. ISSN 1085-3375. (IF(2010)=1,442).

ŠMARDA, Z. Bounds of solutions of integrodifferential equations. *Abstract and Applied Analysis.* 2011. 2011(ID 571795). p. 1 - 7. ISSN 1085-3375. (IF(2010)=1,442).

DIBLÍK, J.; NOWAK, C. Compatible and incompatible nonuniqueness conditions for the classical Cauchy problem. *Abstract and Applied Analysis.* 2011. 2011(1). p. 1 - 15. ISSN 1085-3375. (IF(2010)=1,442).

DIBLÍK, J.; BAŠTINEC, J.; KHUSAINOV, D.; DZHALLADOVA, I. Estimates of exponential stability for solutions of stochastic control systems with delay. *Abstract and Applied Analysis.* 2011. 2011(1). p. 1 -14. ISSN 1085-3375. (IF(2010)=1,442).

DIBLÍK, J.; KHUSAINOV, D.; BAŠTINEC, J.; BAŠTINCOVÁ, A.; SHATYRKO, A. Estimates of perturbation of nonlinear indirect interval regulator system of neutral type. *Journal of automation and information sciences.* 2011. 2011 (43)(DOI: 10.1615/JAu). p. 13 - 28. ISSN 1064-2315. (IF(2010)=0,04).

DIBLÍK, J.; ŠMARDA, Z.; SVOBODA, Z.; KHUSAINOV, D. Instable trivial solution of autonomous differential systems with quadratic right-hand sides in a cone. *Abstract and Applied Analysis.* 2011. 2011(Article ID 15491). p. 1 - 23. ISSN 1085-3375. (IF(2010)=1,442).

DIBLÍK, J.; KHUSAINOV, D.; RŮŽIČKOVÁ, M.; BAŠTINCOVÁ, A. On a dynamical model with delay for the economy. *Nonlinear Oscillations.* 2011. 14920110(4). p. 556 - 568. ISSN 1536-0059. (IF(2010)=0,158).

DIBLÍK, J.; ZAFER, A. On stability of linear delay differential equations under Perrons condition. *Abstract and Applied Analysis.* 2011. 2011(1). p. 1 - 9. ISSN 1085-3375. (IF(2010)=1,442).

VÍTOVEC, J.; ŘEHÁK, P. q-Karamata functions and second order q-difference equations. *Electronic Journal of Qualitative Theory of Differential Equations.* 2011. 24 (2011)(4). p. 1 - 20. ISSN 1417-3875. (IF(2010)=0,387).

DIBLÍK, J.; BRAVERMAN, E.; ROGOVCHENKO, Y.; RŮŽIČKOVÁ, M. Recent progress in differential and difference equations. *Abstract and Applied Analysis.* 2011. 2011(Article ID). p. 1 - 19. ISSN 1085-3375. (IF(2010)=1,442).

DIBLÍK, J.; RŮŽIČKOVÁ, M.; SCHMEIDEL, E.; ZBASZYNIAK, M. Weighted asymptotically periodic solutions of linear volterra difference equations. *Abstract and Applied Analysis.* 2011. 2011(1). p. 1 - 14. ISSN 1085-3375. (IF(2010)=1,442).

Bachelor Degree Programme

Matematický seminář (RNDr. Petr Fuchs, Ph.D.)

Matematika 1 (RNDr. Edita Kolářová, CSc.)

Matematika 2 (prof. RNDr. Jan Chvalina, DrSc.)

Matematika 3 (Mgr. Irena Hlavičková, Ph.D.)

Vybrané partie z matematiky (doc. RNDr. Zdeněk Šmarda, CSc.)

Master Degree Programme

Diferenciální rovnice a jejich použití v elektrotechnice (prof. RNDr. Josef Diblík, DrSc.)

Maticový a tenzorový počet (doc. RNDr. Martin Kovár, Ph.D.)

Moderní numerické metody (doc. RNDr. Jaromír Baštinec, CSc.)

Pravděpodobnost, statistika a operační výzkum (doc. RNDr. Jaromír Baštinec, CSc.)

Náhodné procesy (doc. RNDr. Jaromír Baštinec,CSc.)

Kódování v informatice (RNDr. Petr Fuchs, Ph.D.)

Doctoral Degree Programme

Diskrétní procesy v elektrotechnice (prof. RNDr. Josef Diblík, DrSc.)

Statistika, stochastické procesy, operační výzkum (doc. RNDr. Jaromír Baštinec, CSc.)

Laboratories

Computer Laboratories (2) (instruction in Computers and Programming 2, simulation of application mathematical thematic wholes using the Matlab, Maple, Mathematica software, Petr Fuchs)

Computer Laboratory for Mathematical Modelling (data simulation and processing using software StatSoft and MapleSim, Michal Novák)

Department of Microelectronics

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Prof. Ing. Jaroslav Boušek, CSc.
Prof. Ing. Jaromír Brzobohatý, CSc.
Prof. Ing. Vladislav Musil, CSc.
Prof. Ing. Radimír Vrba, CSc.

Associate Professors

Doc. Ing. Lukáš Fujcik, Ph.D.
Doc. Ing. Jiří Háze, Ph.D.
Doc. Ing. Jaromír Hubálek, Ph.D.
Doc. Ing. Jaroslav Kadlec, Ph.D.
Doc. Ing. Fabian Khateb, Ph.D.
Doc. Ing. René Kizek, Ph.D.
Doc. Ing. Radek Kuchta, Ph.D.
Doc. Ing. Pavel Legát, CSc.
Doc. Ing. Ivan Szendiuch, CSc.
Doc. Ing. Josef Šandera, Ph.D.
Doc. Ing. Pavel Šteffan, Ph.D.
Doc. Ing. František Urban, CSc.

Lecturers

Ing. Martin Adámek, Ph.D., Ing. Daniel Bečvář, Ph.D., Ing. Edita Hejátková, Ing. Radovan Novotný, Ph.D., Ing. Jan Prášek, Ph.D., Ing. Roman Prokop, Ph.D., Ing. Ondřej Sajdl, Ph.D., Ing. Jiří Stehlík, Ph.D., Ing. Cyril Vaško, Ing. Michal Pavlík, Ph.D.

Ph.D. Students

Ing. Marek Bohrn, Ing. Martin Buršík, Ing. Ondřej Frantík, Ing. Jiří Hladík, Ing. Radim Hrdý, Ing. David Jaroš, Ing. Nabhan Khatib, Ing. Vilém Kledrowetz, Ing. Petr Kosina, Ing. Martin Magát, Ing. Ladislav Macháň, Ing. Milan Matějka, Ing. Michal Nicák, Ing. Jiří Panáček, Ing. Jan Pekárek, Ing. Marián Pristach, Ing. Boleslav Psota, Ing. Jiří Pulec, Ing. Zdeněk Pytlíček, Ing. Michal Řezníček, Ing. Jiří Sedláček, Ing. Ayad Khazal Shehab, Ing. Daniel Široký, Ing. Olga Švecová, Ing. Jiří Vávra, Ing. Marina Vorozhtsova, Ing. Doaa Yahya, Ing. Jaromír Žák, Ing. Jakub Cieslar, Ing. Martin Holain, Ing. Milan Holík, Ing. Martin Klíma, Ing. Vladimír Levek, Ing. Petr Schnederle, Dina Younes

Administrative and Technical Staff

RNDr. Vojtěch Adam, Ph.D., Bc. Petr Bednář, Ing. Jan Břínek, Jarmila Fučíková, Petra Jedličková, PhDr. Jarmila Jurášová, Ing. Petr Majzlík, Ph.D., Ing. Martin Magát, Mgr. Eva Martincová, Ph.D., Ing. Ondřej Hégr, Ph.D., RNDr. Michal Masařík, Ph.D., Ing. Břetislav Mikel, Ph.D., Bc. David Nejezchleb, Mgr. MichaelaPekarová, Ph.D., Ing. Robert Plaga, Ph.D., Vladislav Pliska, Mgr. Milan Pouch, Mgr. Markéta Ryvolová, Ph.D., Ing. Jiří Sochor, Ing. Marek Šimčák, Ph.D., Ing. Radek Vlach, Ph.D., Mgr. Ondřej Zítka

Main Interests

The department provides tuition in basic subjects, mainly on electronic components and circuits and subjects specialized in design of integrated circuits and microelectronic technology in the new system of Bachelor and follow-up Master programmes.

Research is centred on basic and applied research of integrated circuits, sensors and microelectronic technologies. The main areas of interest are current mode circuits, switching current circuits and evaluation of signals from chemosensors and biosensors, mainly gases and pesticides, microelectrodes modified by nanostructures (nanotubes, nanocolumns), simulation and evaluation of the reliability of 3D linking systems.

The department closely cooperated (student placements) with Technical University in Sofia (Bulgaria) and KHBO Brugge in Belgium, maintained research cooperation with the company Autoflug Hamburg, Catalania University Rovira i Virgili in Tarragona, the research laboratory IMEC-KHBO in Belgium, Yeditepe University Istanbul and King Mongkut's Institute of Technology North Bangkok.

In cooperation with King Mongkut's University of Technology North Bangkok, Yeditepe University Istanbul, University Delhí and Suan Sunandha Rajabhat University oscillators were synthetized using newly developed active elements CDTA, ZC-CDTA and ZC-CG-CDBA. Research of memristive systems has been conducted in cooperation with Professor Massimiliano Di Ventra of the Department of Physics, University of California, San Diego, who is recognized as the successor of Professor Chua in applications of memo-systems in artificial intelligence and nanotechnology.

In close cooperation with Pbt Rožnov pod Radhoštěm new cleaning methods have been devised in connection with manufacturing of modern cleaning equipment (with focus on after-soldering cleaning and cleaning of templates). Prototypes of sensors developed on the principle of balance thermodynamics (cooperation with HIT s.r.o.) were tested. In cooperation with TU Wien new types of flow sensors were implemented by the LTCC.

In cooperation with Joint Research Center, Institute for Energy, Petten, Holland the group led by J. Boušek tested newly developed hydrogen sensors. Results were published in the impact International Journal of Hydrogen Energy. The group continued research of sputtered passivation and antireflection layers of crystalline solar cells.

Major Achievements

In 2011 members of the department were involved in 3 projects of the 6th FP EU and in 3 projects of the 7th FP EU in programmes ARTEMIS JU and ENIAC JU, 7 GAČR, 1 GAAV, 10 FRVŠ, 6 MPO, 2 TAČR projects and 1 project of the National Research Programme of the Ministry of Education.

In June 2011 the department organized the international conference 'Electronic Devices and Systems EDS 2011' with participation of Czech and international experts. There were 60 papers on microelectronics and technology.

The group involved in microelectronic technology headed by I. Szendiuch focused on lead-free solders, their service life and longterm reliability of soldered connections which were the subject of a TAČR project. Research and development of cleaning methods continued in compliance with the requirements of environmental management. Another area of interest was modelling of thermal stress in soldered connections and casing in ANSYS, including contacting and modelling contacts of semiconductor chips, in cooperation with industrial partners. The unique thermal balance sensor (MPO project) was implemented, and testing of prototypes in industrial applications was completed. A patent application 'Dispensing Apparatus Arrangement for Selective Deposition of Pastes and Adhesives' was submitted. Results were published and presented at Web of Science (ISI) conferences.

The group LabSensNano (Laboratory of Microsensors and Nanotechnology) led by J. Hubálek continued research and developement

of chemical sensors and biosensors for medical and environmental applications. They devised a unique method for fast detection of viruses implementable on Lab on a chip, elaborated a methodology for in-vivo imaging making use of quantum dot, designed a system for electrochemical mass-screening using a sensor field and eight-channel device. The group registered a utility sample for an automated device for deposition of nanostructures and submitted two patent applications, one on this device and the other on separation of biological substances in analysis. Research results were published in several impact journals and presented at ISI WOS conferences.

Professor D. Biolek led the team involved in development of models of the so called mem-systems focused on memristors, memcapacitors and memconductors, development of non-conventional active elements for analog signal processing, electronic tuning, tunable current-mode oscillators and frequency filters based on non-conventional active elements. In 2011 numerous responses were received, among them citations on Web of Science (ISI).

In research of non-conventional microelectronic active elements a number of novel circuit principles were devised - ZC-CITA (Z-Copy Current Inverter Transconductance Amplifier), VD-DIBA (Voltage-Differencing Differential Input Buffered Amplifier), CFBTA (Current Follower Buffered Transconductance Amplifier), CIBTA (Current Inverter Buffered Transconductance Amplifier), CIBDITA (Current Inverter Buffered Differential Input Transconductance Amplifier) and ZC-CG-CDBA (Z Copy – Controlled Gain – Current Differencing Buffered Amplifier). An outstanding achievement was the article published in 'Journal on Circuit Theory and Applications', a journal with the highest impact factor, dealing with the theory of circuits.

Major Research Projects

E3Car Nanoelectronics for an Energy Efficient Electrical Car – ENIAC JU Project 120001 (FP7)

Investigator: Radimír Vrba

Memristive, Memcapacitive and Meminductive Systems: Basic Research, Modelling and Simulation – GAČR P102/10/1614

Investigator: Dalibor Biolek

Research and Development of Digitally Tunable Integrated Circuits Operating in Mixed Mode – GAČR 102/09/1628

Investigator: Radimír Vrba

Novel Constructions and Utilization of Nanobiosensors and Nanosensors in Medicine (NANOSE-MED) – GA AV ČR KAN208130801

Investigator: Jaromír Hubálek

New Trends in Microelectronic Systems and Nanotechnologies (MIKROSYN) – MŠMT ČR MSM0021630503

Investigator: Radimír Vrba

Selected Publications

ZÍTKA, O.; ŠKUTKOVÁ, H.; ADAM, V.; TRNKOVÁ, L.; BABULA, P.; HUBÁLEK, J.; PROVAZNÍK, I.; KIZEK, R. A New Approach how to Define the Coefficient of Electroactivity of Adenine and Its Twelve Derivatives Using Flow Injection Analysis with Amperometric Detection. *ELECTROANALYSIS.* 2011. 23(7). p. 1556 - 1567. ISSN 1040-0397. (IF(2010)=2,721).

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Bachelor Degree Programme

Analogové elektronické obvody
(prof. Ing. Dalibor Biolek, CSc.)

Diagnostika a testování elektronických systémů
(prof. Ing. Vladislav Musil, CSc.)

Digitální obvody a mikroprocesory
(prof. Ing. Radimír Vrba, CSc.)

Elektronické součástky
(prof. Ing. Jaroslav Boušek, CSc.)

Elektrovakuové přístroje a technika nízkých teplot
(doc. Ing. Josef Šandera, Ph.D.)

Mikroelektronické praktikum
(doc. Ing. Josef Šandera, Ph.D.)

Mikroelektronika a technologie součástek
(doc. Ing. Ivan Szendiuch, CSc.)

Mikrosenzory a mikromechanické systémy
(doc. Ing. Jaromír Hubálek, Ph.D.)

Modelování a počítačová simulace
(prof. Ing. Dalibor Biolek, CSc.)

Návrh a konstrukce elektronických přístrojů
(prof. Ing. Vladislav Musil, CSc.)

Návrh analogových integrovaných obvodů
(doc. Ing. Jiří Háze, Ph.D.)

Optoelektronika a optické komunikace
(doc. Ing. František Urban, CSc.)

Podnikatelské minimum
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Master Degree Programme

Analogové integrované obvody
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Aplikovaná počítačová technika
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Konstrukce a technologie elektronických zařízení
(prof. Ing. Vladislav Musil, CSc.)

Metody návrhu analogových integrovaných
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Metody návrhu digitálních integrovaných obvodů
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Microelectronics in English
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Mikroelektronické obvody
(Ing. Daniel Bečvář, Ph.D.)

Mikroelektronické prvky a struktury
(Ing. Ondřej Hégr, Ph.D.)

Modelování a simulace v mikroelektronice
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Moderní technologie elektronických obvodů
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Návrh elektronických přístrojů
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Podnikatelské minimum
(doc. Ing. Pavel Legát, CSc.)

Praktické minimum podnikatele
(doc. Ing. Pavel Legát, CSc.)

Řízení jakosti
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Teorie vzájemného převodu analogového
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(doc. Ing. Jiří Háze, Ph.D.)

Vakuová technika
(doc. Ing. Jaroslav Boušek, CSc.)

Výroba součástek a konstrukčních prvků
(doc. Ing. Ivan Szendiuch, CSc.)

Doctoral Degree Programme

Mikroelektronické systémy
(prof. Ing. Vladislav Musil, CSc.)

Mikroelektronické technologie
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Laboratories

Laboratory of Electronic Components (instruction in Electronic Components, Analog Electronic Circuits, Ondřej Hégr, Jaroslav Boušek)

Laboratory of Microsensors and Nanotechnologies (research laboratory of chemistry, chemical sensors, development of electronic devices, electron microscopy, Jaromír Hubálek)

Laboratory of Microelectronic Technology (thick films, solder surface mount, lead-free soldering and casing, instruction in Microelectronics and Assembly Technology, Manufacturing of Components and Construction Elements, Modern Technology of Electronic Circuits and Systems, student projects, Ivan Szendiuch)

Laboratory of Vacuum Technology (research and development laboratory, Jaroslav Boušek, Josef Šandera)

Laboratory of Microsensors (instruction in Microsensors and Micromechanical Systems, Jaromír Hubálek)

Design Laboratory of Electronic Devices and Systems (instruction in Digital Circuits and Microprocessors, electronic Systems, Analog/Digital Signal Conversion, student projects, Pavel Šteffan)

Laboratory of Integrated Circuit Design (instruction in Design of Analog Integrated Circuits and Design of Digital Integrated Circuits, student projects, Roman Prokop)

Laboratory of Optoelectronics and Laser Technology (instruction in Optoelectronics, student projects, František Urban)

Computer Laboratory (computer exercises for various subjects, self-study, Internet, David Nejezchleb, Jan Prášek)

Laboratory for Semiconductor Components Characterization – Testing of Chips (instruction in Manufacturing of Components and Construction Elements, student projects, Jaromír Hubálek)

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Main Interests

Research is focused on modern electronic circuits, novel signal processing methods, microwave circuits and antennas. Our areas of interest are mobile, satellite and optical communications, television technology, microprocessor technology and low-frequency electronics and electromagnetic compatibility.

In 2011 research was supported by two research plans, two projects of the Operational Programme 'Education for Competitiveness' and one research centre. The staff participated in Czech Science Foundation projects (8 standard, 4 post-graduate a 2 doctoral projects). The department was also involved in 6 MPO projects.

We were also involved in 3 FP7 projects and 3 COST projects, cooperated in 2 contracts for international partners (Volkswagen, EGSTON) and nearly 10 contracts for Czech partners. In 2011 activities of the department were supported by the company T-Mobile.

Research results are immediately incorporated in Bachelor, Master and Ph.D. programmes. Upgrading of the educational process was supported by 20 FRVŠ projects. Financial support was also received from partner companies.

The department cooperates with many organizations and societies. Staff members are engaged in the committee of the Czech and Slovak section of IEEE. The department supports activities of the Radioclub OK2KOJ and Student Section of IEEE at Brno University of Technology. There has been active cooperation with the Czech Electrotechnical Society. The department is a collective member of the international organization AMSAT.

Major Achievements

The department continued, in cooperation with Departments of Telecommunications, Microelectronics and Physics, building the regional 'Centre of Applied Research SIX' (Centre of Sensoric, Information and Communication Systems) with completion scheduled for 2012.

The research teams involved in the 'Programme of Microwave Technology' and 'Programme of Wireless Technology' of Centre SIX have been intensively preparing for international research cooperation within the framework of the OP VK WICOMT project 'Wireless Communication Teams'. Responsible for preparation of the 'Programme of Microwave Technology' is Professor Hans Hartnagel of Technical University Darmstadt, the 'Programme of Wireless Technology' is led by Dr. Michal Ries of Technische Universitat Wien.

In 2011 the department joined international activities of COST (IC1101 Optical Wireless Communications - An Emerging Technology, IC1102 Versatile, Integrated, and Signal-aware Technologies for Antennas (VISTA) and IC1004 Cooperative Radio Communications for Green Smart Environments).

In addition to the two FP7 projects (HIRF-SE, High Intensity Radiated Field – Synthetic Environment, ACOST, Advanced Communication Systems and Technologies) our team joined the project ARTEMOS (Agile RF Transceivers and Front-Ends for Future Smart Multi-Standard Communication Applications).

In 2011 we continued cooperation with Volkswagen, T-Mobile Czech Republic, OMICRON and AVX. The department started cooperation with EGSTON and Marsays, and was involved in four projects of the programme Centrope Vouchers (cooperation between a university and a company from two different Central European countries).

Major Research Projects

Advanced Communication Systems and Technologies – FP7, 230126

Investigator: Zdeněk Kolka

Agile RF Transceivers and Front-Ends for Future Smart Multi-Standard Communications Applications – FP7, 270683-2

Investigator: Tomáš Kratochvíl

Center of Sensoric, Information and Communication Systems (SIX) – MŠMT CZ.1.05/2.1.00/03.0072

Investigator: Zbyněk Raida

Wireless Communication Teams (WICOMT) – MŠMT CZ.1.07/2.3.00/20.0007

Investigator: Zbyněk Raida

High Intensity Radiated Fields – Synthetic Environment – FP7, 205294

Investigator: Zbyněk Raida

Selected Publications

KADLEC, P.; RAIDA, Z. A Novel Multi-Objective Self-Organizing Migrating Algorithm. *Radioengineering.* 2011. 20(4). p. 804 - 816. ISSN 1210-2512. (IF(2010)=0,503).

LÁČÍK, J. Acceleration of Marching on in Time Method for TD-EFIE by Equivalent Dipole Moment Method and its Analysis. *Radioengineering.* 2011. 20(3). p. 569 - 574. ISSN 1210-2512. (IF(2010)=0,503).

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POLÁK, L.; KRATOCHVÍL, T. Analysis and Simulation of the Transmission Distortions of the Mobile Digital Television DVB-SH Part 1: Terrestrial mode DVB-SH-A with OFDM. *Radioengineering.* 2011. 21(4). p. 1 - 9. ISSN 1210-2512. (IF(2010)=0,503).

ŘÍČNÝ, V.; SLANINA, M. Analysis of Resolution in Aerial Earth Surface Photography. *Radioengineering.* 2011. 20(1 (part I)). p. 126 - 129. ISSN 1210-2512. (IF(2010)=0,503).

SIGMUND, M.; ZELINKA, P. Analysis of Voiced Speech Excitation Due to Alcohol Intoxication. *Information Technology and Control.* 2011. 40(2). p. 145 - 150. ISSN 1392-124X. (IF(2010)=0,638).

KOVÁCS, P.; BARTYZAL, J.; BOŠTÍK, T.; MIKULÁŠEK, T.; PUSKELY, J.; RAIDA, Z.; SLÁMA, L.; VOREK, J.; WOLANSKÝ, D. Antenna arrays for tactical communication systems: a comparative study. *Radioengineering.* 2011. 20(4). p. 1 - 11. ISSN 1210-2512. (IF(2010)=0,503).

DIMITRIJEVIC, B.; MILOSEVIC, N.; MARŠÁLEK, R.; NIKOLIC, Z. BPSK Receiver Based on Recursive Adaptive Filter with Remodulation. *Radioengineering.* 2011. 2011 (20)(4). p. 932 - 936. ISSN 1210-2512. (IF(2010)=0,503).

WOLANSKÝ, D.; TKADLEC, R. Coaxial Filters Optimization Using Tuning Space Mapping in CST Studio. *Radioengineering.* 2011. 20(1). p. 289 - 294. ISSN 1210-2512. (IF(2010)=0,503).

BRANČÍK, L.; ŠEVČÍK, B. Computer Simulation of Nonuniform MTLs via Implicit Wendroff and State-Variable Methods. *Radioengineering.* 2011. 20(1). p. 221 - 227. ISSN 1210-2512. (IF(2010)=0,503).

ŠOTNER, R.; JEŘÁBEK, J.; PROKOP, R.; VRBA, K. Current gain controlled CCTA and its application in quadrature oscillator and direct frequency modulator. *Radioengineering.* 2011. 20(1). p. 317 - 326. ISSN 1210-2512. (IF(2010)=0,503).

DVOŘÁK, R.; URBANEC, T. Data processing in multiport-based reflectometer systems. *Radioengineering.* 2011. 2011(4). p. 832 - 837. ISSN 1210-2512. (IF(2010)=0,503).

BRANČÍK, L. Error Analysis at Numerical Inversion of Multidimensional Laplace Transforms based on Complex Fourier Series Approximation. *IEICE TRANSACTIONS ON FUNDAMENTALS OF ELECTRONICS COMMUNICATIONS AND COMPUTER SCIENCES.* 2011. E94-A(3). p. 999 - 1001. ISSN 0916-8508. (IF(2010)=0,291).

KOUDELKA, V.; RAIDA, Z. Evaluation of Electromagnetic Immunity of Layered Structures by Neural Networks. *IET Microwaves Antennas & Propagation.* 2011. vol. 5(4). p. 482 - 488. ISSN 1751-8725. (IF(2010)=0,682).

GÖTTHANS, T.; PETRŽELA, J. Experimental study of the sampled labyrinth chaos. *Radioengineering.* 2011. 20(4). p. 420 - 426. ISSN 1210-2512. (IF(2010)=0,503).

PETRŽELA, J.; GÖTTHANS, T. Chaotic Oscillators with Single Polynomial Nonlinearity and Digital Sampled Dynamics. *Przeglad Elektrotechniczny.* 2011. 3(1). p. 161 - 163. ISSN 0033-2097. (IF(2010)=0,242).

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PETRŽELA, J.; GÖTTHANS, T.; HRUBOŠ, Z. Modeling deterministic chaos using electronic circuits. *Radioengineering.* 2011. 20(2). p. 438 - 444. ISSN 1210-2512. (IF(2010)=0,503).

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ŠOTNER, R.; ŠEVČÍK, B.; BRANČÍK, L.; DOSTÁL, T. Multifunctional Adjustable Biquadratic Active RC Filters: Design Approach by Modification of Corresponding Signal Flow Graphs. *Przeglad Elektrotechniczny.* 2011. 87(2). p. 225 - 229. ISSN 0033-2097. (IF(2010)=0,242).

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ŠOTNER, R.; JEŘÁBEK, J.; ŠEVČÍK, B.; DOSTÁL, T.; VRBA, K. Novel Solution of Notch/All-pass Filter with Special Electronic Adjusting of Attenuation in the Stop Band. *Elektronika Ir Elektrotechnika.* 2011. 16 (2011)(7 (113)). p. 37 - 42. ISSN 1392-1215. (IF(2010)=0,659).

ŠEBESTA, V.; MARŠÁLEK, R.; FEDRA, Z. OFDM Signal Detector Based on Cyclic Autocorrelation Function and its Properties. *Radioengineering.* 2011. 2011 (20)(4). p. 926 - 931. ISSN 1210-2512. (IF(2010)=0,503).

SLEZÁK, J.; ŠOTNER, R.; PETRŽELA, J. On the derivation of Piecewise-Linear Chaotic Oscillators using Simulated Annealing Method and Hspice. *Przeglad Elektrotechniczny.* 2011. 87(1). p. 262 - 265. ISSN 0033-2097. (IF(2010)=0,242).

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ŠOTNER, R.; ŠEVČÍK, B.; SLEZÁK, J.; PETRŽELA, J.; BRANČÍK, L. Sinusoidal Oscillator based on Adjustable Current Amplifier and Diamond Transistors with Buffers. *Przeglad Elektrotechniczny.* 2011. 87(1). p. 266 - 270. ISSN 0033-2097. (IF(2010)=0,242).

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BRANČÍK, L. Time and Laplace-domain methods for MTL transient and sensitivity analysis. *COMPEL The international journal for computation and mathematics in electrical and electronic engineering.* 2011. 30(4). p. 1205 - 1223. ISSN 0332-1649. (IF(2010)=0,394).

KOLKA, Z.; VLK, M.; HORÁK, M. Topology Reduction for Approximate Symbolic Analysis. *Radioengineering.* 2011. 20(1). p. 252 - 256. ISSN 1210-2512. (IF(2010)=0,503).

Bachelor Degree Programme

Analogové elektronické obvody
(prof. Ing. Lubomír Brančík, CSc.)

Návrh analogových filtrů (Ing. Jiří Petržela, Ph.D.)

Elektromagnetická kompatibilita
(Ing. Jiří Dřínovský, Ph.D.)

Elektromagnetické vlny, antény a vedení
(prof. Dr. Ing. Zbyněk Raida)

Elektronické praktikum (Ing. Ivana Jakubová)

Impulzová a číslicová technika
(doc. Ing. Tomáš Frýza, Ph.D.)

Komunikační systémy
(doc. Ing. Aleš Prokeš, Ph.D.)

Mikroprocesorová technika a embedded systémy
(doc. Ing. Tomáš Frýza, Ph.D.)

Napájení elektronických zařízení
(Ing. Michal Kubíček, Ph.D.)

Nízkofrekvenční a audio elektronika
(doc. Ing. Tomáš Kratochvíl, Ph.D.)

Základy optických komunikací a ptoelektronika
(prof. Ing. Otakar Wilfert, CSc.)

Počítače a programování 2
(doc. Ing. Jiří Šebesta, Ph.D.)

Počítačové řešení elektronických obvodů
(prof. Dr. Ing. Zdeněk Kolka)

Počítačové řešení komunikačních systémů
(Ing. Petr Vágner, Ph.D.)

Rádiové a mobilní komunikace
(prof. Ing. Stanislav Hanus, CSc.)

Rádiové přijímače a vysílače
(doc. Ing. Aleš Prokeš, Ph.D.)

Signály a soustavy
(prof. Ing. Milan Sigmund, CSc.)

Moderní bezdrátová komunikace
(Ing. Martin Slanina, Ph.D.)

Vysokofrekvenční a mikrovlnná technika
(Ing. Petr Vágner, Ph.D.)

Vysokofrekvenční technika a antény
(prof. Ing. Miroslav Kasal, CSc.)

Základy televizní techniky
(prof. Ing. Stanislav Hanus, CSc.)

Master Degree Programme

Advanced radio communication systems
(Ing. Martin Slanina, Ph.D.)

Softwarové rádio
(doc. Ing. Roman Maršálek, Ph.D.)

Antény a šíření rádiových vln
(Ing. Zbyněk Lukeš, Ph.D.)

CAD v mikrovlnné technice
(prof. Dr. Ing. Zbyněk Raida)

Digitální televizní systémy
(doc. Ing. Tomáš Kratochvíl, Ph.D.)

Elektronik in Deutsch
(prof. Ing. Milan Sigmund, CSc.)

Fotonika a optické komunikace
(Ing. Lucie Hudcová, Ph.D.)

Kvantová a laserová elektronika
(prof. Ing. Otakar Wilfert, CSc.)

Mikrokontrolery pro přístrojové aplikace
(Ing. Zbyněk Fedra, Ph.D.)

Mikrovlnná integrovaná technika
(Ing. Zbyněk Lukeš, Ph.D.)

Navrhování rádiových spojů
(Ing. Jaroslav Láčík, Ph.D.)

Počítačové a komunikační sítě
(prof. Dr. Ing. Zdeněk Kolka)

Počítačové systémy a jejich aplikace
(Ing. Zbyněk Fedra, Ph.D.)

Programovatelné logické obvody
(Ing. Michal Kubíček, Ph.D.)

Radioelektronická měření
(Ing. Jiří Dřínovský, Ph.D.)

Radiolokační a radionavigační systémy
(doc. Ing. Jiří Šebesta, Ph.D.)

Směrové a družicové spoje
(prof. Ing. Miroslav Kasal, CSc.)

Systémy mobilních komunikací
(Ing. Jan Prokopec, Ph.D.)

Teorie elektronických obvodů
(Ing. Jiří Petržela, Ph.D.)

Teorie rádiové komunikace
(doc. Ing. Roman Maršálek, Ph.D.)

Videotechnika a multimediální technika
(Ing. Martin Slanina, Ph.D.)

Doctoral Degree Programme

Moderní digitální bezdrátová komunikace
(prof. Ing. Milan Sigmund, CSc.)

Návrh moderních elektronických obvodů
(prof. Dr. Ing. Zdeněk Kolka)

Laboratories

Laboratory of Analog Electronic Circuits (instruction in analog technology, Ivana Jakubová)

Laboratory of Low-Frequency Applications (instruction in audio technology, lf electronics and power supply systems for electronic devices, Tomáš Kratochvíl)

Laboratory of Signals and Digital Technology (instruction in signals and digital technology, Viera Biolková)

Laboratory of Microprocessor Technology (instruction in microprocessor and microcomputer technology, Tomáš Frýza)

Laboratory of Communication Systems (research and instruction in communication systems and data transmission, Aleš Prokeš)

Laboratory in Optoelectronics and Photonics (instruction in optoelectronics, photonics and optical communications, Otakar Wilfert)

Laboratory of TV and Video Technology (instruction in analog and digital TV and video technology, Tomáš Kratochvíl)

Laboratory of Microwave Technology (research and instruction in microwave technology and special electronic components, Tomáš Urbanec)

Laboratory of Mobile Communication (research and instruction in mobile wireless communications and systems, Stanislav Hanus, Jan Prokopec)

Laboratory of Antennas and Electromagnetic Field (research and instruction in EM fields, antennas and design of radio links, Jaroslav Láčík)

Laboratory of Radio Relay and Satellite Communication (instruction in radio and satellite communication, radiolocation and navigation, Miroslav Kasal)

Laboratory for Student Research (student projects, theses, self-study, Jiří Šebesta)

Electronic Technology Laboratory (dry and wet techniques for printed circuit boards, photographic production of patterns, Aleš Vanžura)

PC Laboratory (two laboratories for computer-aided exercises in circuits, signals and systems, special areas of radioelectronics and communication technology, Zbyněk Fedra)

Research Laboratory of Experimental Satellite Communicaton (research and development of subsystems for satellite communication and navigation, telemetric and command stations of experimental AMSAT satellites, Miroslav Kasal)

Department of Telecommunications

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Prof. Ing. Zdeněk Smékal, CSc.
Prof. Ing. Kamil Vrba, CSc.

Associate Professors

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Doc. Ing. Otto Dostál, CSc.
Doc. Ing. Dan Komosný, Ph.D.
Doc. Ing. Ivo Lattenberg, Ph.D.
Doc. Ing. Jiří Mišurec, CSc.,
Doc. Ing. Karol Molnár, Ph.D.
Doc. Ing. Vít Novotný, Ph.D.
Doc. Ing. Ivan Rampl, CSc.
Doc. Ing. Vladislav Škorpil, CSc.
Doc. Ing. Václav Zeman, Ph.D.

Lecturers

Ing. Hicham Atassi, Ing. Miroslav Balík., Ph.D., Ing. Radim Burget, Ph.D., Ing. Vladimír Červenka, Ing. Petr Číka, Ph.D., Ing. Radim Číž, Ph.D., Ing. Vít Daněček, Ing. Jan Hajný, Ing. Pavel Hanák, Ing. Norbert Herencsár, Ph.D., Ing. Jiří Hošek, Ph.D., Ing. Jan Jeřábek, Ph.D., Ing. Ladislav Káňa, Ing. Jan Karásek, Ing. Jaroslav Koton, Ph.D. Ing. Martin Koutný, Ph.D., Ing. Ondřej Krajsa, Ph.D., Ing. David Kubánek, Ph.D., Ing. Anna Kubánková, Ph.D., Ing. Petra Lambertová, Ing. Jaromír Mačák, Ing. Zdeněk Martinásek, Ing. Jiří Mekyska, Ing. Ivan Míča, Ing. Petr Mlýnek, Ing. Petr Münster, Ing. Tomáš Pelka, Ing. Libor Potúček, Ing. Jiří Přinosil, Mgr. Pavel Rajmic,Ph.D., Ing. Lukáš Růčka, Ing. Kamil Říha, Ph.D., Ing. Jiří Schimmel, Ph.D., Ing. Jiří Sobotka, Ing. Petr Sysel, Ph.D., Ing. Pavel Šilhavý, Ph.D., Ing. Milan Šimek, Ph.D., Ing. Jan Špiřík, Ing. Pavel Vajsar

Ph.D. Students

Ing. Patrik Babnič, Ing. Jiří Balej, Ing. Milan Bartl, Ing. Vladislav Bartošík, Ing. Radek Beneš, Ing. Miroslav Botta, Ing. Radek Červenec, Ing. Vladimír Červenka, Ing. Vít Daněček, Ing. Radek Doležel, Ing. Pavel Dvořák, Ing. Pavel Endrle, Ing. Milan Grenar, Ing. Jan Hajný, Ing. Martin Hasmanda, Ing. Václav Henzl, Ing. Mojmír Jelínek, Ing. Tomáš Jelínek, Ing. Jan Karásek, Ing. Hasan Khaddour, Ing. Radko Krkoš, Ing. Aleš Křupka, Ing. Pavel Kubíček, Ing. David Kurc, Ing. Jaromír Mačák, Ing. Václav Mach, Ing. Tomáš Mácha, Ing. Nermin Makhlouf, Ing. Lukáš Malina, Ing. Zdeněk Martinásek, Ing. Jiří Mekyska, Ing. Petr Mlýnek, Ing. Patrik Morávek, Ing. Ondřej Morský, Ing. Petr Mrákava, Ing. Ľubomír Mráz, Ing. Jakub Müller, Ing. Petr Münster, Ing. Luboš Nagy, Ing. Yara Omran, Ing. Kristián Orlovský, Ing. Aleš Pospíšil, Ing. Radek Pospíšil, Ing. Zdeněk Průša, Ing. Ondřej Rášo, Ing. Pavel Reichert, Ing. Aleš Roček, Ing. Martin Rosenberg, Ing. Lukáš Růčka, Ing. Jiří Sobotka, Ing. Peter Stančík, Ing. Ivo Strašil, Ing. Martin Sýkora, Ing. Juraj Szőcs, Ing. Jakub Šedý, Ing. Radim Šifta, Ing. Ondřej Šmirg, Ing. Jan Špiřík, Ing. Jan Šporik, Ing. Vladimír Tejkal, Ing. Michal Trzos, Ing. Václav Uher, Ing. Pavel Vajsar, Ing. Lukáš Verner, Ing. Petr Vychodil, Ing. Ján Zátyik, Ing. Martin Zukal

Administrative and Technical Staff

RNDr. Petr Bílek, Jitka Halousková, Jaroslav Klon, Mgr. Otakar Kříž, Magda Lounková, Bc. Jaroslav Meixner, Jana Nosková, Pavel Novotný, Lukáš Pazdera, Robert Pernica, Bohuslava Raidová, Jitka Šichová

Main Interests

Department of Telecommunications develops the Bachelor programme study area Teleinformatics and Master programme study area Telecommunications and Information Technology. The conception reflects the currently progressing convergence of communication and information technologies. Instruction seeks balance between mobile and stationary communications, includes computer systems and networks, design of network applications in different programming languages. Students are instructed in design of analog and digital circuits, microprocessors and signal processors and their applications. They can specialize in media informatics i.e. digital processing of speech, music or images. There is a follow-up Ph.D. study area Teleinformatics.

The department has been successful in obtaining funding from various educational and research programmes. In 2011 our research and development teams were involved in projects relating to basic and applied research yielding more than 36 mil. CZK. A research team has been very successful in providing up-to-date multimedia service via mobile and wireless network. Several members of the team are involved in industrial research and developement within the framework of the MPO programme. Close cooperation continued with companies GiTy a.s., DISK Multimédia s.r.o., WESTCOM s.r.o., ENJOY s.r.o., MEgA-Měřicí Energetické aparáty, Retia s.r.o. and Satturn Holešov s.r.o. The practical outcome is the development of user-friendly videoconferencing, modular architecture of information and videoconferencing systems, development of a new generation IP communication system, transmission of telemetric data from domestic wastewater treatment plants, sewage plants, etc. There were commercial contracts with Siemens and Honeywell. The department has been extensively involved in building of the 'Centre of Sensoric, Information and Communication Systems'.

Major Achievements

The main research interests of the department are converged information and communication systems focused on media informatics, but also electronic systems for medical technology. In 2011 research was targeted at the following issues:

Research and development of HW and SW end-user devices (telephone, fixed and mobile networks, modems, etc.), design and development of the telephone exchange I-tel and special equipment for telephone exchanges.

Cryptographic protection of communication and information systems, data networks and data protection, protection of electronic archives).

Verification of the behaviour of new algorithms and protocols for data networking in the simulation environment OPNET Modeler. Monitoring and analysis of data network operation. Design of advanced traffic telematic systems.

Design and implementation of algorithms for digital processing of speech and music signals for telecommunication and multimedia applications, embedded systems for acoustic signal processing and software for these systems.

Communication systems for crisis management in cities and municipalities (e.g. monitoring of pollution and snow loads on roofs), agricultural activity (soil retention monitoring, landslides).

Development of electronic devices for medical data transmission and processing, design and implementation of algorithms for processing and analysis of biomedical signals (NMR and CT tomography and ultrasound) and 3D modelling of parts of human body for diagnostics and surgery.

Research and development of telemetric systems, remote data collection systems, systems for wireless sensoric networks, networks for industrial data collection and control (smart

grids for power plants, waterworks, sewage plants, heating plants, transport, etc.).

Design and optimization of algorithms for digital processing of signals (digital filters, signal detection, spectral analysis, etc.), implementation of algorithms for digital signal processing in signal processors and microcontrollers (DSP56300, MSC568300, TMS320C6400, TMS320C5500, Microchip PIC16, PIC18).

Design of digitally controlled circuits and systems (communication with converters, digitally controlled current and voltage amplifiers, power generators).

Design of optical networks and industrial applications, measurement and monitoring of optical networks).

Research and design of systems of speech and image processing, protected archiving of multimedia systems, evaluation of emotions in speech and mimics.

Major Research Projects

Applied Research and Development of Systems for Remote Control of the Quality of Electrical Power Supply – MPO FR-TI1/075

Investigator: Jiří Mišurec

Specific MR and Ultrasound Imaging Methods for Study of Jaw Joints – GAČR 102/07/1086

Investigator: Zdeněk Smékal

Utilization of Active Current Elements in Linear and Nonlinear Applications – GAČR 102/07/P353

Investigator: David Kubánek

Computer Automation of Methods for Synthesis of Linear Operating Blocks and Research of Novel Active Elements – GAČR 102/09/1681

Investigator: Kamil Vrba

Combined Methods of Biometric Identification in Increasing Security of Higher Risk Premises – MV ČR P/10/024

Investigator: Kamil Vrba

Selected Publications

HERENCSÁR, N.; LAHIRI, A.; VRBA, K.; KOTON, J. *An electronically tunable current-mode quadrature oscillator using PCAs.* INTERNATIONAL JOURNAL OF ELECTRONICS. 2011. 98(12). p. 1 - 13. ISSN 0020-7217. (IF(2010)=0,257).

HAJNÝ, J.; ZEMAN, V. *Anonymous Authentication with Spread Revelation.* CRYPTOLOGIA. 2011. 35(3). p. 235 - 245. ISSN 0161-1194. (IF(2010)=0,186).

KOTON, J.; HERENCSÁR, N.; VRBA, K. *Current and Voltage Conveyors in Current- and Voltage-Mode Precision Full-Wave Rectifiers.* Radioengineering. 2011. 20(1). p. 19 - 24. ISSN 1210-2512. (IF(2010)=0,503).

KOTON, J.; LAHIRI, A.; HERENCSÁR, N.; VRBA, K. *Current-Mode Dual-Phase Precision Full-Wave Rectifier Using Current-Mode Two-CellWinner-Takes-All (WTA) Circuit.* Radioengineering. 2011. 20(2). p. 428 - 432. ISSN 1210-2512. (IF(2010)=0,503).

MORÁVEK, P.; KOMOSNÝ, D.; ŠIMEK, M.; GIRBAU, D.; LÁZARO, A. *Energy Analysis of Received Signal Strength Localization in Wireless Sensor Networks.* Radioengineering. 2011. 10(4). p. 937 - 945. ISSN 1210-2512. (IF(2010)=0,503).

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JEŘÁBEK, J.; ŠOTNER, R.; VRBA, K. *Tunable universal filter with current follower and transconductance amplifiers and study of parasitic influences.* Journal of Electrical Engineering. 2011. 62(6). p. 317 - 326. ISSN 1335-3632. (IF(2010)=0,278).

HERENCSÁR, N.; KOTON, J.; JEŘÁBEK, J.; VRBA, K.; CICEKOGLU, O. *Voltage-Mode All-Pass Filters Using Universal Voltage Conveyor and MOSFET-Based Electronic Resistors.* Radioengineering. 2011. 20(1). p. 10 - 18. ISSN 1210-2512. (IF(2010)=0,503).

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Bachelor Degree Programme

Analogová technika (prof. Ing. Kamil Vrba, CSc.)

Analýza signálů a soustav (prof. Ing. Zdeněk Smékal, CSc.)

Architektura sítí (doc. Ing. Vít Novotný, Ph.D.)

CISCO akademie I, (doc. Ing. Dan Komosný, Ph.D.)

CISCO akademie II, V, (Ing. Milan Šimek, Ph.D.)

CISCO akademie III, (Ing. Jan Jeřábek, Ph.D.)

CISCO akademie IV, (Ing. Radim Burget, Ph.D.)

Číslicové filtry (Ing. Petr Sysel, Ph.D.)

Číslicové zpracování signálů (doc. Ing. Jiří Mišurec, CSc.)

Datová komunikace (Ing. Pavel Šilhavý, Ph.D.)

Elektroakustika (Ing. Jiří Schimmel, Ph.D.)

Hardware počítačových sítí (doc. Ing. Karol Molnár, Ph.D.)

Komunikační technologie (Ing. Ivo Herman, CSc.)

Konstrukce elektronických zařízení (prof. Ing. Kamil Vrba, CSc.)

Objektově orientované programování (doc. Ing. Ivo Lattenberg, Ph.D.)

Multimediální služby (Ing. Petr Číka, Ph.D.)

Praktikum z informačních sítí (doc. Ing. Karol Molnár, Ph.D.)

Přenosová média (prof. Ing. Miloslav Filka, CSc.)

Přístupové a transportní sítě (doc. Ing. Vladislav Škorpil, CSc.)

Síťové operační systémy (doc. Ing. Dan Komosný, Ph.D.)

Studiová a hudební elektronika (Ing. Jiří Schimmel, Ph.D.)

Zabezpečovací systémy (doc. Ing. Karel Burda, CSc.)

Vysokorychlostní komunikační systémy (doc. Ing. Vladislav Škorpil, CSc.)

Základy počítačové sazby a grafiky (Mgr. Pavel Rajmic, Ph.D.)

Master Degree Programme

Bezpečnost informačních systémů (doc. Ing. Karel Burda, CSc.)

CISCO akademie II, V, (Ing. Milan Šimek, Ph.D.)

CISCO akademie III, (Ing. Jan Jeřábek, Ph.D.)

CISCO akademie IV, (Ing. Radim Burget, Ph.D.)

Číslicové zpracování akustických signálů (Ing. Miroslav Balík, Ph.D.)

Číslicové zpracování signálů (prof. Ing. Zdeněk Smékal, CSc.)

Grafické a multimediální procesory (Mgr. Pavel Rajmic, Ph.D.)

Komunikační prostředky mobilních sítí (doc. Ing. Vít Novotný, Ph.D.)

Kryptografie v informatice (doc. Ing. Václav Zeman, Ph.D.)

Moderní síťové technologie (doc. Ing. Karol Molnár, Ph.D.)

Multimédia (Ing. Petr Číka, Ph.D.)

Návrh, správa a bezpečnost počítačových sítí (doc. Ing. Karel Burda, CSc.)

Optické sítě (prof. Ing. Miloslav Filka, CSc.)

Počítače a jejich periferie (Ing. Miroslav Balík, Ph.D.)

Počítačem podporovaná řešení inženýrských problémů (doc. Ing. Jiří Mišurec, CSc.)

Pokročilé komunikační techniky (Ing. Jan Jeřábek)

Pokročilé techniky zpracování obrazu (Ing. Kamil Říha, Ph.D.)

Bezdrátové senzorové sítě (Ing. Milan Šimek, Ph.D.)

Signálové procesory (Ing. Petr Sysel, Ph.D.)

Služby telekomunikačních sítí (doc. Ing. Vladislav Škorpil, CSc.)

Teoretická informatika (Ing. Radim Burget)

Teorie sdělování (Ing. Radim Číž, Ph.D.)

Theory of Communication (Ing. Radim Číž, Ph.D.)

Vyšší techniky datových přenosů (doc. Ing. Václav Zeman, Ph.D.)

Vzájemný převod A/D signálů (prof. Ing. Kamil Vrba, CSc.)

Zabezpečovací systémy (doc. Ing. Karel Burda, CSc.)

Zpracování řeči (prof. Ing. Zdeněk Smékal, CSc.)

Telekomunikační informační systémy (Ing. Pavel Šilhavý, Ph.D.)

Doctoral Degree Programme

Aplikovaná kryptografie (doc. Ing. Karel Burda, CSc.)

Moderní síťové technologie (doc. Ing. Vít Novotný, Ph.D.)

Laboratories

Laboratory of Analog Techniques (research of non-conventional current-mode circuits, Kamil Vrba)

Laboratory of Converged Networks and Information Systems (convergence of network technology into a united communications system including fixed, wireless and mobile technologies, support of communication services integration, e.g. VoIP services, videoconferencing, IPTV, research and development of VoIP elements, QoS support, Pavel Šilhavý, Vít Novotný)

Laboratory of Digital Music Studio (instruction and research in synthesis, analysis, processing and reproduction of music signals, including multicast systems Surround Sound, Zdeněk Smékal, Jiří Schimmel)

Laboratory of Electroacoustics, Studio and Music Electronics (measurement of electroacoustic converters, audio instruction programmes, examination of human hearing, testing of electroacoustic devices, evaluation of emotions in speech, anechoic room, Jiří Schimmel)

Laboratory of Modern Network Technologies (instruction in network technologies, research of switch and indicator management, analysis of stationary and wireless local computer networks operation, modelling of algorithms used in modern data networks, Karol Molnár)

Laboratory of Multimedia Services (design and multimedia communication services including multimedia data digital processing, Petr Číka)

Laboratory of Optical Links (instruction and research of optical transmission, mechanical work with fibres, direct and reflectometric methods, special measurement, Miloslav Filka)

Laboratory of Data Transmission (instruction in Data Communication, research of modems, modelling of the characteristics of access networks and end devices, Pavel Šilhavý)

Laboratory of Access Networks (instruction and research of end network devices, efficiency of access networks with regard to wire and wireless media, Vladislav Škorpil)

Laboratory of Communication Systems (instruction in the theory of systems and signals, and theory of communication, Radim Číž)

Laboratory of Sensoric Networks (instruction and research in sensoric networks based on the IEEE 802.15.4 standard, analysis of Zigbee and 6lowPAN protocols, sensor units configurations, data transmission and wireless network management, microcontrollers Atmel AVR, Milan Šimek)

Laboratory of Telecommunication Systems (instruction in Telecommunication Systems, research of error-free transmission of messages, modelling of anti-error code systems, Václav Zeman)

Laboratory of High-Rate Communication Systems (instruction and research of high-rate data transmission up to 100 Gb/s, Vladislav Škorpil)

Laboratory of Mutual Analog-Digital Conversion (instruction and research of 'mixed-mode' circuits, Kamil Vrba)

Laboratory of Acoustic Signal Processing (design, optimization and implementation of algorithms for speech and acoustic signal processing, DVD matrix, Miroslav Balík)

Research Laboratory of Signal Processors (applications with digital signal processors with Harvard architecture and VLIW architecture, instruction in Signal Processors, Digital Filters and Digital Signal Processing, Zdeněk Smékal, Petr Sysel)

Research and Instruction Laboratory of Safety Systems (research and development of cryptographically protected extensive data files, research of biometric authentication methods, research of security of multifunction two-way communication technology for warning systems, Karel Burda)

Laboratory of CISCO Academy (instruction in Cisco Academy courses for all study areas at FEEC, Dan Komosný)

Department of Theoretical and Experimental Electrical Engineering

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Professors

Prof. Ing. Karel Bartušek, DrSc.
Prof. Ing. Jarmila Dědková, CSc.
Prof. Ing. Eva Gescheidtová, CSc.

Associate Professors

Doc. Ing. Petr Drexler, Ph.D.
Doc. Ing. Pavel Fiala, Ph.D.
Doc. Ing. Pavel Kaláb, CSc.
Doc. Ing. Milan Murina, CSc.
Doc. Ing. Jiří Rez, CSc.
Doc. Ing. Jiří Sedláček, CSc.
Doc. Ing. Miloslav Steinbauer, Ph.D.

Lecturers

Ing. Michal Hadinec, Ph.D., Ing. Eva Kroutilová, Ph.D., Ing. Radek Kubásek, Ph.D., Ing. Jan Mikulka, Ph.D.

Ph.D. Students

Ing. Mouin Al Khaddour, Ing. Martin Čáp, Ing. Martin Friedl, Ing. Lubomír Frohlich, Ing. Michal Hanzelka, MBA, Ing. Jan Hrozek, Ing. Radim Kadlec, Ing. Radim Kořínek, Ing. Pavel Křepelka, Ing. Tomáš Kříž, Ing. Petr Marcoň, Ing. Radek Myška, Ing. Dušan Nešpor, Ing. Ksenia Ostanina, Ing. Michaela Pokludová, Ing. Zdeněk Roubal, Ing. Zoltán Szabó

Administrative and Technical Staff

Ing. Tibor Bachorec, Ph.D., Eva Cupáková, Marie Hábová, doc. Ing. Petr Koňas, Ph.D., Ing. Taťána Krajčírovičová, Ing. Tomáš Kříž, Veronika Raabová, Ing. Zoltán Szabó

Main Interests

Basic research results on wideband signal processing, noise spectroscopy (patent application on low-level measurement sensor modification), special applications of metamaterial structures (patent application) for nuclear magnetic resonance and electron microscopy. NMR research results on material diffusion, NMR imaging and impedance tomography were published. Results on numerical models of velocities of single processes were presented, and measurements of the cryogenic device for DNA samples conservation were published. The department continued cooperation in design and implementation of special cooling systems for electronic devices. Unique systems for cooling and exposure of biological samples were completed. A system for detection of partial

charges in high-voltage power transformers was developed. They were tested on unique systems, and research results for special methods of single-process measurement were compared. Verified in laboratory conditions were systems for detection and localization of partial charges in power converters with liquid dielectric. Research results on non-destructive measuring methods for scanning the velocity of fluid flow in parts of plants and root systems were published. Research results were presented at reputable conferences 'Progress in Electromagnetics Research Symposium' in China and Morocco, organized by the World Electromagnetics Academy in Cambridge, USA. The research also resulted in a number of unique operating samples.

Major Achievements

Research was focused on wideband signal processing, noise spectroscopy, special applications of metamaterial structures for NMR and electron microscopy in cooperation with Spacek Labs, Santa Barbara, California, USA. Applied research was focused on evaluation of NMR images. Research was carried out in cooperation with Honeywell s.r.o on numerical models of tests of VN and EMC electronic systems. Research of cryogenic devices and techniques for sample conservation continued. Electron microscopy research was started in cooperation with FEI, Czech Academy of Sciences and Delong Instruments, with focus on biological material scanning avoiding damage or destruction of tissue. There were joint projects with SIEMENS dealing with analysis of thermal ignition in electric motor stators, hygiene of work aimed at reducing vibrations due to tightening keys on assembly lines. We established contacts with the company DRAKA Kabely s r.o. and continued longterm cooperation with PROTOTYPA a.s. in research of special single-process measuring methods. With the company TES s.r.o. we continued work on detection and localization of partial charges in electric power converters with liquid dielectric. We also continued cooperation with Mendel University in Brno in simulation of biological systems by means of controlled heat and light sources. Our research also included non-destructive measuring methods of scanning the velocity of fluid flow in parts of plants and root systems. Our contacts with Technische Universität Wien continued. There was a meeting on MEMS in WIen. We carried on research within the framework of research plans and dealt with nanomaterial engineering, heterogeneous structures for applications in a safety programme and electric power sources. Research of numerical models of mass elementary parts continued in cooperation with Institute of Instrument Technology, Czech Academy of Sciences.

Major Research Projects

Measurement and Simulation of the Impact of Susceptibility and Conductivity in MR Tomography – GA AV ČR KJB208130603

Investigator: Miloslav Steinbauer

Research of New NMR Techniques for Study of Porous Material Structure – GAČR 102/07/0389

Investigator: Eva Gescheidtová

Study of the Properties of Metamaterials and Microwave Structures Using Noise Spectroscopy and Magnetic Resonance – GAČR 102/09/0314

Investigator: Pavel Fiala

Charge Activity Detection in Oil Transformers – MPO FR-TI1/001

Investigator: Pavel Fiala

Diagnostics of Ultrafast Objects for Safety Tests – MPO FR-TI1/368

Investigator: Pavel Fiala

Selected Publications

KŘÍŽ, T. Initial Conditions and Regularization Parameter Influence in EIT Image Reconstruction. *Przeglad Elektrotechniczny.* 2011. 2011(5). p. 77 - 80. ISSN 0033-2097. (IF(2010)=0,242).

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Bachelor Degree Programme

Bezpečná elektrotechnika (doc. Ing. Pavel Kaláb, CSc.)

Elektrotechnický seminář (doc. Ing. Miloslav Steinbauer, Ph.D.)

Elektrotechnika 1 (doc. Ing. Jiří Sedláček, CSc.)

Elektrotechnika 2 (doc. Ing. Jiří Sedláček, CSc.)

Měření v elektrotechnice (prof. Ing. Karel Bartušek, DrSc.)

Seminář C++ (doc. Ing. Pavel Fiala, Ph.D.)

Počítačové modelování elektrotechnických zařízení a komponentů polí (doc. Ing. Pavel Fiala, PhD.)

Master Degree Programme

Bezpečná elektrotechnika (doc. Ing. Pavel Kaláb, CSc.)

Elektrické instalace (doc. Ing. Pavel Kaláb, CSc.)

Modelování elektromagnetických polí (prof. Ing. Jarmila Dědková, CSc.)

Doctoral Degree Programme

Numerické úlohy s parciálními diferenciálními rovnicemi (doc. Ing. Pavel Fiala, Ph.D.)

Speciální měřicí metody (prof. Ing. Karel Bartušek, DrSc.

Laboratories

Laboratory of Electrical Measurements (instruction in Measurements in Electrical Engineering, Radek Kubásek)

Laboratory of Electrical Engineering (instruction in Electrical Engineering 1 and 2, Martin Friedl)

Computer Laboratory of Electrical Engineering (instruction in Electrical Engineering 1 and 2, Miloslav Steinbauer)

Computer Laboratory (Electrical Engineering, Computers and Programming 2, Electromagnetic Field Modelling, Seminar C++, Miloslav Steinbauer)

Research Laboratory of Magnetic Measurement (research laboratory of magnetic measurement, Jiří Rez)

Research Laboratory of Light Technology (parameters of light sources, Eva Kroutilová)

Research Laboratory for Modelling and Optimization in Electromechanical Systems (basic and applied research of numerical methods, Pavel Fiala)

Research Laboratory of Numerical Modelling (solution of extensive numerical problems, Miloslav Steinbauer)

Research Laboratory of Electrical Circuits (Ph.D. projects, Zoltán Szabó)

Research Laboratory of Pulse Sources and Microwave Devices (basic research, low-noise measurements, shielded laboratory, semi-anechoic laboratory, Pavel Fiala)

Research Laboratory of Electro-Optics (optoelectronic measuring methods, Eva Kroutilová)

IET Laboratory (instruction, Miloslav Steinbauer)

Laboratory of Electrical Measurement (instruction in Measurement in Electrical Engineering, Radek Kubásek)

Laboratory of Electrical Engineering and Electrical Installations (instruction in Seminar of Electrical Engineering, Electrical Installations, Petr Drexler)

Department of Power Electrical and Electronic Engineering

Ing. Ondřej Vítek, Ph.D.

Head

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Professors

Prof. RNDr. Vladimír Aubrecht, CSc.
Prof. Ing. Vítězslav Hájek, CSc.
Prof. Ing. Jiří Skalický, CSc.

Associate Professors

Doc. Ing. Bohuslav Bušov, CSc.
Doc. Ing. Josef Koláčný, CSc.
Doc. Dr. Ing. Hana Kuchyňková
Doc. Ing. Josef Lapčík, CSc.
Doc. Ing. Čestmír Ondrůšek, CSc.
Doc. Dr. Ing. Miroslav Patočka,
Doc. Ing. Zdeněk Vávra, CSc.
Doc. Ing. František Veselka, CSc.
Doc. Ing. Pavel Vorel, Ph.D.

Lecturers

Ing. Petr Huták, Ph.D., Ing. Bohumil Klíma, Ph.D., Ing. Ondřej Vítek, Ph.D., Ing. Marcel Janda, Ph.D., Ing. Dalibor Červinka, Ph.D., Ing. Petr Procházka, Ph.D.

Ph.D. Students

Ing. Aleš Mikulčík, Ing. Eva Vítková, BA., Ing. Ivo Pazdera, Ing. Jan Hejkrlík, Ing. Jan Knobloch, Ing. Jan Kuzdas, Ing. Jan Otýpka, Ing. Jaroslav Chlup, Ing. Jindřich Hvězda, Ing. Jiří Dušek, Ing. Jiří Kurfürst, Ing. Jiří Vondruš, Ing. Josef Běloušek, Ing. Josef Kadlec, Ing. Lukáš Dostál, Ing. Martin Mach, Ing. Martin Pochyla, Ing. Miroslav Skalka, Ing. Mohammed Hussain Mohammed, Ing. Mustafa Osman Elrayah Aboelhassan, Ing. Petr Grmela, Ing. Petr Chmelíček, Ing. Petr Michailidis, Ing. Radoslav Cipín, Ing. Ramia Deeb, Ing. Rostislav Huzlík, Ing. Vladimír Minárik, Ing. Zbyněk Makki, Mousa Sattouf, Ziad Nouman, Ing. Martin Prudík, Ing. Petr Fajkus, Ing. Vojtěch Vetiška, Ing. Jan Kachlík, Ing. Lukáš Mišinger, Ing. Petr Španěl

Administrative and Technical Staff

Ing. Zdeněk Feiler, Ph.D., Zdeněk Liška, Alena Šmídková

Main Interests

The department provides instruction in the study area Power Electrical and Electronic Engineering in the Bachelor and Ph.D. programmes and in the study areas Power Electronics and Power Electrical Engineering in the Master programme. Instruction is focused on the theory and construction of electrical machines and devices, CAD systems including solutions for

electromagnetic and thermal fields and optimization methods for construction designs. The design, size, control and dynamics of electromechanical systems are the subject of instruction. Another area of interest is power electronics including pulse transducers (switching sources), DC/AC alternators, rectifiers, etc. Attention is paid to the theory of regulation and digital control.

In basic research the department deals with theoretical modelling of radiation energy transport in thermal plasma. In applied research power electronics, electrical machines, drives and devices are in the focus of interest. Research is mainly concerned with low-voltage machines used in automotive industry, synchronous machines with permanent magnets, asynchronous and DC machines. The department staff have experience in development of special machines such as startergenerators,

controlled magnetic bearings and levitation systems. We also focused on power exploitation for electric arc extinction in low- and high-voltage devices. Research was also focused on power converters of extreme parameters, optimal regulation of electric drives aimed at loss minimization in traction drives, implementation of ultracapacitors, accumulators and fuel cells in the system of traction drives.

The department cooperates with a number of universities, e.g., SPGU St Petersburg, TU Pskov, TU Omsk, TU Gliwice, TU Delft, TU Žilina, MU Brno, and industrial companies and institutions, e.g. JSC Electrocontact (Kineshma-RF), Siemens Elektromotory Drásov, OEZ Letohrad, APS Světlá nad Sázavou, ATAS Náchod, EMP Slavkov u Brna, JULI Motorenwerk Moravany, VUES Brno a.s., IVEP Brno, ŠLP Křtiny a.s.,etc.

Major Achievements

The project 'The Calculation of Eddy Current Losses in the Permanent Magnets of Servo Motor' by our student Ramia Deeb ranked first in the 12th year of the Čez Foundation competition for higher education institutions, category Electrical machines, devices and drives.

One of the prime areas of interest was the development of fast chargers for electromobiles (DC/DC alternators with transformer) using progressive semiconductor technology on the basis of silicon carbide (SiC) and exceptionally high switching frequency of 100kHz. The charger with output parameters 140V/100A for electromobile 'Peugeot 106 Electric' and the charger 380V/42A for the LiFePO accumulator of one-seat experimental plane with electrical drives is in the stage of compact product.

For this plane implemented in cooperation with Institute of Aerospace Engineering of the Faculty of Mechanical Engineering, Brno University of Technology, we developed a synchronous motor 50 kW, power and control circuits of three-phase DC/AC alternator and electronic circuits for

accumulator monitoring and balancing. In cooperation with the SPGU in St Peterburg we successfully applied the 'Method of Powder Particles' in longterm testing conducted by Professor V. N. Zaboin for the company Elektrosila. Professor V.D. Avilov was invited to lecture on research of the sliding contact. The lecture was organized for the industrial sector. An original concept of sliding contact without brushes and holders of brushes was presented. In cooperation with the company VÚES Brno application of an innovated sliding contact on asynchronous ring generators of VÚES in Italy was evaluated. This application is aimed at reduction of brush wear to approx. 30% of original condition.

M. Patočka published a book 'Magnetické jevy a obvody ve výkonové elektronice, měřicí technice a elektroenergetice', VUTIUM, 2011. 564 p. ISBN: 978-80-214-4003- 6.

The department developed two prototypes and 20 operating samples.

Major Research Projects

Analysis and Modelling of the Properties of Low-Voltage Electrical Machines– GAČR GA102/09/1875

Investigator: Vítězslav Hájek.

Research and Development of the Construction Line of Compact Driving Axles for Light Integrated Electric Drive Vehicles – TAČR TA01011060

Investigator: Pavel Vorel

Application of the VUT 001 Marabu Plane for Hydrogen Fuel Cell Drive – FR-TI1/061 (UVEE is implementing the complete electrical drive)

Investigator: Bohumil Klíma

E3CAR Nanoelectronics for an Energy Efficient Electrical Car - 7H09009

Investigator: Radimír Vrba

Research and Development of Servomotor with High Efficiency Permanent Magnets – MPO FR-TI1/082

Investigator: Čestmír Ondrůšek

Selected Publications

JENIŠTA, J.; TAKANA, H.; NISHIYAMA, H.; BARTLOVÁ, M.; AUBRECHT, V.; KŘENEK, P.; SEMBER, V.; MAŠLÁNI, A. *A comparative numerical study of hybrid-stabilized argon-water electric arc.* COMPUTER PHYSICS COMMUNICATIONS. 2011. 182(9). p. 1776 - 1783. ISSN 0010-4655. (IF(2010)=2,3).

JENIŠTA, J.; TAKANA, H.; NISHIYAMA, H.; KŘENEK, P.; BARTLOVÁ, M.; AUBRECHT, V. *Computer Modeling of Radiative Transfer in Hybrid-Stabilized Argon-Water Electric Arc.* IEEE Transactions on Plasma Science. 2011. p. 2892 - 2893. ISSN 0093-3813. (IF(2010)=1,076).

HNILICA, J.; KUDRLE, V.; VAŠINA, P.; SCHÄFER, J.; AUBRECHT, V. *Characterization of a periodic instability in filamentary surface wave discharge at atmospheric pressure in argon.* Journal of Physics D: Applied Physics. 2012. 45(1). p. 1 - 9. ISSN 0022-3727. (IF(2010)=2,109).

JENIŠTA, J.; TAKANA, H.; NISHIYAMA, H.; BARTLOVÁ, M.; AUBRECHT, V.; KŘENEK, P.; HRABOVSKÝ, M.; KAVKA, T.; SEMBER, V.; MAŠLÁNI, A. Integrated parametric study of a hybrid-stabilized argon - water arc under subsonic, transonic and supersonic plasma flow regimes. *Journal of Physics D: Applied Physics.* 2011. 44(43). (20 p.). ISSN 0022-3727. (IF(2010)=2,109).

Bachelor Degree Programme

Automobilová elektrotechnika (prof. Ing. Vítězslav Hájek, CSc.)

Elektrické pohony (Ing. Dalibor Červinka, Ph.D.)

Elektrické stroje (doc. Ing. Čestmír Ondrůšek, CSc.)

Informatika v silnoproudé elektrotechnice (prof. RNDr. Vladimír Aubrecht, CSc.)

Inspekční a revizní činnost (doc. Ing. František Veselka, CSc.)

Mikroprocesorová technika v pohonech (Ing. Bohumil Klíma, Ph.D.)

Navrhování elektrických pohonů (prof. Ing. Jiří Skalický, CSc.)

Počítačová animace a vizualizace (doc. Dr. Ing. Hana Kuchyňková)

Počítačová podpora konstruování (doc. Dr. Ing. Hana Kuchyňková)

Počítačové metody v silnoproudé elektrotechnice (Ing. Radek Vlach, Ph.D.)

Řídicí elektronika (doc. Dr. Ing. Miroslav Patočka)

Teorie řízení (Ing. Petr Huták, Ph.D.)

Výkonová elektronika (doc. Dr. Ing. Miroslav Patočka)

Master Degree Programme

Adaptivní a optimální řízení pohonů (prof. Ing. Jiří Skalický, CSc.)

Dynamika elektromechanických soustav (doc. Ing. Čestmír Ondrůšek, CSc.)

Electromechanical Systems (doc. Ing. Čestmír Ondrůšek, CSc.)

Elektrické mikropohony (Ing. Ondřej Vítek, Ph.D.)

Elektrické regulované pohony (prof. Ing. Jiří Skalický, CSc.)

Fyzika a diagnostika plazmatu (prof. RNDr. Vladimír Aubrecht, CSc.)

Laboratoře elektrických strojů a přístrojů (Ing. Marcel Janda, Ph.D.)

Laboratoř elektrických pohonů (Ing. Dalibor Červinka, Ph.D.)

Mikropočítačové řízení elektrických pohonů (Ing. Bohumil Klíma, Ph.D.)

Mikrostroje (prof. Ing. Vítězslav Hájek, CSc.)

Navrhování elektrických pohonů (doc. Dr. Ing. Miroslav Patočka)

Navrhování výkonových měničů (doc. Dr. Ing. Miroslav Patočka)

Počítačové modelování v silnoproudé elektrotechnice (doc. Dr. Ing. Hana Kuchyňková)

Projektové řízení inovací (doc. Ing. Bohuslav Bušov, CSc.)

Průmyslová elektronika (doc. Ing. Pavel Vorel, Ph.D.)

Řídicí členy v elektrických pohonech (doc. Ing. Pavel Vorel, Ph.D.)

Řízení dynamických soustav (Ing. Petr Huták, Ph.D.)

Speciální technologie (doc. Ing. František Veselka, CSc.)

Stavba elektrických strojů a přístrojů (doc. Ing. Bohuslav Bušov, CSc.)

Střídavé pohony (Ing. Bohumil Klíma, Ph.D.)

Technika výkonových měničů (doc. Dr. Ing. Miroslav Patočka)

Doctoral Degree Programme

Vybrané statě z elektrických strojů a přístrojů (doc. Ing. Čestmír Ondrůšek, CSc.)

Vybrané statě z výkonové elektroniky a elektrických pohonů (prof. Ing. Jiří Skalický, CSc.)

Laboratories

Laboratory of Electrical Machines (commutation of electrical machines, measurement of medium-power output, magnetic bearings, automated measurements, Čestmír Ondrůšek)

Laboratory of Mechatronics (Čestmír Ondrůšek)

Laboratory of Electrical Apparatus (switching devices, Jiří Valenta)

Laboratory of Electric Arc (non-electric characteristics, optical diagnostics of switching arc in low-voltage and high-voltage switches, Zdeněk Vávra)

High-Voltage Laboratory (high-voltage switching effects, Bohuslav Bušov)

Laboratory of Small Electrical Machines (DC motors, measurement of universal high-revolution commutator motors, Čestmír Ondrůšek)

Laboratory of Automotive Electrical Machines (switching arc in alternators, starters amd low-voltage engines, Vítězslav Hájek)

Laboratory of Holographic Interferometry (optical stand for holographic interferometry, e.g. diagnostics of torque vibrations, Marcel Janda)

Laboratory of Electrical Drives (nonlinear dynamic systems with changed parameters, Dalibor Červinka)

Laboratory of Power Electronics (research of pulse converters, Miroslav Patočka)

Laboratory of Power Electronics (DC/DC transformers, alternators and low-voltage brushless drives, Pavel Vorel

Laboratory of Industrial Electronics (analog electronics, logical circuits, pulse techniques, Pavel Vorel)

Digital Control Laboratory (microprocessor techniques, digital control and diagnostics of electrical drives, power converters and mechatronic systems, Bohumil Klíma)

Laboratory of Special Diagnostics and Fast Processes Recording (digital high-speed camera scanning of fast processes and equidensitometric evaluation of images, Vladimír Aubrecht)

Laboratory of Dynamic Properties of Electrical Machines (experimental analysis of transient performances in electrical machines, Ondřej Vítek)