

# ANNUAL REPORT 2007

**FACULTY OF ELECTRICAL ENGINEERING  
AND COMMUNICATION  
BRNO UNIVERSITY OF TECHNOLOGY**



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# 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 1959 when an inde-

pendent Faculty of Power Engineering was founded, and subsequently transformed into Electrotechnical Faculty, over 22,000 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). Organizational and economic activities concerned with the founding of FIT and transformation of FEECS were crowned by the decision of the Rector of BUT to appoint Prof. Radimír Vrba Acting Dean of FEEC and Prof. Tomáš Hruška Acting Dean of FIT as of 1 January 2002. The Faculty of Electrical Engineering and Communication came to being on 1 January 2002.

## Faculty in 2007

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 became Vice-Rector for Information and Communication Technologies.

In 2007, the Dean, Professor Radimír Vrba served his second term in office, from 1 February 2006, together with four vice-deans and the faculty bursar: Professor Jarmila Dědková (Vice-Dean for Bachelor programme, Acting Vice-Dean) Professor Stanislav Hanus (Vice-Dean for

Master programme), Professor Ivo Provazník, (Vice-Dean for External Relations and International Affairs), Professor Vladimír Aubrecht (Vice-Dean for Research and Postgraduate Study), Miloslav Morda (Faculty Bursar). At the end of 2007, there were 219 teachers and 4,117 students in all forms of state-supported programmes. Moreover, education was provided to 328 students of the Faculty of Information Technology, 25 students of the Faculty of Mechanical Engineering and 190 students of the Faculty of Management. On the other hand, the Faculty purchased tuition for 13 students from the Faculty

of Management, for 10 students from the Faculty of Information Technology and for 13 students from the Centre of Consultancy and Education. As a result, the total number of students taught at the faculty is 4,452. Education was provided in the ending study programmes Electrical Engineering and Computer Science (EI) on one hand, and in Electrical Engineering, Electronics, Communication and Control Technology (EECR) accredited in 2001 in accordance with the Bologna Declaration on the other hand. The programme Biomedical Technology and Bioinformatics (BTBIO-A) was accredited in 2007. The study programmes at FEEC are now fully compatible with 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 2007 were 615 students who completed their studies in the Bachelor degree programme, 413 Master degree graduates, and 35 postgraduates completed their doctoral studies. There were 1,440 students coming to the Faculty, 586 students entered the first year of the follow-up Master programme, and 92 graduates entered the doctoral programme. Tuition in English was provided to 22 international students paying their fees. Three academics were habilitated and appointed associate professors with the title Docent. There were five appointments to professorship.

## Events and Activities

- meeting of the former deans and the Rector of BUT on the occasion of the 102nd birthday of Professor Jiří Brauner, one of the first deans of the Faculty of Electrical Engineering
- first graduates of the Master degree programme EECR in academic year 2006/07
- extended accreditation of the full-time follow-up Master degree programme EECR-M and accreditation of the part-time Master degree programme EECR-ML
- opening of the new Bachelor degree programme BTBIO-A Biomedical Technology and Bioinformatics
- development of part-time and distance formats of study in a new structured form of study supported by development projects of Ministry of Education
- publishing of 83 titles of electronic texts of the total extent of 6,768 pages, two electronic texts in English of 373 pages and 19 multimedia aids
- preparatory courses for secondary-school students interested in study at FEEC organized by the Department of Mathematics to help them prepare for entrance examination in mathematics
- Open Door Days (December 2007), visits by students and teachers to secondary schools
- presentation of new study programmes at FEEC BUT at the trade fair of higher education and lifelong education GAUDEAMUS 2007, 30 October – 2 November 2007, to promote FEEC and arise interest of secondary school students in study at FEEC
- meeting of the leaderships of the Czech and Slovak faculties of electrical engineering and associated faculties in Bojnice, Slovakia, 9-11 May 2007
- publication of the faculty yearbook 2006/2007, in cooperation with the club ELEKTRON
- development of education leading to habilitations and procedures to professorship
- The STUDENT EEICT 2007 Conference and Competition organized in cooperation with the Faculty of Information Technology and sponsored by the companies ABB, TYCO, HONEYWELL, and other, with 45 Bachelor papers, 85 participants in the Master section, and 96 participants in the Doctoral section
- work on Longlife Learning Programme-Erasmus and on other European programmes
- transfer of the faculty information system and faculty websites to IS Apollo
- activities focused on construction of new premises in campus Pod Palackého vrchem - Technická 10 and Technická 12

- continuation of the three research plans commenced in 2005 (scheduled 2005-2009 or 2011), chief investigators Prof. Jiří Kazelle, Prof. Jiří Svačina and Prof. Radimír Vrba
- acquisition of another research plan commenced on 1 January 2007, investigator Prof. Pavel Jura
- activities of the Chairman of Academic Senate Vlasta Krupková in her capacity as a member of the Higher Education Council
- activities of members of Academic Senate and mainly its chairman Vlasta Krupková focused on the organizational and economic aspects of the development of FEEC
- activities of Advisor for Equal Opportunities Naděžda Uhdeová supported by the Development Programme of the Ministry of Education focused on the analysis of the causes of the very low interest of girls in studies at FEEC, consultancy for female students, and study opportunities for handicapped students at FEEC
- recruitment and care of foreign students paying their fees. Education of these students is a valuable experience for participation of individuals and departments in mobility projects, and is also a source of additional income for qualified teachers with language skills
- traditional 40<sup>th</sup> faculty ball at the International hotel

### Achievements

In 2007, economic results of FEEC were very good. The trend in wages and material supply was again favourable, to a great extent due to involvement in research projects of the Czech Science Foundation, Foundation of Czech Academy of Sciences, Ministry of Industry and Trade,

European Commission (FP5 and FP6) and Higher Education Development Fund, mainly owing to the efforts of all those who under the leadership of chief investigators participated in research plans and activities of three research centres. All staff members and postgraduate students of FEEC deserve appreciation and my gratitude.

Radimír Vrba  
Dean





# Faculty of Electrical Engineering and Communication

## **Dean**

Prof. Ing. Radimír Vrba, CSc.

## **Vice-Deans**

Prof. Ing. Jarmila Dědková, CSc.

Acting Dean, Vice-Dean for Bachelor Degree Programme

Prof. Ing. Stanislav Hanus, CSc.

Vice-Dean for Master Degree Programme

Prof. RNDr. Vladimír Aubrecht, CSc.

Vice-Dean for Research and Doctoral Degree Programme

Prof. Ing. Ivo Provazník, Ph.D.

Vice-Dean for External Relations and International Affairs

## **Chairman of Academic Senate**

RNDr. Vlasta Krupková, CSc.

## **Faculty Secretary**

Ing. Miloslav Morda

## **Student Advisor to the Dean**

Irena Hývnarová

## **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.  
Doc. Ing. Jarmila Dědková, CSc.  
Doc. Ing. Eva Gescheidtová, CSc.  
Doc. Ing. Luboš Grmela, CSc.  
Doc. Ing. Stanislav Hanus, CSc.  
Prof. Ing. Tomáš Hruška, CSc.  
Prof. RNDr. Jan Chvalina, DrSc.  
Prof. Ing. Jiří Jan, CSc.  
Prof. Ing. Pavel Jura, CSc.  
Prof. Ing. Jiří Kazelle, CSc.

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

### External Members

Ing. Jiří Potěšil  
Ing. Ivan Skalka  
Ing. Ladislav Škapa, CSc.  
Ing. Rostislav Vinkler  
Ing. Jiří Winkler, CSc.

RNDr. Luděk Frank, DrSc.  
Ing. Robert Vích, DrSc.  
Prof. Ing. Miroslav Husák, CSc.  
Doc. Ing. Jiří Masopust, CSc.  
Prof. Ing. Aleš Richter, CSc.

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# Accredited Study Programmes

## Accredited Study Programmes

### **Bachelor Degree Programme Electrical, Electronic, Communication and Control Technology**

Study Areas: Automation and Measurement  
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  
Communications and Informatics  
Cybernetics, Control and Measurement  
Electronics and Wireless Communication  
Electrotechnical Manufacturing and Management  
Microelectronics  
Power Electrical and Electronic Engineering  
Power Electrical Engineering

### **Doctoral Degree Programme Electrical, Electronic, Communication and Control Technology**

Study Areas: Biomedical Electronics and Biocybernetics  
Cybernetics, Control and Measurement  
Electronics and Wireless Communication  
Microelectronics and Technology  
Power Electrical and Electronic Engineering  
Teleinformatics  
Theoretical Electrical Engineering

### **Doctoral Degree Programme Electrical Engineering and Communication Technology**

Study areas: Biomedical Electronics and Biocybernetics  
Cybernetics, Control and Measurement  
Electronics and Communications  
Mathematics in Electrical Engineering  
Microelectronics and Technology  
Physical Electronics and Nanotechnology  
Power Electrical and Electronic Engineering  
Teleinformatics  
Theoretical Electrical Engineering

## **Accredited Areas for Habilitation Procedures and Procedures for Appointment to Professorship**

Biomedical Engineering  
Electrical and Electronic Technology  
Electronics and Communications  
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 has been launched (BTBIO-A) in full-time format of study the study area Biomedical Technology and Bioinformatics (A-BTB) is offered. Taking part in tuition in this interdisciplinary programme is the Medical Faculty of Masaryk University in Brno.

The Bachelor programme Biomedical Technology and Bioinformatics is mainly focused on practice, but it also prepares graduates for further studies in follow-up Master programmes at universities providing education in biomedical engineering, medical informatics and mathematical biology (Brno University of Technology, Czech Technical University, Charles University, and Masaryk University). Students gain theoretical knowledge in mathematics, physics and chemistry, basic knowledge in biology, human anatomy and physiology, necessary for understanding 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 rules for use of medical technology and medical informatics including

ability to communicate with them. They are also offered information on legislative and learn how to apply it in practice. Emphasis is laid on general and professional language skills.

Included in the programme is four-week professional training in hospitals, health centres, companies focused on medical treatment, research, production and sales in biomedical technology and bioinformatics in the Czech Republic and abroad. The training is arranged by students themselves and takes place outside the periods of tuition (mainly during the summer holidays) during their study in the Bachelor programme.

There were 127 paid applications for the Bachelor programme BTBIO-A. The highest possible number of students approved for admission in 2007/08 was 150. As the number of applicants was lower, the Dean decided to admit all those coming to the admission procedure and exempt them from entrance examination.

Out of the 127 applicants, 104 were admitted and 103 registered.

In 2007, there were 81 full-time students in the Bachelor programme BTBIO-A.

## 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 (EEKR) in full-time format of study since academic year 2002/2003, and in part-time format of study since 2004/2005. In 2007, 2201 full-time students enrolled in the Bachelor programme EEKR-B. Studies were successfully completed by 580 students, 98 of them in Automation and Measurement (B-AMT), 154 in Electronics and Communications (B-EST), 66 in Microelectronics and Technology (B-MET), 78 in Power Electrical and Electronic Engineering (B-SEE) and 184 in Teleinformatics (B-TLI).

In the part-time Bachelor programme EEKR-BK there were 323 students in 2007 - 187 in the first

year, 75 in the second year and 91 in the third year. Part-time study was completed by 35 students, 8 in the study area Automation and Measurement (BK-AMT), 6 in Electronics and Communications (BK-EST), 2 in Microelectronics and Technology (BK-MET), 7 in Power Electrical and Electronic Engineering (BK-SEE) and 12 in Teleinformatics (BK-TLI).

Admission procedure is a priority of the Faculty. It took place on 5 June 2007, an alternative date was 15 June 2007. Applications for both full-time and part-time formats of study were accepted.

The maximum number of students for admission to the Bachelor programme approved by Academic Senate for 2007/08 was 1600 for full-time format of study and 300 for part-time format of

study. As the number of applicants was lower, the Dean decided to exempt from entrance examination all applicants coming to the admission procedure.

A place at FEEC was also offered to applicants for study at FIT who had not been admitted for capacity reasons and attained at least 250 points out of the required 1000 points.

In 2007, there were 1,618 applicants for study at FEEC, 1,329 for full-time study and 289 for part-time study. Out of them, 1083 students were admitted in full-time study and 252 in part-time study. Finally, 793 students enrolled in full-time study and 215 students in part-time study. These numbers confirm the increasing interest in the part-time study format.

Also long-term admission statistics show increasing numbers of applicants interested in the part-time study format.

Graph 1 shows numbers of applicants, admitted and enrolled full-time students since 2003. The decreasing numbers of applicants are due to the considerably lower demographic figures. Interest of applicants in study areas is recorded at the end of the first semester after presentations of study areas. Statistics from academic years 2003/04 to 2007/08 are in Table 1.

The level of incoming students has been monitored for several years. An important factor is the percentage of applicants who have taken the school-leaving examination in mathematics or

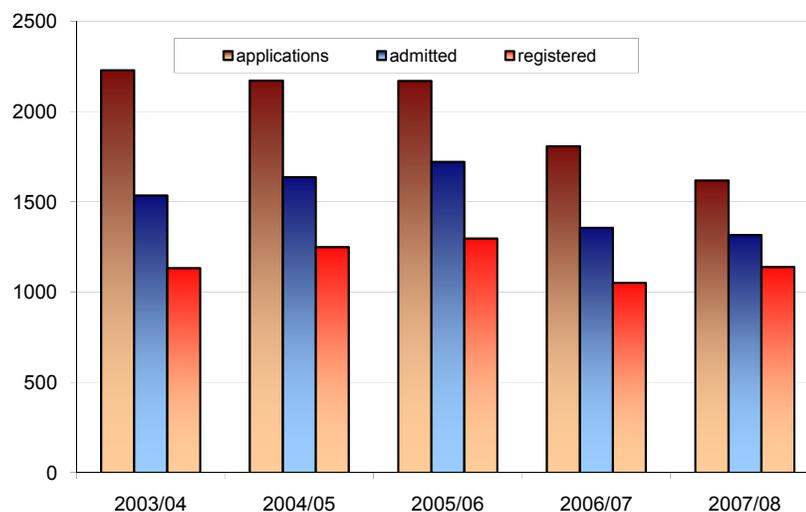
physics, see Graph 2. Contrary to previous years, the number of applicants who had taken the school-leaving examination in mathematics has increased. Another indicator is the percentage of applicants coming from certain types of secondary schools – gymnasium-type secondary schools (G), technical secondary schools (SPS) and technical training centres (SOU), see Graph 3. The graph shows that the numbers of applicants coming from gymnasium-type schools has decreased.

Preparatory courses in mathematics and physics were offered by the Departments of Mathematics and Physics to assist applicants preparing for entrance examinations, and to help them adapt to study at university. In 2007 the course in mathematics was attended by 160 students and the course in physics was completed by 28 students.

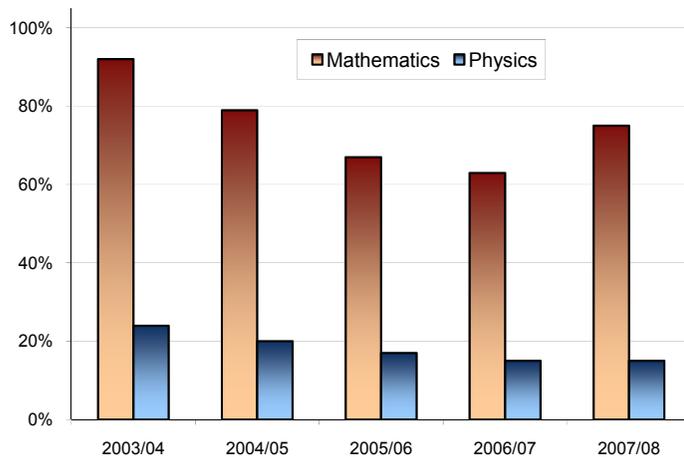
All formats of study and qualifications such as Certificate of Electrotechnical Qualification, Certificate of Pedagogical Practice, Microsoft Certificate, Cisco Certificate are presented in the media. In order to promote the study programmes offered at FEEC and increase the number of secondary-school students interested in them Open Door Days were organized, students and teachers visited secondary schools, and FEEC participated in the 14th GAUDEAMUS fair.

Table1: Interest of full-time students in study areas in the Bachelor degree programme – 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)

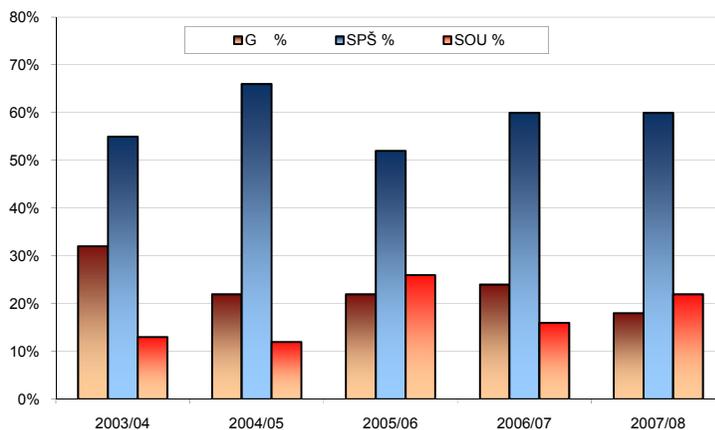
aca- demic year		<b>B-AMT</b>	<b>B-EST</b>	<b>B-MET</b>	<b>B-SEE</b>	<b>B-TLI</b>	<b>not given</b>	<b>total</b>
<b>2003/04</b>	number	120	248	73	77	329	130	977
	%	14.2	29.3	8.6	9.1	38.8		
<b>2004/05</b>	number	155	243	77	96	362	119	1052
	%	16.6	26.0	8.3	10.3	38.8		
<b>2005/06</b>	number	153	241	74	120	331	119	1052
	%	16.6	26.2	8.1	13.1	36.0		
<b>2006/07</b>	number	139	172	68	95	221	89	784
	%	20.0	24.7	9.8	13.7	31.8		
<b>2007/08</b>	number	152	178	51	98	195	45	719
	%	22.6	26.4	7.6	14.5	28.9		



Graph 1: Applicants, admitted and enrolled in full-time and part-time study, 2003/04 – 2007/08



Graph 2: Percentages of students who have taken the school-leaving examination in mathematics or physics



Graph 3: Percentages of students coming from different types of secondary schools (G – secondary schools, SPŠ – secondary technical schools, SOU – vocational training centres)



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

The faculty also provides education in the follow-up Master programme Electrical, Electronic, Communication and Control Technology in full-time format of study since academic year 2005/06 and in part-time format since academic year 2007/08. In 2007, there were 1059 full-time students in the follow-up Master programme EEKR-M, 503 in the first year and 556 in the second year. And there were 51 part-time students in the first year of the study programme EEKR-ML.

In 2007, the part-time study programme was completed by 293 students, 28 in the study area Biomedical and Ecological Engineering (M-BEI), 19 in Power Electrical Engineering (M-EEN), 78 in Electronics and Communications (M-EST), 20 in Electrotechnical Manufacturing and Management (M-EVM), 29 in Cybernetics, Automation and Measurement (M-KAM), 16 in Microelectronics (M-MEL), 14 in Power Electrical and Electronic Engineering (M-SVE) and 89 in Communications and Informatics (M-TIT).

The total number of applicants for full-time study in the follow-up Master programme EEKR-M (sending in the required application fee) was 770, 656 for EEKR-M and 114 for EEKR-ML. The maximum numbers of admissions approved by Academic Senate were 600 in full-time study and 100 in part-time study.

Entrance examinations were held on 29 June 2007 at Technická 8, 651 applicants took the examination - 579 in EEKR-M and 72 in EEKR-ML. Applicants who in the Bachelor programme had achieved the weight study average  $VSP \leq 2.0$  were exempt from entrance examination. There were 215 such applicants, 193 for EEKR-M and 22 for EEKR-ML. They received a written decision on admission and could enrol in first-year study.

There was a written entrance examination, and contained 10 tasks from 5 subjects approved by the Council of Study Programmes, two tasks from each subject – Electrical Engineering I, Electrical Engineering II, Electronic Components, Signals and Systems, and Measurement in Electrical Engineering. The time was 75 minutes. Applicants were divided in 5 groups with two sub-groups A and B. The maximum number of points was 100, 10 for each task.

The Faculty received 770 applications, 656 for full-time study and 114 for part-time study. Entrance examination was taken by 651 applicants, 579 and 72. The total number of admitted was 586, 537 in full-time study and 49 in part-time study.

All admitted students were registered for study areas they had selected. Numbers of applicants and admitted by study areas are in Tab.2.

Table 2: Numbers of applicants and admitted to study areas of the follow-up Master programmes EEKR-M a EEKR-ML in 2007: Biomedical and Ecological Engineering (M-BEI, ML-BEI), Power Electrical Engineering (M-EEN, ML-EEN), Electronics and Communications (M-EST, ML-EST), Electrotechnical Manufacturing and Management (M-EVM, ML-EVM), Cybernetics, Automation and Measurement (M-KAM, ML-KAM), Microelectronics (M-MEL, ML-MEL), Power Electrical and Electronic Engineering (M-SVE, ML-SVE), Telecommunication and Information Technology (M-TIT, ML-TIT)

<i>Study area</i>	<i>Applicants</i>	<i>Admitted</i>	<i>Study area</i>	<i>Applicants</i>	<i>Admitted</i>
M-BEI	51	35	ML-BEI	9	3
M-EEN	48	39	ML-EEN	13	5
M-EST	95	81	ML-EST	13	5
M-EVM	81	51	ML-EVM	24	7
M-KAM	103	75	ML-KAM	18	7
M-MEL	39	27	ML-MEL	5	4
M-SVE	33	26	ML-SVE	8	7
M-TIT	206	168	ML-TIT	24	11

### Ending Bachelor and Master Degree Programme Electrical Engineering and Computer Science

In 2007, 120 students graduated in the five-year Master programme Electrical Engineering and Computer Science, 20 of them in the study area Electrotechnical Manufacturing and Management, 23 in Cybernetics, Automation and Measurement,

64 in Electronics and Communications and 13 in Power Electrical and Electronic Engineering. Accreditation for this study programme expired to 31 December 2007.

Table 3: Graduates in the study programme Electrical Engineering and Computer Science in study areas Electrotechnical Manufacturing and Management (EVM), Cybernetics, Automation and Measurement (KAM), Electronics and Communications (EST) and Power Electrical and Electronic Engineering (SEE)

<i>Master Study Areas</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>
<i>EVM</i>	37	71	44	65	20
<i>KAM</i>	68	67	36	109	23
<i>EST</i>	130	132	86	199	64
<i>SEE</i>	59	58	33	64	13
<b>Total</b>	294	328	199	437	120

Following Amendment to the Higher Education Act No. 111/98, FEEC started activities in the lifelong education system. A whole range of specialized courses for professionals are offered. For those interested in the study programme EECR, paid courses are offered in both the Bachelor programme and the follow-up Master programme. Having completed these courses and earned the prescribed number of credits, students can enrol in full-time study at FEEC without being required to pass the entrance examination, and the earned credits will be recognized. In 2007, there were 85 students in the lifelong education programme.

In the programme for students paying their fees there were 22 international students, 12 in the three-year Bachelor programme EECR, 6 students in the two-year follow-up Master programme and 4 in the Ph.D. programme.

There has been a consistent effort at the FEEC to use more extensively the information system for

management of study affairs and to make relevant information accessible to students.

In 2007, the management of study affairs was transferred to the BUT information system (Apollo).

Regular assessment of the quality of teaching took place at the end of the summer semester, again with the aid of the faculty information system, in the winter semester using the system Apollo.

In support of tuition in the part-time Bachelor and the follow-up Master study programme 83 (6768 pages) new or innovated electronic texts (ET) and 19 multimedia aids (MP) were created.

ET texts (373 pages) in English were created for two specialized subjects in the Bachelor programme to support teaching of professional English.

All texts are on faculty websites and are accessible to students of a particular programme.



# Research and Postgraduate Study

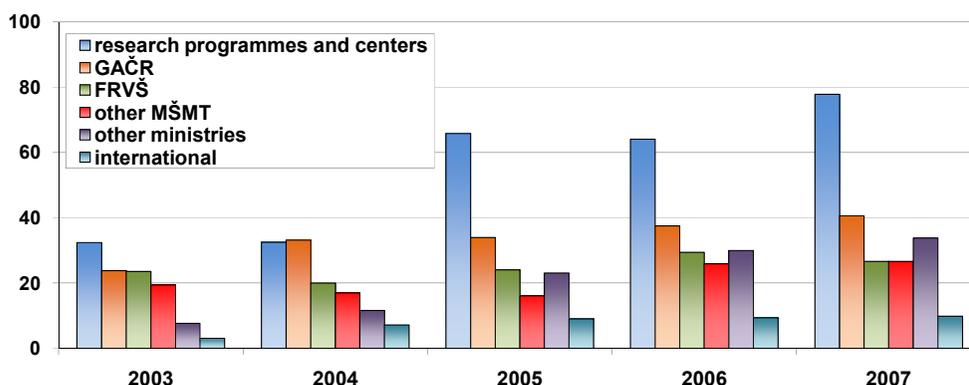
## Research

Growth in research continued in 2007, in both funds and quality of research results.

As compared with the previous year, the funding obtained for research and development (graph 4) increased by approximately 11%. The major sources were four research plans followed by the Czech Science Foundation projects (GAČR) and

projects of the Higher Education Development Fund (FRVŠ).

Results of original research and professional work at FEEC were published in three international monographs and 40 articles in impact journals.



Graph 4: Research funds at FEEC in million CZK, 2003 - 2007

## Research Plans, Research Centres

The most significant development and research results in 2007 were achieved by teams involved in four research plans and three research centres. A brief evaluation follows:

### New Trends in Microelectronic Systems and Nanotechnologies (MIKROSYN)

(Investigator: Radimír Vrba)

The research plan is focused on basic and applied research of microelectronic systems and technologies. Research covers several interconnected study areas. The focus of research are integrated circuits and systems and their elements investigated from the viewpoint of system and technology. Research is based on and supported by modelling and simulation of semicon-

ductor circuits and structures, diagnostics and development of implementation technology.

Involved in the research plan in 2007 were members of academic staff and postgraduate students from the departments of Microelectronics, Physics, Control, Measurement and Instrumentation, Mathematics, Theoretical and Experimental Electrical Engineering, Radioelectronics and Languages. Also taking part in the research plan were researchers from the Faculty of Information Technology and the Faculty of Mechanical Engineering. There were 46 participants in category D1, 21 in category D2 and 5 in category D3 - 14 professors, 14 associate professors, 20 senior lecturers and 9 lecturers, technical staff of 23 and

39 full-time Ph.D. students participating in the research plan.

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 (IO) in submicron technologies:* Two different integrated circuits were designed using the AMIS CMOS07 technology, and manufactured within the framework of the EURO PRACTICE programme. A polymorphic gate was designed and implemented to perform various logic functions. Also implemented was the second generation band-pass sigma-delta AD converter. This prototype is the first version of the substantially enhanced type with a differential resonator. A unique utilization is assumed for measurement of capacity pressure sensors. A mathematical model was designed for this integrated circuit. It was simulated and modelled in Matlab and Simulink. For generation of a carrier harmonic signal, digital sigma-delta modulation was utilized designed using the VHDL language and implemented in integrated circuit. A measurement board with appropriate software was devised for automatic evaluation of the microelectronic measuring system for measurement of the electrochemical sensor of fluid characteristics designed in 2006. Measurement accuracy with tolerance up to 1% can be achieved. In one measuring range a prominent error occurs, and therefore redesign is planned for 2008. The in 2006 designed integrated circuits CDTA a CCTA were measured. They were designed mainly for current signal processing. The circuits are functional and meet all required parameters. Development of further applications for these circuits is in progress as well as design of behavioural models.

*2. Modelling and simulation of integrated circuits:* Direct channel current simulations were carried out on nanometric NMOS structures using a structural simulator. Results for individual thicknesses of gate oxide and for individual electrode bias voltages were used to identify areas with predominant direct channels. The same structures were used for simulations including quantizing effects in the NMOS transistor channel. Interaction of electromagnetic radiation with semiconductor systems was studied. Research focused on the differences between the microscopic field acting on atoms or elements and the macroscopic field which is the mean value of the micro-

scopic field and enters Maxwell equations. Further improved were the methods for calculating sensitivity in hybrid systems with multiconductor transmission systems using the method of matrix exponential function derivation. Work was started, using the FDTD techniques, on the methods of wave propagation simulation and their sensitivity in the time domain.

*3. Microsystems and nanosystems:* The actual agents affecting the resulting structure in galvanic growth of nanostructures in pores of nanoporous ceramics were found and confirmed. These agents are the concentration of a solution and its pH, current magnitude and size of nanopores. Besides Ni nanotubes, we succeeded to create gold nanotubes using the same direct method. Ni nanotubes were tested in the ureasa biosensor with very good results for future construction of biosensors. In case of the thin nanoporous mask there are still problems with structure adhesion and subsequent opening of pores for metal deposition. Due to the stress between layers, cracking and in places even peeling occurs. The basic part of the new prototype of the device for local chemical and electrochemical deposition was constructed. Also completed were designs of electrodes for the electrochemical sensor optimized from the viewpoint of electrode topology for a three-electrode array. The operating electrode area was gradually enlarged up to  $1,9 \text{ mm}^2$  while the substrate electrode area was reduced to  $5 \times 5 \text{ mm}^2$ . In some designs partial 3D structures were used. By optimizing the deposition on operating electrodes of sensors created by direct growth of carbon nanotubes on the surface of operating electrodes of sensors, an increased sensitivity was achieved. Further research focused on the effect of individual electrodes of the sensor on the output current response of the sensor. Researches on hydrogen sensors for security applications. Analysis of hydrogen sensor technology. Characteristics of hydrogen sensors on the basis of palladium. Design of hydrogen sensors on the basis of palladium. Software development for testing the iteration method of conductivity measurement. Design and development of software for the device for conductometer circuit testing, design of software for other applications. Design and development of a device for testing the micropotentiostat circuit on a real set of non-linear sensors. Designed and implemented was a potentiostat communicating along the standard USB bus with a PC or a notebook.

The potentiostat primarily uses the cyclic voltammetry method for measurement, but also other measuring methods. For this device, control and operating software was developed for MS Windows XP and over.

*4. Advanced microelectronic and nanoelectronic technologies:* Research of thick-film sensors for heavy metal detection and for thermodynamic balance sensor focused on deposition of carbon nanotubes made of silver, gold and platinum thick-film paste. The target was an improved 3D construction of thick-film sensors and capsules. A prototype of a device for direct dispersion print of viscose materials with axial resolution  $X \sim 45 \mu\text{m}$ ,  $Y \sim 200 \mu\text{m}$  and  $Z \sim 1,5 \mu\text{m}$  and the parameters affecting print quality were checked, and electrical characteristics of conducting thick-film pastes were measured. Laser was applied to create troughs in silicon solar cells and to isolate edge - p-n junction break on the back of the cell. A study on optimization of lead-free soldering process based on thermal cycling of chip components (-20 to +120 C) using the lead-free solder SAC 305. Models of microconnections were created (ANSYS a FLOTHERM) and a testing chip for reliability study was designed and implemented, reliability tests were commenced. A model tool for ecological assessment of electrical products (ecodesign) focused on elimination of effects harmful to the environment.

*5. Modern diagnostics of materials and components:* Two new unique workplaces were opened – a workplace for measurement of semiconductor samples at ultralow temperatures (up to 10 K) and the workplace SNOM for scanning microscopy of quantum elements – resolution  $< 40\text{nm}$ . Research of quantum elements was started. The prototype of a device for measurement of potential distribution was used for tests. Research of crystalline CdTe samples suitable for detection of X-ray and gamma radiation continued, and the origin of noise  $1/f$  was described. The signal/noise ratio was optimized. Results are applied in preparation technology. There is interest in application in safety sensors. Research was done on stochastic characteristics of impact ionization processes in  $A_2B_5$  semiconductors where the number of free charge carriers can be controlled by illumination. Affinity in polymer materials was studied. A new measuring technique was introduced - spectroscopy of stationary waves that can produce information on location of displaced

dielectric boundaries. This method is based on the magnitude of the change of a stationary wave phase as a wavelength function. Sources of noise and the dependence of noise spectral density on the mean free trajectory of carriers, mobility, temperature dependence, illumination and electric field intensity were analyzed. A method of separating the contact noise from the noise of specimen volume in ohmic contacts technology on homogeneous structures MOSFET and HEMT was prepared.

Research results were published in 2 monographs, 32 papers in international journals, 224 papers presented at international and national conferences. There were 5 dissertations and 31 research reports. Two habilitation procedures and one procedure leading to professorship were started.

In connection with their research work within the framework of the research plan the members of the team were involved in 2 international projects, 12 GAČR projects, 13 FRVŠ projects, 8 projects of Ministry of Industry and Trade, 2 projects of Academy of Sciences, and in projects for other institutions.

#### **New Generation Electronic Communication Systems and Technologies (ELKOM)**

(Investigator: Jiří Svačina)

The research plan is concerned with advanced communication circuits, signals and systems within the entire communication chain. Research is focused on multimedia systems from the point of view of transmitted signals, transmission channels and technologies. The research plan is scheduled until the end of 2011. Its goal are original outcomes concerning novel communication structures and solution methods, efficient techniques of multimedia signal processing and advanced technologies for new generation communication systems. Involved in the research plan in 2007 were academics and Ph.D. students of the departments of Radioelectronics, Telecommunications, Biomedical Engineering and Theoretical and Experimental Power Engineering. The investigation team included 14 professors, 19 associate professors, 56 assistant professors and lecturers, a technical staff of 19 and 85 full-time Ph.D. students.

The research plan covered 6 areas where the following results were achieved in 2007:

*1. New generation wireless and mobile wide-band communication systems:* Research in optical links was focused on the model of atmospheric precipitation impact on the qualitative parameters of wireless optical link. Dual atmospheric connection was developed for testing conditions of optical wave propagation in frequent and heavy fogs. The connection is located in the observatory of Academy of Sciences on the mountain Milešovka. In mobile systems and 3G network, research concentrated on three algorithms for suppression of interferences: the G-RAKE receiver, multicast detection and generalized multicast detection for uplink. Models of wireless communication systems Wi-Fi and Bluetooth, working in the licence-free range ISM 2,4 GHz, were made in Mathworks Matlab. Added to the experimental mobile network GSM was the fundamental part of element Softswitch/ MediaGateway, which is the basis of the backbone of third generation mobile networks.

*2. Multimedia and hypermedia communication services and technologies:* In research of image compression for DVB-T applications, a new method was designed for continuous transition of standard TV broadcasting resolution (SDTV) to high resolution (HDTV) in DVB-T network. For copyright protection by water gauging, DCT (Discrete Cosine Transform) based methods with support of safeguard block and convolution codes were tested. A multicast experimental network with SSM support was designed and implemented, and sets of experimental and validation tests were completed for assessment of these new SSM algorithms. The development and implementation of the operating sample of a hardware simulator of a real transmission channel for TV signals (channel selectable in the frequency range 50 – 450 MHz by change in bandpass filter tuning) were finished.

*3. High-frequency and microwave communication systems:* Synthesis of special wide-band funnel and coplanar antennas, multicriterion optimization of multiband antennas, synthesis of partially filtering mirrors based on frequency selective surface, development of multiband substrates with band-stop filter, development of planar rotational symmetric structures with band-stop filter. Research and development of communication systems for the experimental satellite AMSAT P3E and sonde P5A. Study of the impact of intrinsic noise on the characteristics of narrow-band telemetric channel in space sondes and systems with coherent de-

tection. Analysis and measurement of attenuation characteristics of EMC filters in conditions of non-standard input and output impedance. Design and implementation of symmetrization cells with modern active elements for measurement of input attenuation in regard to symmetric interference signals. Analysis of electromagnetic field distribution in the working area of multiconductor EMC simulator using the program 4NEC2. Continued work on the design and development of wide-band circuit on the principle of microwave hexagon.

*4. Advanced technologies of integrated communication systems:* Assessment of the possibility to control the quality of services (QoS) on an interface between the end station and transmission network. Analysis of cooperation with the mechanism DiffServ. Research of VoIP technology focused on techniques of transfer from conventional extension network technology to VoIP using the existing distribution network and end user sets. A safe algorithm for collector systems of measuring devices was developed. Algorithms are based on the principle of symmetric cryptographic systems. Impact of transmission errors on decoded data was studied. Mathematical description of the resynchronization interval for all published self-synchronization types of operation - CFB, OCFB and SCFB operation of block code was completed. Results can be used to select a suitable type of self-synchronization operation of a block code.

*5. Special electronic circuits and operating blocks for modern communication systems:* Research focused on the new active elements CMI (Current Mirror and Inverter) and COA (Current Operational Amplifier) operating in current mode and their applications in frequency filters and A/D converters. In cooperation with Design Centre AMI Semiconductors, implementation of experimental structures was prepared. Methods of the design of frequency filters operating mainly in current mode with our integrated circuits UCC. The major achievement in A/D converters is modern circuitry of internal structures with special focus on sigma-delta converters. In cooperation with German Aerospace Center, Wessling we developed a unique data tester on the basis of FPGA to characterize the distribution of errors in an optical transmission channel in turbulent atmosphere. In the FPGA circuit, a method was implemented for estimation of the delay between



the signal on the input and the output of power amplifier.

**6. Digital methods of analysis, processing and transmission of multimedia signals and images:** A unique extensive database of multicast biological and technical signals for development of algorithms of detection, resolution and analysis of short-term changes and trends of changes. A concept of new metrics for assessing the quality of videosequences compressed by means of the H.264/AVC was designed and simulations made. The metrics uniquely does not require compressed material. An optimal spectral representation of speech signal by means of chirp transformation was designed. A method was designed and implemented for mutual analysis of audio and video recordings for search of sequences without speech activity with highly positive results. For water gauging of audio signals, a method was designed for digital water gauging of audio signals based on decomposition of modular components of input audio signals in singular values modified in dependence on input water gauge and on the value of adaptive coefficient of robustness.

Research plan results were published in 5 scientific monographs, more than 140 articles in international and national journals (9 impact ones), 380 papers at international and national conferences, seminars, workshops. There were more than 30 partial research and technical reports, 20 dissertation and habilitations and 2 appointments to professorship. The investigating team had 23 international citations and 14 responses (4 of them from abroad).

In connection with their research within the framework of the research plan the members of the investigating team were involved in another 7 international research and development projects, more than 30 GAČR projects, over 50 FRVŠ projects, 10 projects of Ministry of Industry and Trade, and more than 25 research and development projects for other institutions.

### **Resources, Accumulation and Optimization of Electric Energy Exploitation in Conditions of Permanently Sustainable Growth**

(Investigator: Jiří Kazelle)

The research plan is focused on electrochemical sources of electrical energy including fuel cells, transport systems with alternative sources of electric energy, optimization of photovoltaic en-

ergy converters operation, small hydroelectric power plants and cogeneration units, their cooperation in larger systems, effective electric energy exploitation, unconventional low-potential sources of heat and unconventional energy accumulation. The research plan is focused on lead-acid batteries and optimization of their utility characteristics, on explanation of the mechanism of exploitation defects, modeling of currents over electrode surfaces, research of the properties of gel polymer electrolytes, carbon electrodes and electrocatalysts of lithium-ion batteries, fuel cells and supercapacitors, study of material structure in the environmental scanning electron microscope (signal detection and optimization of monitoring conditions), research of transport systems based on alternative electric energy sources, exploitation of electric power produced in small water stations for charge of electric vehicles, artificial intelligence in electromechanical systems and electric drives, identification and optimization of the parameters and design of electric machines using genetic algorithms and simulated annealing, management of electrochemical energy conversion by means of up-to-date methods, application of the theory of chaos and fractals to describe non-linear dynamic systems with variable parameters, new fundamental findings related to plasma energy converters, development of methods for allocation of electric energy loss due dissipated sources, methods for localization of failures in distribution network, and optimization of maintenance strategy.

Involved in the research plan were academics and Ph.D. students of the departments of Electrotechnology, Power Electrical and Electronic Engineering, Power Electrical Engineering, Theoretical and Experimental Electrical Engineering, Languages and one staff member of the Department of Physics, Faculty of Civil Engineering. In 2007, there were 24 members of the team in category D1, 49 in category D2, 19 in category D3 that is 7 professors, 21 associate professors, 27 assistant professors, 18 Ph.D. students employed at the departments, and technical and administrative staff of 19. The research plan covered four major areas. The following results were achieved during the third year of the research plan.

**1. Chemical sources of electric energy:** Preparation of a new ion-exchange membrane and electrocatalysts for H<sub>2</sub>-O<sub>2</sub> fuel cells including design of specified testing technique. Study of the physi-

cal and chemical properties of gel polymer electrolytes electrical conductivity increase at the presence of alumina nanoparticles), their preparation by polymerization using a chemical initiator and UV radiation. NMR spectroscopy-based investigation of lithium and sodium ion mobility in electrolytes. Research of stable and resistant cathode materials for lithium-ion batteries on the basis of  $\text{LiCoO}_2$  containing dopants, research of the high efficiency of graphite as an anode material, of electrochemical insertion of alcalic ions into  $\text{WO}_3$  films, mass increase including measurement by means of the QCB technology. Research of the impact of additives in negative active mass of lead-acid batteries to minimize the negative effects occurring in the long-term PSOC mode. Start of long-term tests with conducting and non-conducting additives. Construction of a mathematical model of current distribution in lead-acid battery electrode systems using calculation on an equivalent electric circuit. Optimization of operating conditions in the EREM specimen chamber for battery mass investigation design of a humidity measurement technique, work on two signal electron detectors.

*2. Optimization of electrochemical energy conversion:* design and analysis of a laboratory specimen of axial starter for motor vehicles. Optimization of a number of synchronous generators using artificial intelligence methods. Design of an alternator for deteriorated working conditions. Design and research of high-speed asynchronous motors. Concept, design and laboratory model of an electronically controlled engine. Implementation of a levitation system with the loading capacity of 200 kg. Work continued on innovation of a collector system for low-voltage DC machines to be used in traction drives. Tests on a traction converters with an output of 500 kW. The MKP method for microgenerator magnetic field measurement, optimization calculations and operating sample implementation. Development and implementation of a switching power source, implementation of a three-phase alternator for electric traction. Model verification of the dynamic characteristics of electromechanical systems with focus on effects of nonlinearities and changes of parameters, chaos, bifurcation analysis.

*3. Optimization of energy conversion and exploitation in systems with ecological power sources:* Optimization of the operating point of photovoltaic converters. Simulation of using the new analytical method Fast LBIC and measurement of the pro-

totype. Analysis of measurements at different wavelengths of the LBIC of light source. Exploitation of electroluminescence for non-destructive testing of the quality of contacts in solar cells. A device of photoluminescence measurements. Software for calculating the structure and thermodynamic characteristics of thermal plasma, method for calculating current density in coaxial cables made of two tube conductors, a measuring method and system for determination of transmission functions of light sources in frequency domain, and a unique prototype of a signal lamp with highly illuminating LEDs. A system for measurement and data acquisition from solar systems for evaluation of light sources efficiency, implementation of an operating model of thermoelectric generator of novel construction. Design and implementation of special light sources with high efficiency energy conversion. Implementation of several sensors - measuring transformers of current or voltage without interference signals (so called partial discharge). A reliability analysis of the distribution network and cost assessment. Implementation of a model of power supply failures in cable distribution networks. An analysis of the characteristics vital for cogeneration unit control.

Mathematical modelling of radiation energy transport in air plasma considering additives of selected metals. Modification of software for mathematical modelling of radiation energy transport by means of the method of partial characteristics. Completing the database of input spectral data for air plasma with additives of selected metal vapours. On the basis of results the radiation energy transport can be relatively easily determined, which is important namely in modelling of the switching-off process in low-voltage arc. Theoretical and experimental work on short arc in low-voltage devices. A set of experiments in cooperation with OEZ Letohrad when pressure measurements were executed in the quenching chamber.

*4. Alternative ecological transport:* Capacity measurements and long-term monitoring of Ni-Cd batteries composed of 110 pieces of 6 V Ni-Cd blocks from the French company SAFT type STM 5.100 MRE, capacity 100 Ah, and of 126 V Ni-Cd batteries made of twenty-one 6 V Ni-Cd cells from the French company SAFT type STM 5.100 MRE capacity 100 Ah, and 180 V Ni-Cd batteries made up of 30 pieces of 6 V Ni-Cd cells from the French company SAFT type STM 5,100 MRE, capacity 100 Ah. Measurements were carried out

on batteries used in the hybrid bus of the company ČAS-SERVICE Znojmo and in the electric vehicle BETA EL 180.

Development and implementation of an electro-mobile with hydrogen fuel cells NEXA. Fuel cells provide an average output. For peak output the Li-Fe-Po accumulator is used as a DC intercircuit of the traction converter for asynchronous motor. Novel construction of second-generation electric bicycle with asynchronous motor. Work started on a traction system for single-track vehicle with petrol four-engine and electric transfer of output in order to maximize reduction of combustion motor consumption. Work continued on innovation of collector system for commutator engine.

The research team published 6 papers in impact journals of ISI database, 33 papers in reviewed non-impact journals, 206 papers in conference proceedings. There were 15 prototypes and operating models, 4 dissertations.

The members of the team participated in 5 GAČR projects, 2 GAAV projects, 2 FRVŠ projects, 1 project of Ministry of Industry and Trade, one project of Ministry of the Environment. They also participate in one project of the Faculty of Mechanical Engineering and in a project of the 6th FP EU.

With support from the research plan, investigators and co-investigators organised 4 major world conferences.

### **Intelligent systems in automation**

(Investigator: Pavel Jura)

The research plan deals with research of up-to-date methods and tools making up the design system for automation of processes focused on methods exploiting artificial intelligence. Research is focused on up-to-date methods and procedures of data scanning and verification, optimization, monitoring and diagnostics of processes, modelling of systems and research of control algorithms using artificial intelligence. Emphasis is laid on new communication and internet technologies.

Involved in the research plan in 2007 were academics and Ph.D. students of the departments of Control, Measurement and Instrumentation and Mathematics, and the Department of Control, Measurement and Instrumentation of the Faculty of Mechanical Engineering. The investigating team included 4 professors, 8 associate professors, 13 assistant professors and lecturers, tech-

nical and administrative staff of 4 and 12 Ph.D. students.

The research plan covered 5 study areas where the following results were achieved in 2007:

*1. Smart control and identification algorithms:* In research of sensorless control an algorithm granting stability of an estimate of revolutions was verified on an operating model. The possibility to estimate revolutions of an asynchronous motor on the basis of an analysis of the spectrum of stator electric parameters. Achieved research results led to closer cooperation with our industrial partner Freescale Polovodiče. Within the framework of this cooperation, the group took part in implementation of the operating system AUTOSAR for Freescale processors. This development resulted in two products – authorized software distributed to producers in automotive industry worldwide. Developed and verified were conventional algorithms and adaptive, optimal controllers using artificial intelligence on both parallel mathematical models of processes and real processes. The objective is to create up-to-date control algorithms on artificial intelligence principles and provide for supervision and monitoring with focus of application in real environment. Also implemented was a non-linear dynamic model (motor-generator with a flexible coupling) for verification of heterogeneous structures of controllers for one- and multiparameter control systems. Research was focused on selection and verification of suitable predictive controllers using artificial intelligence tools for implementation.

Mathematical support paid attention to controllability of discrete systems with a delay and stability of the trivial solution of differential equations in a critical problem. Some results were published in impact journals *Computers and Mathematics with Applications* and *Journal of Discrete Mathematics*.

*2. Control of complex systems:* The group concentrated on the following research and development areas: Designed and tested were progressive and original softcomputing optimization algorithms and algorithms for generation of optimal mathematical models. Structural methods (String Matrix, Grammar) for description and identification of objects were analyzed and tested. Operating models of a multidirectional mobile robot were implemented for a further utilization in 2008 in research of intelligent systems

in automation. Research in other areas of intelligent systems in automation was completed. It resulted in two utility models for new technical solutions (no. 171174: I/O circuit for data communication over an electric energy distribution system, no. 17218: a spinning turbine with two rotating chambers).

The research group took part in the prestigious international competition Xplore, organized by the German company PhoenixContact, with the project of so called intelligent weighting system (the project was successful in the first selection round. Work on the project is going on, evaluation is to take place in June 2008). The paper presented at the international congress WCECS 2007 (USA) was awarded as the *Best of Paper*.

**3. Artificial intelligence and robotics:** This group focused on three major areas: expert systems, remote controlled service robotic systems and cooperation between robots. State-of-the-art in expert systems was analyzed and appropriate tools for further work were chosen. Further research in service robotics was prepared. Research of user interfaces of remote controlled robots was carried out. A new distribution system for remote control of mobile robots with telepresence option was designed. Besides standard priorities such as intuitive and comfortable control technical parameters for implementation of end products, namely increased reliability, were also included. Work was commenced on a system of autonomous control of robots in an outdoor environment. Results were published at prestigious conferences. Our robots ranked first in the competition of autonomous robots Robotour 2007 in Prague. Further research of robot cooperation was prepared. New miniature mobile robots with modern architecture for practical testing of sensors, control algorithms and artificial intelligence were designed.

Mathematical support focused on structures made up of preferential relations including bottleneck algebras providing an apparatus for modelling in decision-making processes. In research of the methods of criteria ordering and subsequent search for objective functions we applied fuzzy preferential relations, fuzzy metrics and fuzzy set operations.

**4. Communication networks and systems of processing automation:** Design and implementation of wireless technology into intelligent process instrumentation and evaluation of the parameters

of the wireless standard IEEE 802.15.4 in office accommodation, common and private premises in blocks of flats and outdoors, verification of applications of wireless networks with battery supplied points of junction – a wireless system for temperature monitoring. Design and start of implementation on a technology model for research of hybrid logic-dynamic systems management – technology for distillation (of oils) by water vapours. Measurement of parameters quantifying real-time communication in the Ethernet network environment with non-trivial topology and IP protocol, including development of a model of network containing active network elements (routers) within the framework of research for implementation of complex control units. Accurate measurement of real-time characteristics of active and passive network elements will be able to specify parameters achievable in RT communication containing more than one IP subnetwork to define QoS parameters for industrial automation.

**5. Methods and tools for automated measurement:** The group participated as a co-investigator in two European projects: COST D41 – ‘Heterogeneous catalysts for oxidation of organic compounds based on composite perovskite oxides’ a 6 RP CREDO – ‘Cabin Noise Reduction by Experimental and Numerical Design Optimization’. The members of the group attended the prestigious international conference INTER-NOISE 2007 ‘Identification of regularization parameter for NAH by comparison of results of different NAH calculation methods’. The group cooperated with the Laboratory of Heat and Flow Transfer at the Faculty of Mechanical Engineering, Brno University of Technology – three expert reports for Válcovny Třinec and Bohumín: ‘Optimization of cooling cylinders in rolls’ and with the Institute of Experimental Biology of Masaryk University Brno work on a measuring system for an experimental laboratory.

The members of the group involved in computer vision as a method of contactless measurement focused on four independent projects – development of a camera system for detection of ground glass stones of different orientation (Preciosa), development of the control system Cutter (APOS - TRADE), development of periscope and software for monitoring operations performed in ionizing radiation chamber (VF Černá Hora, UJP Praha) and development of a device for recording, automatic localization and evaluation of microdot characters (APOS - TRADE). The re-

sults are two operating models and authorized software.

For mathematical support, the Cauchy integral formula was used for compression of images and determination of transfer function using Laguerre functions.

Results of research plan solution in 2007 were published in 3 monographs, more than 15 articles in international and national scientific and professional journals, in more than 60 papers presented at international and national conferences, seminars and workshops. The research team implemented 18 engineering works and prototypes, submitted two applications for utility models, 10 partial research and technical reports were opposed, one dissertation and one habilitation work defended. The team received several responses, two from abroad.

In connection with the research plan team members were involved as chief investigators or co-investigators in other three international projects, eight research projects of the Czech Science Foundation, and one project of the Grant Agency of Academy of Sciences, more than 10 projects of Ministry of Education, four projects of Ministry of Industry and Trade and more than 10 research and development projects for other institutions.

### **Research Center of Applied Cybernetics**

(Investigator: Petr Vavřín)

Research Center 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 Prof. Vladimír Kučera at the Czech Technical University Prague. Other co-investigators are VSB-TU Ostrava, University of West Bohemia Plzeň, Tomas Bata University Zlín, Institute of Information and Automation Theory, Academy of Sciences Prague, Čerticin, a.s., Praha, Cygni, s.r.o. Praha, UniControls a.s., Praha, Neovision s.r.o., Praha, Camea s.r.o., Brno, UNIS, s.r.o. Brno, Siemens Automobilové systémy s.r.o., Frenštát pod Radhoštěm. In the period 1999-2004 the first five-year cycle was completed. Regarding the high quality of achieved results, the second cycle for 2005-2009 was started. The group was joined by other researchers, and the set of end users was somewhat changed. Details can be found at the Research center address [www.c-a-k.cz](http://www.c-a-k.cz).

The leader of the co-investigating team at the Faculty of Electrical Engineering and Communi-

cation is Prof. Petr Vavřín from the Department of Control, Measurement and Instrumentation.

There are four research groups:

#### *1. Automatic control algorithms*

*P. Vavřín, P. Blaha, P. Václavěk, L. Veselý, P. Zbranek*

Development continued of intelligent robust algorithms for contactless control of asynchronous engines using the reconstruction state of the system. The algorithms were tested on models of engines, and results were provided to end users for practical tests. Optimization of the hierarchy of relationships man-machine continued.

#### *2. Artificial intelligence and robotics*

*F. Šolc, L. Žalud, T. Neužil, L. Kopečný*

The robotic system Orpheus-X2 was further improved. The ARGOS universal system for telepresence control of mobile robots was expanded for simultaneous control of a number of robots. Development of rescue robots using flying pilotless systems (namely helicopters) continued.

#### *3. Computer Vision*

*J. Honec, P. Honec, P. Petrovský, S. Valach*

The research team focused on automatic processing of optical data, and achieved outstanding results in installation of their camera systems for traffic surveillance. Developed and set in operation were systems for measurement of average speed of vehicles in given sectors (tunnels). Development of special HW for such applications continued.

#### *4. Control systems;*

*F. Zezulka, P. Kučera, O. Hynčica*

Designed and implemented was a technological model of continuous steel casting. The model was used to verify the designed sophisticated control algorithms and implementation of required control systems.

### **Research center of quasioptical systems and terahertz spectroscopy**

(Investigator: Zbyněk Raida, co-investigators Jaroslav Láčik, Zbyněk Lukeš)

Research center of quasioptical systems and terahertz spectroscopy (KVAŠTES) was established in March 2006 by the High School of Chemistry and Technology, J. Heyrovsky Institute of Academy of Sciences, Czech Technical Uni-

versity and Brno University of Technology. The center is involved in basic research funded by Ministry of Education, project No. LC06071.

The center is focused on basic research of the structure and dynamics of molecules, relaxation processes, and atmospheric response to electromagnetic waves. Research involves the wide frequency band, ranging from centimeter to sub-millimeter waves.

The Brno branch of the KVAŠTES center is involved in the development of numerical models of spectroscopy components and their optimization to enhance its parameters. Numerical modelling will be used to investigate interactions between electromagnetic field and elementary particles.

In 2007, the Brno branch achieved the following results:

- A unique numerical model of electromagnetic waves propagation through spectroscopy cell was developed. In an original way adapted approaches *ray tracing* and *ray launching* were used. The numerical model of spectroscopy will be used for sensitivity analyses and optimization of the entire spectroscopic apparatus.

- Optimized numerical models of partially filtering mirrors based on frequency selective surfaces were constructed. By changing the shape and size of selective surface elements, frequencies of the reflecting and the interpenetrating agent can be affected.

Partially filtering mirrors will be used for development of multiple reflection cell, which will significantly increase the sensitivity of spectroscopic measurements.

- Optimized numerical models of planar monopoles of extreme bandwidth were created. Planar monopoles will be used for excitation of spectroscopic apparatus.

In 2008, the centre will concentrate on parametric analysis of the wave part of spectroscopy as a whole, on global optimization of this part of spectroscopy and on completing the development of partially filtering mirrors and planar monopoles.

### **Research centre 'Data, algorithms, decision-making'**

(coordinator: Institute of Information and Automation Theory, Academy of Science Prague)  
(Brno group investigator: Jiří Jan)

The research team involving co-investigators R. Jiřík, R. Kolář and other investigators, mainly Ph.D. students, continued research in the centre D.A.R in two major areas: reconstruction of ultrasound tomography images including computing calibration of the measuring system, and analysis and evaluation of ophthalmological data.

#### *Ultrasound tomography*

New approaches for reconstruction of images in ultrasound computer tomography (USCT) focused on increasing the quality of reconstructed images on the basis of fusing attenuation data and velocity images with basic diffraction (reflection) modality. The following problems were tackled:

- Reconstruction of attenuation images in USCT by algebraic methods using modified iteration methods with experimentally selected regularization aimed at data restoration. Generalization of these approaches on 3D imaging.

- A new method of calibrating 2D and 3D USCT systems, mainly in terms of accurate system geometry (positions of transducers).

- Specification of ultrasound field simulation models in the USCT system based on numerical solution of a wave equation in the 2D problem (a generalized 3D variant was started) to gradually encompass all conflicting effects (non-homogeneous environment, diffraction, non-linearities, pulse mode). The aim is to find out whether the rather simplified models are sufficiently realistic in terms of reconstruction of images.

To verify the reconstruction methods, software was developed for accurate simulation of 2D measurement data using commercial software Wave 2000 (CyberLogic, USA). The data was used for a detailed analysis of effects causing errors in estimates of attenuation along the beam path. These effects were partially suppressed by means of a specially devised synthetic zooming method. Software was developed for simplified simulation of measurement data from experimental 3D tomograph.

Software for estimation of attenuation maps for 2D problems was modularized and expanded by processing of data measured with the experimental 3D tomograph, so far for computation of attenuation maps in 2D sections. For the program of algebraic reconstruction the team designed and implemented a method for solving predetermined systems of linear equations with regulari-

zation for reconstruction in homogeneous parts. A paper was offered for publication. The techniques were tested experimentally on simulated data. A substantial improvement of reconstructed maps was observed.

For diploma projects, the workplace for ultrasound measurements was set in operation, and experimental measurements of attenuation velocity of ultrasound propagation required for reconstruction of testing phantom circuits were carried out.

For geometrical calibration of 2D systems a method was designed and tested by simulation, based on the measurement TOF (time-of-flight, through a homogeneous environment of aqueous systems), which does not require any a priori information and provides the needed submillimeter accuracy. A 3D variant (using block array of transducers) has been designed. Simulation of the ultrasound field by means of 2D wave equation solution was implemented in geometry near to the real arrangement USCT of 2D systems, based on the physically transparent formulation, limited to standard solution. In the same way generalization for a 3D problem is performed (wave equation at different approximation levels and MKP algorithms) with an assumed further integration of higher realistic members of equation, retaining procedure transparency at each step (absent in commercial software). Theoretical studies focused on blending of seismological detection methods in the studied problem of ultrasound propagation in tissue and solution of specific wave effect approximation (FDTD, Fast Marching Methods).

#### *Ophthalmological images:*

Multimodal vision and subsequent analysis of ophthalmological images for glaucoma diagnostics.

- Modification of previously verified recording methods for pairs of autofluorescence and in-

fra-images with subsequent vision and semi-automatic analysis for clinical diagnostics.

- Possibilities of sight distortion compensation after laser ablation (LASIK) – researches and introductory experiments, according to previously achieved results the outlook is not very promising).
- Search for suitable texture methods for detecting of a layer of retina neural fibres.

An extensive database of images (131 pairs of images) was used to test and modify an efficient recording procedure for AF (autofluorescence) and IR (infrared) images. Results were evaluated and published. Sliced fitted images were focused on an easier interactive evaluation in medical practice. Results were offered for publication. At the ophthalmological clinique in Erlangen (Germany), cooperating in the research, a program for segmentation and quantization of zones with increased autofluorescence were tested.

In research of sight improvement in people suffering from vision defects after laser ablation (LASIK) we focused on literature search and further study of optical models of human eye. Some simulation algorithms and experiments were carried out on optical bench. The project is still in its initial stage, and information obtained in this part of the project leads to rather pessimistic conclusions. It seems that another methodology will be required.

For detection of the layer of retina neural fibres, we verified the efficiency of some procedures of texture analysis (statistic and spectral analysis, wavelet transformation, mixed histograms and *run-length* matrix). The methods were – so far with poor results – tested on three sets of data representing diseased and healthy tissue in patients with dropout. Retina images from healthy people constituted the control group.

## Habilitations and Appointments to Professorship

In 2007, five members of FEEC staff were granted the title of professor and three new associate professors were appointed:

**Prof. Ing. Jarmila Dědková, CSc.**  
Theoretical Electrical Engineering

**Prof. Ing. Karel Bartušek, DrSc.**  
Theoretical Electrical Engineering

**Prof. Ing. Milan Sigmund, CSc.**  
Electronics and Communications

**Prof. Ing. Otakar Wilfert, CSc.**  
Electronics and Communications

**Prof. Dr. Ing. Pavol Bauer**  
Power Electrical and Electronic Engineering

**Doc. Ing. Petr Blaha, Ph.D.**

Technical Cybernetics

**Doc. Ing. Jiří Mišurec, CSc.**

Electronics and Communications

**Doc. Ing. Ivo Lattenberg, Ph.D.**

Electronics and Communications

### Postgraduate Doctoral Study

In academic year 2007/08, there are 353 students in the doctoral study programme. Among them 8 students are in the study programme in English, and 2 international students receive government scholarship. Numbers of Ph.D. students in individual years of study over the past five years are given in Table 4.

Table 5 shows numbers of doctoral programme graduates at individual departments over the past five years.

A list of doctoral programme graduates in 2007 can be found on FEEC websites, links *Study*, *Doctoral study programme*, *Doctoral programme graduates*.

Table 4: Numbers of doctoral students from 2003 to 2007

<i>year</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>
<i>1.</i>	96	87	49	83	92
<i>2.</i>	70	80	71	44	72
<i>3.</i>	57	65	72	67	40
<i>4.</i>	31	48	44	48	43
<i>5.</i>	32	27	33	32	39
<i>6.</i>	31	28	24	29	27
<i>7.</i>	25	31	24	28	40
<i>total</i>	<b>342</b>	<b>366</b>	<b>317</b>	<b>331</b>	<b>353</b>

### Student Creativity

STUDENT EEICT Conference and Competition was jointly organized by FEEC and FIT on 26 April 2007. The abbreviation conceals 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 233 papers, 45 Bachelor, 85 Master and 96 doctoral papers and 7 papers presented by secondary school students.

Competition papers were evaluated by expert committees including representatives of sponsoring companies, academics and Student Union representatives. Top 84 papers were awarded at the closing ceremony.

For more information on the competition see FEEC websites, links *Research*, *STUDENT competition*.



Table 5: Doctoral programme graduates at FEEC departments from 2003 to 2007

	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>total</b>
<b>UAMT</b>	4	8	3	3	2	<b>20</b>
<b>UBMI</b>	1	2	2	0	2	<b>7</b>
<b>UEEN</b>	0	6	1	5	0	<b>12</b>
<b>UETE</b>	2	0	3	2	0	<b>7</b>
<b>UFYZ</b>	0	1	1	0	5	<b>7</b>
<b>UMEL</b>	1	3	8	4	6	<b>22</b>
<b>UREL</b>	3	1	9	10	7	<b>30</b>
<b>UTEE</b>	1	1	2	4	3	<b>11</b>
<b>UTKO</b>	11	4	4	10	6	<b>35</b>
<b>UVEE</b>	6	3	4	6	4	<b>23</b>
<b>total</b>	<b>29</b>	<b>29</b>	<b>37</b>	<b>44</b>	<b>35</b>	<b>174</b>



# External Relations and International Cooperation

## International Affairs

International activities have been aimed at increasing the prestige of FEEC by presenting results of research projects at international conferences and by participating in research and education projects, by making it possible for our students to study at partner universities abroad, and by offering tuition in English to international students.

Among our priorities is student and teacher mobility among universities cooperating within the framework of the European Commission programmes. FEEC is one of the most active faculties of Brno University of Technology. There has been a very good cooperation with the BUT Department of International Relations responsible for economic support and organization of international programmes, also the Longlife Learning Programme (LLP)/Erasmus. As a result, 39 students could study abroad in the extent of 182 student/months, and 24 teachers were on lecture stays at the length of 27 weeks, (see Table 6). Student mobility within the framework of this programme increased by 56%, and the number of student/months was the highest in the last five years. Teacher mobility, on the other hand, decreased.

Reciprocally, there has been an increased interest of international students in placements at FEEC. Within the LPP programme there were 29 students coming for placements in the total extent of 104 months, which represents an increase by 38% of student/month in comparison with 2006. Mobility figures for incoming and outgoing students in individual programmes for 2007 are in Table 7. Existing agreements in the LPP-Erasmus programme were renewed. On the whole, the faculty has concluded 40 bilateral agreements. A list of universities cooperating with

FEEC on the basis of LPP-Erasmus agreements for academic year 2008/09 is in Table 9.

In 2007, the funds from the Development Programme of the Ministry of Education for long-term study and research placements abroad of students of all degree programmes again amounted to 480,000 CZK. Further financial support of 165 thousand CZK from these programmes was provided directly to students who started their placements at the beginning of 2006.

Funded from the Development Programme were placements of 18 students in the extent of 49 months.

Table 8 shows mobility trends in incoming and outgoing students for all mobility programmes over the past four years. The gradually increasing trend in both incoming and outgoing students is obvious. FEEC students' placements amounted to 264 months, which is an increase by 19% as compared with 2006. Incoming students' placements amounted to 68 months, which is an increase by 51%.

FEEC supports cooperation of departments and academics with institutions abroad based on interfaculty and LPP-Erasmus agreements as well as newly established contacts. In 2007, the amount of 650,000 CZK was provided in support of such activities. Another 800,000 CZK was provided in support of international activities. Funds in the amount of 250 thousand CZK were obtained from the development programme of Ministry of Education 'Systematic support for work of international academics at FEEC BUT'. These funds were used to cover travel expenses of academics from abroad coming to short lecture stays at FEEC.

The trend in funding over the past 5 years is shown in graph 5.

Table 6: Student and teacher placements in Socrates-Erasmus and Longlife Learning Programme-Erasmus from 2003 to 2007

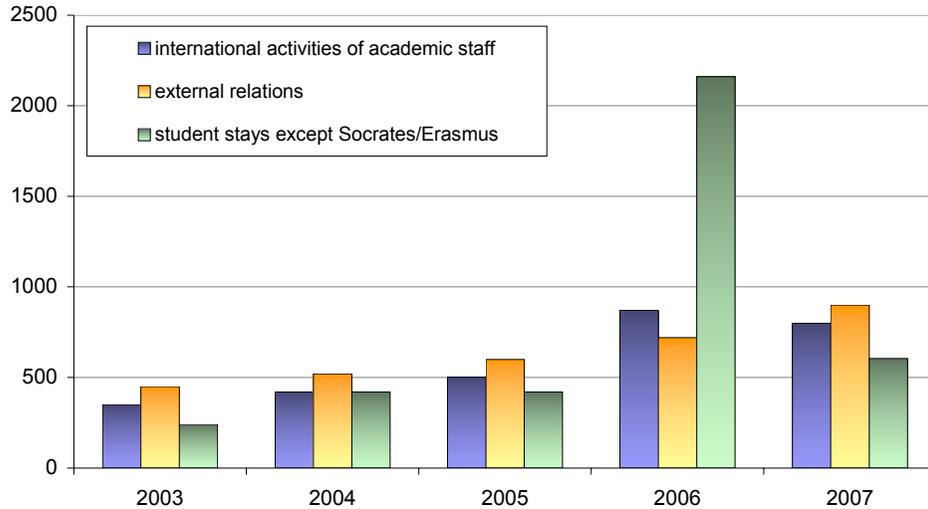
<b>Socrates (LLP)-Erasmus</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>
Students	29	42	45	25	39
Months	128	165	161	146	182
Lecture stays	23	28	26	37	24
Lecture weeks	25	38	30	45	27

Table 7: Student placements at FEEC and abroad within the framework of various programmes in 2007 – summary

<b>Activity</b>	<b>Arrivals</b>		<b>Departures</b>	
	<b>Students</b>	<b>Months</b>	<b>Students</b>	<b>Months</b>
Socrates(LLP)-Erasmus	29	104	39	182
CEEPUS	2	6	-	-
Leonardo	2	6	11	33
Inter-university agreements	5	15	-	-
Development Programme of Ministry of Education	-	-	18	49
Other	7	11	-	-

Table 8: Student placements at FEEC and abroad in all mobility programmes from 2004 to 2007

		<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>
<b>Arrivals</b>	<b>Students</b>	20	36	34	45
	<b>Months</b>	55	113	125	141
<b>Departures</b>	<b>Students</b>	55	59	45	68
	<b>Months</b>	191	203	221	264



Graph 5: Funding of FEEC staff international activities, faculty international activities and student placements outside the Socrates programme (LLP) in the period 2003-2007 in thousand CZK

## External Relations

Activities were focused on presentation of FEEC by giving to the public current and specific information on the study programmes and study areas offered at the faculty. Information was also given in the media on basic and applied research results and cooperation with industrial companies.

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

As every year, the management of FEEC participated in the annual meeting of the Czech and Slovak faculties of electrical engineering and associated faculties in Bojnice, 9 to 11 May 2007. The meeting dealt with transformation of study programmes of Czech universities based on the Bologna Declaration and with accreditation of new study programmes. Also discussed were EU research projects, coordination of projects, cooperation in research plans and centres of Ministry of Education, and cooperation with foreign universities.

Close contacts have been maintained with industrial companies in the Brno region and in other places in 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, ABB, Veletrhy Brno, Siemens A.G., Honeywell, T-Mobile Czech Republic, a.s., ON Semiconductor Czech Republic, Rockwell/Allen Bradley, Škoda Volkswagen Mladá Boleslav, Motorola, AMI Semiconductor s.r.o., Celestica, etc.

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. Some members of the Institute's staff are part-time teachers at FEEC, in Master and in doctoral programmes. On the basis of an agreement between FEEC and Academy of Sciences Ph.D. students can be educated at Academy's institutes.

Cooperation has been going on with other institutions as well. Academic staff, mainly the 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 which concluded Socrates-Erasmus agreements with FEEC for academic year 2007/08

<b>University</b>	<b>Country</b>
Katholieke Hogeschool Brugge-Oostende	Belgium
Katholieke Hogeschool Limburg	Belgium
Технически университет-София	Bulgaria
Технически университет-София - Пловдив	Bulgaria
Aalborg Universitet	Denmark
Danmarks Tekniske Universitet Lyngby	Denmark
Kuopion yliopisto	Finland
Tampereen teknillinen yliopisto	Finland
EPITA Paris	France
ESIGELEC - Technopôle du Madrillet - Saint Etienne du Rouvray	France
Groupe ESIEE Paris	France
Institut Catholique de Paris	France
Institut National des Sciences Appliquées de Lyon	France
Institut National Polytechnique de Grenoble	France
Université Joseph Fourier – Polytechnique de l'Université Grenoble	France
Università degli Studi Salerno	Italy
Fachhochschule Furtwangen	Germany
Fachhochschule Pforzheim	Germany
Fachhochschule Wiesbaden	Germany
Friedrich-Alexander-Universität Erlangen	Germany
Hochschule für Technik, Wirtschaft und Kultur Leipzig	Germany
Technische Universität Dresden	Germany
Technische Universität Magdeburg	Germany
Universitetet i Bergen	Norway
Instituto Politécnico de Lisboa – ISEL	Portugal
Instituto Superior de Engenharia de Coimbra	Portugal
Technische Universität Wien	Austria
ΤΕΙ Κρήτης - Παράρτημα Χανίων	Greece
Žilinská univerzita, Elektrotechnická fakulta	Slovakia
Žilinská univerzita, Fakulta prírodných vied	Slovakia

Universidad de Cantabria	Spain
Universidad de Malaga	Spain
Modragon Unibertsitatea	Spain
Universitat de València	Spain
Universidad de Zaragoza	Spain
Universitat Rovira i Virgili Tarragona	Spain
Högskolan i Halmstad	Sweden
Malmö högskola	Sweden
University of Salford	Great Britain
University of Huddersfield	Great Britain

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# Academic Senate

In 2007, the members of Academic Senate were (membership in legislative committee – LK, pedagogical committee – PK, economic committee – EK) :

## Chair

RNDr. Vlasta Krupková, CSc., UMAT

## Academic Staff Chamber

Doc. Ing. Jiří Kozumplík, CSc., EK, UBMI, chairman

Ing. Petr Baxant, Ph.D., LK, UEEN

Ing. Petr Fiedler, Ph.D., EK, UAMT

Ing. Ivana Jakobová, PK, UREL

RNDr. Vlasta Krupková, CSc., EK,LK, UMAT

PhDr. Ludmila Neuwirthová, Ph.D., PK, UJAZ

Ing. Radovan Novotný, Ph.D., EK,LK, UMEL

Ing. Helena Polsterová, CSc., PK, UETE

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

RNDr. Naděžda Uhdeová, Ph.D., PK , UFYZ

doc. Ing. Pavel Vorel, Ph.D., PK, UVEE

doc. Ing. Václav Zeman, Ph.D., EK, UTKO

## Student Chamber

Bc. Radim Bártek, EK, chairman, until 20 June 2007

Bc. Irena Hývnarová, LK, chairman since 20 June 2007

Petr Bílek, PK, since 1 November 2007

Bc. Martin Daniel, EK, LK

Bc. Jiří Hermany, PK

Ing. Kristýna Jandová, PK

Bc. Marian Klampár, PK, since 1 November 2007

Tomáš Szöllősi, PK, since 1 November 2007

Michal Karásek, PK, until 20 June 2007

Jiří Piškula, LK, EK, until 20 June 2007

Academic Senate held 12 regular meetings and one irregular meeting, with an average attendance of 86%. Academic Senate dealt with legislative, economic and pedagogical issues.

Academic Senate dealt with proposals for Admission Procedure Regulations for all formats of study for academic year 2008/09 as well as amendments of internal FEEC regulations.

A special data store for all proposals was established on the server, which considerably simplified procedures dealing with these documents. Amendments of Election Decree and Rule of Procedure are being prepared for next elections.

Academic Senate discussed and approved the economic report for 2006 and the proposal for

distribution of funds for 2007 and allotment of education funds.

Academic Senate organized a Pedagogical Conference devoted to the structured form of study held at the beginning of the summer semester.

Discussions at the meetings were always constructive as the proposals were first sent to all members and departments for comments.

# Campus Development

At the campus Pod Palackého vrchem access system was changed and integrated in the control system of building EBI at Kolejní 4.

Modernization of the technical equipment of lecture and seminar rooms and of the computer and information network continued.

## Reconstructions

Student canteen Maruška at Kolejní at the campus Pod Palackého vrchem was closed down and the premises were rented to a catering company. All adaptations were covered by the renting company.

General reconstruction of the roof of building A3 at Technická 8 led to extensive emergency repairs at premises 5,6 and 7. Repairs were completed by the end of 2007 and were covered by the company responsible for reconstruction of the roof.

In building U1 at Údolní 53 floors were repaired and new flooring laid. Walls and doors were painted, and access system was innovated. In building U2 emergency repairs of water distribution system were completed as well as reconstruction. FEEC started transfer to the university information system Apollo. Negotiations and analyses of system modules were carried out. Consequently the Apollo system was tuned to functions per-

structions in U4 and U5. The main entrance to the premises was equipped with a chip card system, and surveillance cameras were installed.

## Construction Works

In the spring of 2007, the Ministry of Education cancelled the competition for selection of construction supplier for the new building of FEEC at Technická 10, and it was not possible to restart the competition due to lack of investment capital.

## Computer Network and Information Systems

Priority was given to:

- upgrading of servers and adaptation of premises
- strengthening of the network of Gb information and communication technologies
- network backup
- innovation and administration of faculty websites

## Information Systems and Services

formed by the previous faculty information system. The process went on all over the year 2007 and continues in 2008.

# Other

## Equal Opportunities at FEEC

The 'Consultancy and Information Gender Studies Centre' was set up at the faculty in 2003 with support from the Higher Education Development Fund, and continued its activities in 2007

The Centre provides consultancy, professional and personal, to female students, and organizes information events for the public aimed at removing the barriers female students face when choosing careers in technical fields. Support to the training of women for jobs where they would use information and communication technologies is fully in agreement with the policy of equal opportunities for men and women which is among the priorities of the European Union.

The Development project of the Ministry of Education 'Support for an Interest of Women in study at the Faculty of Electrical Engineering and Communication' made it possible to maintain at

the faculty the consultancy centre for female students also in 2007.

However, equal opportunities can be understood in a broader sense. In 2007, the Centre focused on equal opportunities in education of handicapped students.

The Centre also concentrates on integration of handicapped students in full-time and part-time study programmes.

The Centre pays attention to promotion of study opportunities for handicapped students, development of contacts with selected secondary schools integrating handicapped students, and to creating conditions taking into account the specific needs of such students. The Centre cooperates with the Department of Physics, Student Union and other departments' staff members.

Contact: [uhdeova@feec.vutbr.cz](mailto:uhdeova@feec.vutbr.cz).

## Institute of Signal and Image Processing

The Institute of Signal and Image Processing is an inter-department body for exchange of information and coordination of the work of departments involved in the processing and analysis of signals and images. The task of the Institute is to present the activities and results achieved in the given area of interest to national and international scientific community.

The Institute groups the Department of Control and Instrumentation, Department of Biomedical Engineering, Department of Radioelectronics and Department of Telecommunications.

Activities of the Institute cover participation in international and national organizations and institutions, publishing, research and grant projects, organizing of international conferences, local seminars and lectures.

Results, mainly information on publications, are published in annual reports of participating departments.

Institute Committee:

Coordinator:

Prof. Ing. Jiří Jan, CSc (ÚBMI)

Members:

Prof. Ing. Miroslav Kasal, CSc. (UREL), Doc. Ing. Zdeněk Malec, CSc. (UAMT), Prof. Ing. Zdeněk Smékal, CSc. (UTKO), Prof. Ing. Vladimír Šebesta, CSc. (UREL), Ing. Robert Vích, DrSc., Dr.h.c. (Academy of Sciences)

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# Department of Control and Instrumentation

## **Prof. Ing. Pavel Jura, 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. Jozef Honec, CSc.  
Doc. Ing. Václav Jirsík, CSc.  
Doc. Ing. Pavel Václavík, Ph.D.  
Doc. Ing. Luděk Žalud, Ph.D.

## **Lecturers**

Ing. Zdeněk Bradáč, Ph.D., Ing. Miloslav Čejka, CSc., Ing. Petr Fiedler, Ph.D., Ing. Marie Havlíková, 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.

## **Postgraduate Students**

Ing. Jan Beran, Ing. František Burian, Ing. Luděk Caha, Ing. Jolana Dvorská, Ing. Petr Fidler, Ing. Luděk Chomát, Ing. Jan Chovanec, Ing. Ondřej Jež, Ing. Peter Kacz, Ing. Zdeněk Kaňa, Ing. Marek Kváš, Ing. Ondřej Lebeda, Ing. Petr Malounek, Ing. Vojtěch Mikšánek, Ing. Vojtěch Němec, Ing. Jan Pohl, Ing. Petr Polách, Ing. Václav Sáblik, Ing. Jan Srb, Ing. Jaroslav Šembera, Ing. Jan Valenta, Ing. Libor Veselý, Ing. Miloš Veselý, Ing. Pavel Branek, Ing. Martin Žurek

## **Administrative and Technical Staff**

Ing. Luděk Anděra, Ing. Jan Beran, Ing. František Burian, Ing. Zdeněk Havránek, Ing. Petr Honec, Ing. Karel Horák, Ph.D., Ing. Jakub Hrabec, Ing. Ondřej Hynčica, Ing. Ilona Kalová, Ph.D., Ing. Jiří Keprt, Ing. Lukáš Kopečný, Ing. Pavel Kučera, Ph.D., Ing. Tomáš Neužil, Ing. Jan Pásek, CSc., Lenka Petrová, Ing. Petr Petyovský, Ing. Soběslav Valach, Ing. Libor Veselý, Jan Vodička, Miloš Zbořil, Ing. Pavel Zbranek

## Main Interests

The group involved in industrial automation concentrates on real-time imbedded systems, wireless communication systems and industrial Ethernet with focus on operational safety and protection against internal errors, faults and attacks.

The group of computer vision concentrates on solutions related to orders from the industrial sector (Metra Blansko, APOS-TRADE, Volkswagen, Škoda Auto, AVX, Pegas, Police of the Czech Republic). Also tuition is focused on applications, mainly the new Master programme subject Computer Vision Applications with tasks prepared using new laboratory equipment (FRVŠ project 1473/F1a).

The group involved in automatic control continued the development of intelligent algorithms for electric drives control, namely sensorless control and identification of the parameters of asynchronous motor. In this research the group cooperates with the company Freescale Semiconductor.

## Major Achievements

The laboratory E135 of control systems Simatic S7 with industrial networks Profibus DP and Ethernet Profinet was completed. The year 2007 was the second year of our participation in the European project Virtual Automation Network within the 7th framework programme. The development and implementation of the wireless communication system for automation of buildings (Ministry of Industry and Trade project Safe House) was completed in cooperation with the company Betacontrol. The department organized the international Workshop CEEPUS CZ31. AS-interface, Czech Republic presented their results at the trade fair AMPER 2007.

The development of the camera system and imaging unit on the basis of FPGA Spartan (VW AG), the control system for laboratory experiments (Stanford University), the visual system for welding laser beam sweep (AVX Lanškroun), and other, continued.

The communication standards CAN/LIN were implemented for the operation system AUTOSAR

Development and verification of conventional and adaptive algorithms, optimal controllers based on artificial intelligence principles in both parallel mathematical models of processes and real processes. The aim is to design modern control algorithms on artificial intelligence principles and to secure their supervision and monitoring with focus on application in real environment.

The group of artificial intelligence and robotics has been involved in long-term research and instruction in service mobile robotics, in close cooperation with VOP026 Šternberk, s.p. in search robots for special use.

The group of measurement technology focused on electrical and electronic measurements, sensors of non-electrical characteristics, optical fibre sensors, smart sensors, measurement and evaluation of non-electrical characteristics, vibrodiagnostics, thermodiagnosics, acoustic emissions and flux measurements.

on the Freescale HCSX12 platform – authorized software, worldwide use in automotive industry.

The drive of servomechanism based on thermal deformation of metal alloys with shape memory was patented – patent no. 297963. An industrial slot camera for visual search of inaccessible areas was designed for the rescue team of the South Moravian Firebrigade. Innovation of the robot UTAR resulted in the first place in the competition Robotour 2007, (see [www.robotika.cz](http://www.robotika.cz)).

Members of the department became co-investigators of the European project COST D41: 'Heterogeneous catalysts for oxidation of organic compounds based on composite perovskite oxides' at the Department of Material Sciences and Engineering, Section of Ceramics and Polymers, Faculty of Mechanical Engineering, BUT.

At the meeting of presidents of European national NDT associations, 4th ICNDT, members of the department presented the paper 'Determination of uncertainty of primary calibration of acoustic emission sensors', (Keprt, J. - Beneš, P.).

## Major Research Projects

**Intelligent Control Algorithms for Electric Drives with Induction and Synchronous Motors – GAČR 102/06/0949**

Investigator: Pavel Václavek

**Analysis of Model Components of a System for Acoustic Emission Method – GAČR 101/06/1689**

Investigator: Petr Beneš

**Wireless Technology ZigBee in Decentralized Control Systems – GAČR 102/05/0663**

Investigator: František Zezulka

**Cabin Noise Reduction by Experimental and Numerical Design Optimization (CREDO) – 6th FP EU 030814-6**

Co-investigator: Petr Beneš

**Automation Intelligent Systems – MŠMT MSM0021630529**

Investigator: Pavel Jura

**Modern Approaches to Measurement of Vibrations – GAČR 102/06/1617**

Investigator: Ludvík Bejček

**Softcomputing Control Methods – GAČR 102/06/1132**

Investigator: Petr Pivoňka

**Virtual Automation Network (VAN) – 6th FP EU 016969**

Co-investigator: František Zezulka

**Implementation and Delivery of a Robotic System – HS 1870030**

Investigator: Luděk Žalud

**Research and Development of an Economical Information and Safety System for Housing Construction and Modernization of Old and Mainly Panel Houses – TANDEM FT-TA2/087**

Investigator: Zdeněk Bradáč

**Research Centre of Applied Cybernetics – MŠMT 1M6840770004**

Investigator: Vladimír Kučera, co-investigator: Petr Vavřín

## Selected Publications

TIAN, G. Y.; WILSON, J.; KEPRT, J. Magnetic and Acoustic Barkhausen Noise for the Characterisation of Tensile Deformation and Stresses in Steel. *Studies in Applied Electromagnetics and Mechanics*, 2007, vol. 28, no. 1, pp. 193-200. ISSN: 1383-7281.

BRADÁČ, Z.; ZEULKA, F.; TSANKOVA, D.; GEORGIEVA, V. Immune network control for stigmergy based foraging behaviour of autonomous mobile robot. *International Journal of Adaptive Control and Signal Processing*, 2007, vol. 21, no. 2-3, pp. 265-285. ISSN: 0890-6327.

## Bachelor's Programme

Computer Control (Petr Pivoňka)

Computer Science in Automation (Petr Pivoňka)

Control Theory 1 (Petr Vavřín)

Control Theory 2 (Petr Vavřín)

Databases Systems (Radovan Holek)

Electronic Measurement Systems (Miloslav Čejka)

Fibre Optics in Automatization (Ludvík Bejček)

Fundamentals of Robotics (Luděk Žalud)

Industrial Automation (František Zezulka)

Measurement in Electroengineering (Ludvík Bejček)

Measurement of Physical Quantities (Ludvík Bejček)

Microprocessors (Tomáš Macho)

Modeling and Simulation (Pavel Václavek)

Modern Means in Automation (Václav Jirsík)  
PCs in Instrumentation (Miloslav Čejka)  
PC systems (Jozef Honec)  
Practical Programming in C++ (Miloslav Richter)

Programmable Logics Controllers (František Zezulka)  
Signals and Systems (Pavel Jura)

## Master's Programme

Artificial Intelligence (Václav Jirsík)  
Application of Computer Vision (Ilona Kalová)  
Computer Vision (Jozef Honec)  
Computers for Control (Zdeněk Bradáč)  
Distributed Systems and Networks (Petr Fiedler)  
Electronic Measurement Technics (Miloslav Čejka)  
Embedded Systems for Industrial Control (Zdeněk Bradáč)  
Fuzzy Systems (Pavel Jura)  
Intelligent Controllers (Petr Pivoňka)  
Logical Systems (Radovan Holek)  
Machine Learning (Petr Honzík)  
Measurement in Nonelectrical Quantities (Ludvík Bejček)  
Modelling and Identification (Petr Blaha)

Operating Systems and Networks (Tomáš Macho)  
Real-Time Operating Systems (Pavel Kučera)  
Optimization of Controllers (Petr Pivoňka)  
Optoelectrical Sensors (Ludvík Bejček)  
Process Automation (František Zezulka)  
Robotics (Luděk Žalud)  
Robust and Algebraic Control (Petr Blaha)  
Sensors of Nonelectrical Quantities (Ludvík Bejček)  
Signal Processors in Automation and Measurement (Miroslav Čejka)  
Smart and Semiconductor Sensors (Petr Beneš)  
Systems of Discrete Events (Pavel Václavek)  
Theory of Dynamic Systems (Petr Vavřín)

## Doctoral Programme

Selected Chapters from Automatic Control (Petr Pivoňka)

Selected Chapters from Measurement Technology (Ludvík Bejček)

## 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 and 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 and research in continuous and discrete physical models, design and verification of identification and control algorithms on principles of artificial intelligence, development and verification of controllers, Petr Pivoňka)

**Laboratory for Measurement of Non-Electrical Characteristics** (instruction in Measurement of Non-Electrical Characteristics, Sensors of Non-Electrical Characteristics, experiments for student projects, diploma theses and research projects, Petr Beneš)

**Laboratory of Pressure and Flux Measurement** (research laboratory, air-track for flux measurement evaluation, Ludvík Bejček)

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



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

**PLC Laboratory with Rockwell Systems** (instruction and development of software for PLC of the company Rockwell, instruction and development of communication via DeviceNet a Ethernet IP, Petr Fiedler)

**Laboratory of Computer Vision** (instruction, research and development in image processing and computer vision, Ilona Kalová)

**Laboratory of Industrial Automation** with Siemens systems (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, Radek Štohl)

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

**Laboratory of Drives Control** (research and development of intelligent control of electrical drives, Pavel Václavek )

**Laboratory of PC Subsystems** (instruction, research and development of signal processor peripheries, Soběslav Valach)

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

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



# Department of Biomedical Engineering

## **Prof. Ing. Jiří Jan, CSc.**

Head

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## **Professors**

Prof. MUDr. Nataša Honzíková, CSc.  
Prof. Ing. Jiří Jan, CSc.  
Prof. Ing. Ivo Provazník, Ph.D.  
Prof. MUDr. Jindřich Vomela, CSc.

## **Associate Professors**

Doc. Ing. Aleš Drastich, CSc.  
Doc. MUDr. Václav Chaloupka, CSc.  
Doc. Ing. Milan Chmelař, CSc.  
Doc. Ing. Jiří Kozumplík, CSc.  
Doc. Ing. Jiří Rozman, CSc.  
Doc. RNDr. Ing. Jiří Šimurda, CSc.

## **Lecturers**

Ing. Jana Bardoňová, Ph.D., Ing. Miroslav Dvořák, CSc., Ing. Petr Fedra, Ing. Karel Jehlička, CSc., Ing. Radovan Jiřík, Ph.D., Ing. Radim Kolář, Ph.D.

## **Postgraduate Students**

Ing. Tomáš Archalous, Ing. Michal Bartoš, Ing. David Čermák, Ing. Tomáš Červinka, Ing. Martin Čížek, Ing. Vratislav Čmiel, Ing. Jiří Dlouhý, Ing. Adam Filipík, Ing. Vratislav Harabiš, Ing. Martin Havlíček, Ing. Ferdinand Hodáň, Ing. Jan Hruběš, Ing. Lukáš Chmelka, Ing. Dina Kičmerová, Ing. Libor Kubečka, Ing. Pavel Leinveber, Ing. Michal Mikl, Ing. Pawan Pathak, Ing. Martin Pichút, Ing. Jiří Roleček, Ing. Milan Rychtárik, Ing. Ivo Říha, Ing. Jiří Sekora, Ing. Petr Sadovský, Ing. Martin Švrček, Ing. Viktor Svoboda, Ing. Milan Tannenberga, Ing. Petr Verner, Ing. Martin Vítek, Ing. Roman Vopálka, Ing. Jiří Začal, Ing. Roman Žák

## **Administrative and Technical Staff**

Mgr. Dušan Hemzal, Ph.D., Anna Oujeská, Mgr. Igor Peterlík, Hana Rýznarová, Jaroslav Sedláček, Ing. Vlastimil Václavík

## Main Interests

The department provides tuition in basic subjects, mainly processing of signals and images, and specialized subjects of biomedical and ecological engineering in the new and the ending Bachelor and Master degree programmes. The department is involved in basic and applied research of engineering principles in medicine, biology and ecology. The main areas of interest are digital processing and analysis of cardiological signals (digital processing and analysis of the records of electric activity of ischemic heart) and ophthalmological images and ultrasonographic data. The department cooperates with the Ophthalmological Clinic of Friedrich- Alexander-University Erlangen, Forschungs-Zentrum Karlsruhe, Germany, University of Bergen, Medical Faculty of Masaryk University Brno, the Faculty Hospital in Brno-Bohunice.

Research carried out in the research centre D.A.R. focuses on processing of medical images. The Brno team is mainly concerned with reconstruction methods in 2D and 3D ultrasonic tomography and ophthalmology. Research is supported by a research plan (investigator Prof.

## Major Achievements

Members of the department were investigators of several research projects, whose results were published in scientific journals and presented at reputable international conferences, and were published in a monograph.

The division of the national research centre D.A.R (Data-Algorithms-Decision-Making, coordinator Institute of Information Theory and Automation, Academy of Science, Prague), focused on analysis and fusion of images, continued its activities.

The staff is continually joined by young teachers, the former doctoral students at the department. Two of them became supervisors of doctoral theses. One young lecturer is working on his habilitation.

In 2007, the second year of the study area Biomedical and Ecological Engineering was completed. The study area aroused a relatively high interest. About 40 students apply for enrolment in this study area every year.

J. Svačina) and by national grant projects on modelling of the origin and analysis of cardiologic electric signals, including a further development of a unique apparatus for simultaneous recording of heart activity by optical and electrical methods for detection of by-effects of medicines. Research laboratories will be upgraded and used for instruction, with priority given to tuition of talented students. Instruction was centred on the new Master study area Biomedical and Ecological Engineering, on new ecological subjects, and on the newly introduced Bachelor programme Biomedical Technology and Bioinformatics which has recently started. Upgrading of research laboratories to the international standard is intended as well as upgrading of instruction laboratories. Currently underway is modernization of instrument and computer laboratories, mainly the laboratory of biosystems for instruction in biomedical subjects, with focus on clinical and diagnostic procedures, and the laboratory of biophysics, which was reconstructed and refurbished, and the laboratory of electrocardiography.

Last year was a gap year between the biennial conferences BIOSIGNAL, regularly organized by the department under the auspices of the European association EURASIP and the world organization IEEE EMBS. The department was preparing the 2008 conference. The international programme committee was presided by Prof. J. Jan and the organizing committee was headed by Prof. I. Provazník.

The department participated in the European project EVICAB (European virtual campus for e-learning in biomedical engineering), chief investigator Prof. J. Jan, investigators R. Jiřík a R. Kolář, with focus on the study programme BMI and logistics for the virtual BMI university.

A major event in the development of the study area and at the department was the start of the new Bachelor degree programme Biomedical Technology and Bioinformatics prepared by Prof. I. Provazník who received funding from Ministry of Education grants, which enabled us to enlarge and upgrade the department's laboratories. Although the funds were mainly used for laborato-

ries intended for the new programme, the previous Master study area Biomedical Engineering

and Ecology also benefits from using the facilities.

## Major Research Projects

### **EVICAB - European Virtual Campus for Biomedical Engineering – EU ELE-ELEB12**

Investigator: Jiří Jan

### **Analysis of Mechanical and Electrical Activity of Heart in Experimental Cardiology – GAČR 102/07/1473**

Investigator: Jana Bardoňová

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

Investigator: Ivo Provazník

### **Topographic Colour Image as a New Imaging Modality for Web-Based Support of Glaucoma Diagnosis – D20-CZ8/07-08**

Investigator: Jiří Jan

### **Research Centre Data, Algorithms and Decision-Making – 1M6798555601**

Co-investigator: Jiří Jan

## Selected Publications

BRÁZDIL, M.; MIKL, M.; MAREČEK, R.; KRUPA, P.; REKTOR, I. Effective connectivity in target stimulus processing: A dynamic causal modeling study of visual oddball task. *NeuroImage*, 2007, vol. 35, no. 2, pp. 827-835. ISSN: 1053-8119.

HONZÍKOVÁ, N.; FIŠER, B.; ZÁVODNÁ, E.; NOVÁKOVÁ, Z.; KRTIČKA, A. Effectiveness of suppression of systolic blood pressure variability by baroreflex. *Clinical Autonomic Research*, 2007, vol. 17, no. 5, 281 (1 p.). ISSN: 0959-9851.

CHLEBUS, P.; MIKL, M.; BRÁZDIL, M.; PAŽOURKOVÁ, M.; KRUPA, P.; REKTOR, I. fMRI evaluation of hemispheric language dominance using various methods of laterality index calculation. *EXPERIMENTAL BRAIN RESEARCH*, 2007, vol. 179, no. 3, pp. 365-374. ISSN: 0014-4819.

CHMELARŠ, M.; BODEČEK, K.; ŘÍHA, K. Bloodstream Model and its Application in Research into New Diagnostic Methods for Probing Circulatory System Parameters. *International Transactions on Communication and Signal Processing*, 2007, vol. 10, no. 10, pp. 21-27. ISSN: 1738-9682.

JÍRA, M.; HONZÍKOVÁ, N.; ZÁVODNÁ, E.; NOVÁKOVÁ, Z.; VAŠKŮ, A.; FIŠER, B.; IZAKOVIČOVÁ-HOLLÁ, L. Baroreflex sensitivity and A1166C polymorphism in AT1 receptor gene. *Physiological Research*, 2007, vol. 56, no. 3, (15 p.) ISSN: 0862-8408.

JIŘÍK, R.; TAXT, T. Homomorphic Deconvolution of Ultrasonic Images. In *Ultrasonic and Advanced Methods for Nondestructive Testing and Material Characterization*. 1. Singapore: World Scientific, 2007. pp. 559-590. ISBN: 978-9812704092.

KAŠPÁREK, T.; PŘIKRYL, R.; MIKL, M.; SCHWARZ, D.; ČEŠKOVÁ, E.; KRUPA, P. Prefrontal but not temporal gray matter changes in males with first-episode schizophrenia. *Progress In Neuro-Psychopharmacology & Biological Psychiatry*, 2007, vol. 2007, no. 31, pp. 151-157. ISSN: 0278-5846.

NOVÁKOVÁ, Z.; BALCÁRKOVÁ, P.; HONZÍKOVÁ, N.; FIŠER, B.; ZÁVODNÁ, E.; HRSTKOVÁ, H.; KRONTORÁDOVÁ, K.; ŠŤASTNÁ, J. Arterial blood pressure and baroreflex sensitivity 1-18 years after completing anthracycline therapy. *Neoplasma*, 2007, vol. 54, no. 2, pp. 162-167. ISSN: 0028-2685.

NOVÁKOVÁ, Z.; HONZÍKOVÁ, N.; ZÁVODNÁ, E.; HRSTKOVÁ, H.; FIŠER, B.; ŠŤASTNÁ, J.; KRONTORÁDOVÁ, K. Ambulatory blood pressure monitoring in patients after anthracycline therapy. *Physiological Research*, 2007, vol. 56, no. 3 (15 p.) ISSN: 0862-8408.

PÁSEK, M.; ŠIMURDA, J.; CHRISTÉ, G.; ORCHARD, C. Modelling the cardiac transverse-axial tubular system. Progress In Biophysics & Molecular Biology, 2007, vol. 2008 (96), pp. 226-243. ISSN: 0079-6107.

PÁSEK, M.; ŠIMURDA, J.; ORCHARD, C.; CHRISTÉ, G. A model of the guinea-pig ventricular cardiac myocyte incorporating a transverse-axial tubular system. Progress In Biophysics & Molecular Biology, 2007, vol. 2007 (96), nos. 1-3, pp. 258-280. ISSN: 0079-6107.

REKTOROVÁ, I.; BARRETT, J.; MIKL, M.; REKTOR, I.; PAUS, T. Functional abnormalities in the primary orofacial sensorimotor cortex during speech in Parkinson's disease. Movement Disorders, 2007, vol. 22, no. 14, pp. 2043-2050. ISSN: 0885-3185.

SCHWARZ, D.; PROVAZNÍK, I. A Deformable Registration Method for Automated Morphometry of MRI Brain Images in Neuropsychiatric Research. IEEE Transactions on Medical Imaging, 2007, vol. 26, no. 4, pp. 452-461. ISSN: 0278-0062.

### **Bachelor's Programme**

Computers and Programming 1 (Ivo Provazník)

Digital Signal Processing and Analysis (Jiří Jan)

Ecology in Electrotechnical profession (Jiří Rozman)

Biology of Man (Nataša Honzíková)

Introduction to Medical Informatics (Ivo Provazník)

Medical Diagnostic Devices (Radim Kolář)

Multimedia Signals and Data (Jiří Jan)

Therapeutic and Prosthetic Instruments (Jiří Rozman)

### **Master's Programme**

Advanced Methods of Signal Processing (Jiří Jan)

Analysis of Signals and Images (Jiří Jan)

Biological System Modelling (Radovan Jiřík)

Bionics (Jiří Kozumplík)

Biophysics (Jiří Šimurda)

Clinical Physiology (Václav Chaloupka)

Computer-Aided Medical Diagnostics (Ivo Provazník)

Design and Operation of Complex Systems (Jiří Rozman)

Diagnostics of Bio- and Ecosystems (Milan Chmelař)

Ecological eEngineering (Jiří Rozman)

Healthcare (Jindřich Vomela)

Biology of Man (Nataša Honzíková)

Introduction to Environmental Studies (Hana Librová)

Medical Information Systems (Ivo Provazník)

Medical Systems Design (Karel Jehlička)

Multirate Systems (Jiří Kozumplík)

Special Devices for Healthcare and Ecology (Jiří Rozman)

Tomographic Imaging Systems (Aleš Drastich)

Traditional Medical and Ecological Imaging Systems (Aleš Drastich)

### **Doctoral Programme**

Advanced Methods of Processing and Analysis of Signals and Images (Jiří Jan)

Selected Problems of Biomedical Engineering (Jiří Jan)

## Laboratories

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

**Laboratory of Image Data Analysis** (a division of the centre D.A.R., research in digital processing and analysis of images, digitization and archiving of static images and videosequences, Radovan Jiřík)

**Laboratory of Biophysics** (Faraday cage, research in electrophysiology mainly of cells, Ivo Provazník)

**Laboratory of Biomedical and Ecological Technology** (instruction in Therapeutic and Prosthetic Technology, Specialized Medical and Ecological Technology, Introduction to Environmental Research, Ecological Engineering, Design and Operation of Complex Systems, experiments in research and student projects, Jana Bardoňová)

**Laboratory of Biomedical Electronics** (with locally controlled air-conditioning, research in instrument technology, infratechnology and diploma projects, Radovan Jiřík)

**Laboratory of Diagnostic Systems** (instruction in Medical Diagnostic Technology, Diagnostics of Bio and Ecosystems, Conventional Imaging Systems, Tomography Imaging Systems, Ecology in Electrical Engineering, experiments in research and student projects, Radim Kolář)

**Laboratory of Clinical Technology** (instruction in Human Biology and Bionics, research of brain and muscle electrophysiology, Ivo Provazník)

**Laboratory of Medical Informatics** (instruction in Medical Information Systems – an up-to-date professional hospital information system is available, Computer Support of Medical Diagnostics, Ecological Information Systems, Modeling of Biological Systems, Petr Fedra)

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

**Laboratory of Digital Signal and Image Processing** (instruction in Digital Signal Processing and Analysis, Multimedia Signals and Data, Analysis of Signals and Images, Advanced Methods of Signal Processing, Multicycle Systems, Computer and Programming I, Computer and Programming 2, Petr Fedra.)

**Construction Laboratory** (mechanical and electrotechnical tasks for research related to student projects, Jaroslav Sedláček, Hana Rýznarová)





# Department of Electrical Power Engineering

## **Doc. Ing. Petr Toman, Ph.D.**

Head

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## **Associate Professors**

Doc. Ing. Vladimír Blažek, CSc.  
Doc. Ing. Evžen Haluzík, CSc.  
Doc. Ing. Antonín Matoušek, CSc.  
Doc. Ing. Jiří Raček, CSc.  
Doc. Ing. Petr Toman, Ph.D.  
Doc. RNDr. Oldřich Coufal, CSc.

## **Lecturers**

Ing. Petr Baxant, Ph.D., Ing. Jiří Drápela, Ph.D., Ing. Michal Chmela, Ph.D., Ing. Ilona Lázničková, Ph.D.,  
Ing. Petr Mastný, Ph.D., Ing. Jaroslava Orságová, Ph.D.

## **Postgraduate Students**

Ing. Branislav Bátora, Ing. Martin Belatka, Ing. Michal Bernard, Ing. René Borek, Ing. Petr Čambala, Ing. Daniel Foltýn, Ph.D., Ing. Jan Macháček, Ing. Jiří Malý, Ing. Zdeněk Matoušek, Ing. Tomáš Mendl, Ing. Alexej Nováček, Ing. Martin Paar, Ing. Lukáš Potáček, Ing. Zdeněk Procházka, Ing. Václav Prokop, Ing. Jaroslav Špaček, Ing. Jiří Uher, Ing. Libor Weidinger, Ing. Michal Závodný

## **Administrative and Technical Staff**

Ing. Jan Gregor, CSc., Helena Karásková, František Matoušek, Ing. Josef Šenk, CSc., Mgr. Oldřich Živný

## Main Interests

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

Research is focused on electric energy production in conditions of permanently sustainable growth that is search for new ways of electric energy production from renewable sources, on reduction of losses and fast localization of defects in networks due to appliances, quality assurance, increasing operating efficiency of electric energy

## Major Achievements

The department's most significant achievements published in reputable scientific journals and in proceedings of national and international conferences are e.g. the software for computing the composition and thermodynamic characteristics of thermal plasma, the method of computing flux density in coaxial cable made up of two tube conductors, the measuring method and measuring system for identification of transfer functions in light sources in the frequency domain, the system for measurement and data acquisition from solar systems for evaluating the efficiency of sources and implementation of an operating sample of a thermoelectric generator of novel construction.

Our cooperation with the Institute of Plasma Physics of Czech Academy of Sciences continued in the Joint Plasma Laboratory focused on experimental research on a unique gas modular plasmatron designed by the department. Cooperation with EGU Brno centred on connecting

sources, the Stirling thermodynamic cycle for efficient exploitation of low-potential heat, utilization of the hydrogen accumulation cycle in solar systems, optimization of loading, small variable output power sources for system services in the conditions of liberalized market, technical and technological limits in inter-state energy exchange, analysis of major system failures and measures to be taken to avoid them, connection of wind-powered stations into the electrification system and implementation of an expert system for space illumination in special conditions of vision. The department cooperated with a number of companies, e.g. E.ON, Siemens, EGÚ Brno, ABB, ČEPS, ČEZ, Teplárny Brno, ABB s.r.o. and other. Cooperation continued with the departments of power electrical engineering at all Czech and Slovak technical universities, in both research and instruction.

wind-powered stations. In cooperation with the University of West Bohemia, Plzeň and with the companies ČEPS, a.s., Siemens, s.r.o., EGÚ HV Laboratory, a.s. and EG-Expert, s.r.o. we started a Ministry of Industry and Trade research project focused on increasing the efficiency and safety of the electrification system of the Czech Republic (SES).

A series of measurements of the operating characteristics of lighting fittings and electric energy quality measurements were carried out in cooperation with the industrial sector. Design of a protection system for MVE Nové Mlýny and of a railway signal lamp NSV01 with highly illuminating LEDs for Unicontrols-Tramex s.r.o.

The department organized a student excursion to power stations in Austria and Switzerland. The laboratory of electric protection was equipped with a programmable primary tester (2000V, 800A).

## Major Research Projects

**Thermodynamic and Transport Properties of Electric Arc Plasma – GAČR 102/06/1337**

Investigator: Oldřich Coufal

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

Investigator: Petr Toman

## Selected Publications

COUFAL, O. Composition and thermodynamic properties of thermal plasma up to 50 kK. Journal of Physics D: Applied Physics, 2007, vol. 40, no. 11, pp. 3371-3385. ISSN: 0022-3727.

COUFAL, O. Current density in a pair of solid coaxial conductors. Electromagnetics, 2007, vol. 27, no. 5, pp. 299-320. ISSN: 0272-6343.

CZERNEK, J.; ŽIVNÝ, O. The EOM-CC studies of low-lying electronic states of NO-2, CCl2 and OF2+. Chemical Physics Letters, 2007, vol. 435, nos. 1-3, pp. 29-33. ISSN: 0009-2614.

GREGOR, J.; JAKUBOVÁ, I.; MENDEL, T.; ŠENK, J.; KONRÁD, M. Interaction of hot gas mixture free jet with surrounding air. High Temperature Material Processes: An International Journal, 2007, vol. 11, no. 2, pp. 181-190. ISSN: 1093-3611.

GREGOR, J.; JAKUBOVÁ, I.; ŠENK, J. Investigation of radial energy flows in an arc heater channel. High Temperature Material Processes: An International Journal, 2007, vol. 11, no. 3, pp. 421-430. ISSN: 1093-3611.

MASTNÝ, P. Cooperation of Heat Pump and Solar System in the Common Power Unit. WSEAS e-journal Energy and Environment, 2007, vol. 1, no. 5, pp. 186-194. ISSN: 1790-5095.

MASTNÝ, P. Optimization of Combined Operation of Heat Pump and Active Solar System. WSEAS Transaction on Heat and Mass Transfer, 2008, vol. 1, no. 9, pp. 721-729. ISSN: 1790-5044.

MASTNÝ, P.; MATOUŠEK, A. Increase of Efficiency of Energy System with Heat Pump Using Solar Radiation. WSEAS e-journal Energy and Environment, 2007, vol. 2007, no. 10, pp. 13-18. ISSN: 1790-5095.

## Bachelor's Programme

Computer Modelling and Simulations (Petr Baxant)

Design in power electric systems (Petr Toman)

Distribution Equipment (Jaroslava Orságová)

Economy and Control (Michal Chmela)

Electrical Power Distribution (Vladimír Blažek)

Electrical Power Generation (Antonín Matoušek)

Energy Use (Jiří Drápela)

Environmental Science in Electroenergetic (Antonín Matoušek)

High Voltage and Electric Apparatus (Vladimír Blažek)

Machinery of Power Plants (Jiří Raček)

Protection of Electrical Power Equipment (Petr Toman)

Technical Mechanics (Jiří Raček)

## Master's Programme

Diagnostics in Electricity Industry (Jiří Drápela)

Economy of Electrical Power Engineering (Petr Toman)

Electrical Heat Technology (Ilona Lázníčková)

Information and Control Systems in Power Engineering (Petr Baxant)

Integrated Protection Systems (Petr Toman)

Lighting Systems (Petr Baxant)

Lighting Technology (Petr Baxant)

Low Power Electrical Sources (Petr Mastný)

Municipal and Industrial Power Networks (Jaroslava Orságová)

Nuclear Power Plant (Jiří Raček)

Power Energetic Equipments (Jiří Raček)

Power Plants and Heating Power Stations (Antonín Matoušek)

Power Systems (Jaroslava Orságová)

Power Systems Control (Evžen Haluzík)

Power Transmission Networks (Vladimír Blažek)

Some Chosen Issues of Power Engineering (Vladimír Blažek)

Substations and Lines (Jaroslava Orságová)

The Power Quality and EMC (Jiří Drápela)

Transient Phenomena (Michal Chmela)

Unconventional Conversions (Antonín Matoušek)

## Doctoral Programme

Mathematical Modelling of Electrical Power Systems (Evžen Haluzík)

Selected Problems of Electricity Production. (Antonín Matoušek)

## Laboratories

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

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

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

**Laboratory of the Quality of Electric Power and Electromagnetic Compatibility** (instruction in Quality of Electric Power, EMC 1 and 2, Diagnostics in Power Engineering, Jiří Drápela)

**Laboratory of Non-Conventional Energy Conversion** (instruction in Ecology in Power Engineering, Small Sources of Electric Power, 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 Lighting Fittings, research projects, Petr Baxant)

**Laboratory of Heating Technology** (instruction in Electric Power Exploitation and 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 and 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 for 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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## **Professors**

Prof. Ing. Jiří Kazelle, CSc.  
Prof. Ing. Pavel Procházka, CSc.  
Prof. Ing. Jiří Vondrák, DrSc.

## **Associate Professors**

Doc. RNDr. Milan Calábek, CSc.  
Doc. RNDr. Miroslav Cenek, CSc.  
Doc. Ing. Karel Liedermann, CSc.  
Doc. Ing. Josef Jirák, CSc.  
Doc. Ing. Marie Sedlaříková, CSc.

## **Lecturers**

Ing. Petr Bača, Ph.D., Ing. Svatopluk Havlíček, CSc., Ing. Martin Frk, Ph.D., Ing. Petr Křivík, Ph.D., Ing. Jiří Maxa, Ph.D., Ing. Vítězslav Novák, Ph.D., Ing. Helena Polsterová, CSc., Ing. Zdenka Rozsivalová, Ing. Jiří Starý, Ph.D., Ing. Jiří Špinka, Ing. Jiří Vaněk, Ph.D.

## **Postgraduate Students**

Ing. Peter Barath, Ing. Radek Bilko, Ing. Patrik Bocek, Ing. Pavel Černoch, Ing. Martin Dočkal, Ing. Radek Drnovský, Ing. Miroslav Haman, Ing. Tibor Jirák, Ing. Roman Kameník, Ing. Martin Kocian, Ing. Ondřej Krejza, Ing. Kristýna Jandová, Ing. Radek Lábus, Ing. Jan Linhart, Ing. Michal Macalík, Ing. Jaromír Makovička, Ing. Jan Mertl, Ing. Pavel Nečesal, Ing. Vilém Neděla, Ing. Tomáš Nováček, Ing. Jan Rychnovský, Ing. Mgr. Luděk Schneider, Ing. Vít Svoboda, Ing. Petr Špičák, Ing. Jiří Vognar, Ing. Jiří Vrbický, Ing. Petr Wandrol

## **Administrative and Technical Staff**

Jarmila Bartošková, Ing. Zdeněk Buřival, CSc., Ing. Petr Kahle, Věra Kittnerová, František Kořínek, Rudolf Krásenský, Ing. Radek Kubásek, Ph.D., Ing. Jiří Macola, Dagmar Prosová, Ing. Miloslav Steinbauer, Ph.D., Ing. Miroslav Zatloukal, Martin Zatloukal

## Main Interests

In 2007, the department provided tuition in the subject Materials and Technical Documentation for all students, full-time and part-time, in the first year of the Bachelor programme EECR as well as instruction in subjects focused on electrotechnical materials, manufacturing processes and their control, surface mount technology, diagnostics, testing and reliability of electrotechnical materials and processes, quality assurance, design systems and alternative sources of electric energy, in the Bachelor and the Master programme.

Research was centred on basic and applied research of electrochemical sources of electric energy – lead-acid batteries, alkaline batteries and fuel cells (development of polymer membranes), renewable sources of electric energy in general and their exploitation in alternative transport by electric and hybrid vehicles, detection of signal electrons and methods of environmental scanning electron microscopy, gel electrolytes (increasing electric conductivity through presence of alumina nanoparticles) and their utilization in lithium-ion batteries (high efficiency of graphite as an anodic material) electrocatalysts for fuel cells and thin-film electrodes for electrochromic systems, lead-free soldering and quality and reliability

## Major Achievements

The department organized the '8th International Conference Advanced Batteries and Accumulators' (A.B.A.-8) Brno (M. Sedlářiková, J. Vondrák). The department coorganized, in cooperation with the Czech Electrotechnical Society, group for chemical sources of electric energy (M. Calábek, P. Bača), the 28th conference 'Non-Conventional Sources of Electric Energy', September 2007, Soběslav. Representatives of the department participated in the regular meeting of institutes and departments of electrotechnology of Czech and Slovak technical universities 'Elektrotechnológia 07', held as an International conference 'Meeting of Departments of Electrotechnology', September 2007, Herlany (J. Kazelle).

On the occasion of the visit in August of Professor Günter Fafílek (Institute of Chemical Technology and Analytics, University of Technology

of soldered joints and degradation and diagnostics of dielectric systems.

The department has maintained cooperation with a number of national and international institutions: Technische Universität Wien, Universität Ulm - Zentrum für Sonnenenergie - und Wasserstoff-Forschung, École Polytechnique de Montréal, surface analysis workplace Nanolytics in Feldkirchen, Austria, Institute of Instrument Technology, Institute of Anorganic Chemistry, Institute of Physical Chemistry and Institute of Macromolecular Chemistry of Czech Academy of Sciences, with the companies Bochemie Bohumín, CINK vodní elektrárny Karlovy Vary, ČAS-Service Znojmo, EPRONA a.s. Rokytnice n. Jizerou, ROTOKOV Křídlovky u Znojma and EL-MARCO Liberec. Within the framework of the programme KONTAKT the department cooperates with the institute INIFTA Universidad Nacional de La Plata, Argentina.

Research will continue in all mentioned study areas as related to the GAČR, GAAV, FRVŠ research projects and the research plan scheduled for the period 2005 – 2009.

The department pays attention to upgrading of instruction laboratories, to increased use of computer rooms and library for instruction and self-study.

Wien) the department organized a seminar on 'Impedance Spectroscopy' and 'Electroanalytical Methods' with focus on identification of the characteristics of electrochemical sources of electric energy (M. Sedlářiková, J. Vondrák ).

In November, Dr. Arnaldo Visitin of Instituto de Físicoquímica Teóricas Aplicadas, Facultad de Ciencias Exactas, (INIFTA) Universidad Nacional de La Plata, Argentina, visited the department. There were lectures on electrochemical sources of electric energy and their exploitation 'Metal Hydride for Batteries', 'Nickel Hydroxide Electrode for Alkaline Batteries', 'Advances in the Development of PEM Fuel Cell Stack Prototypes' (M. Sedlářiková, J. Vondrák, ). Prof. J. Vondrák was awarded the title 'Visiting Professor' at Universidad Nacional de La Plata, Argentina.

In 2007, the department was the chief investigator of the research plan 'Resources, Accumulation and Optimization of Electric Energy Exploitation in Conditions of Sustainable Growth', of the GAAV project 'NMR Mobility and Conductivity of Ions in Gel Electrolytes', three GAČR projects 'New Methods of Non-Destructive Quality Testing of Contacts in Photovoltaic Cells', 'Systems of Secondary Electrons Detection in Newly Conceived Environmental Scanning Electron Microscope' and 'Mobility and Accumulation of Ions in

Polymer Ion Conductors', one Ministry of the Environment project 'Systems for Electric Energy Accumulation from Renewable Sources', and four FRVŠ projects 'Innovation and Modernization of Problems in Laboratory of Electrotechnical Materials', 'A Measuring Workplace for Solar Cells Testing and Application in Instruction', 'Design and Manufacturing of a Facility for Thin-Film Preparation', 'Alternative Sources of Energy' – concept of a new subject. The department participated in another research plan at FEEC.

## Major Research Projects

### **New Methods of Non-Destructive Quality Testing of Contacts in Photovoltaic Cells – GAČR 102/05/P199**

Investigator: Jiří Vaněk

### **NMR Mobility and Conductivity of Ions in Gel Electrolytes – GA AV ČR KJB208130604**

Investigator: Vítězslav Novák

### **Systems for Accumulation of Electric Energy from Renewable Sources – VaVSN/3/171/05**

Investigator: Marie Sedlaříková

### **Systems of Secondary Electrons Detection in Newly Conceived Environmental Scanning Electron Microscope – GAČR 102/05/0886**

Investigator: Josef Jiráček

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

Investigator: Jiří Kazelle

## Selected Publications

CHOBOLA, Z.; JURÁNKOVÁ, V.; VANĚK, J.; BAŘINKA, R. Noise spectroscopy of new silicon solar cells with double-sided texture. Proceedings of SPIE, 2007, vol. 2007, no. 6600, 1M-1 (8 p.) ISSN: 0277-786X.

KREJZA, O.; VELICKÁ, J.; SEDLAŘÍKOVÁ, M.; VONDRÁK, J. The presence of nanostructured Al<sub>2</sub>O<sub>3</sub> in PMMA based gel electrolytes. Journal of Power Sources, 2007, vol. 24, no. 176, pp. 1-5. ISSN: 0378-7753.

MAXA, J.; NEDĚLA, V. Selection of PDM Information System. Solid State Phenomena, 2007, vol. 15, no. 3, pp. 12-17. ISSN: 1012-0394.

NEDĚLA, V.; ROUBALÍKOVÁ, L.; ČERNOCH, P. Study of Tooth Root Surface Treated with Various Techniques Using Variable Pressure SEM. Microscopy And Microanalysis, 2007, vol. 13, no. 3, pp. 234-235. ISSN: 1431-9276.

NEDĚLA, V.; WEYDA, F.; ČERNOCH, P. Advantages of Study of Amber Fossils with Ionization Detector in Variable Pressure SEM. Microscopy And Microanalysis, 2007, vol. 13, no. 3, pp. 250-251. ISSN: 1431-9276.

VANĚK, J.; KOKTAVÝ, P.; JANDOVÁ, K.; SADOVSKÝ, P. Usage of micro-plasma signal noise for solar cells diagnostic. Proceedings of SPIE, 2007, vol. 2007, no. 6600, 17-1 (8 p.) ISSN: 0277-786X.

VONDRÁK, J.; SEDLAŘÍKOVÁ, M.; VELICKÁ, J.; ŠPIČÁK, P.; SVOBODA, V.; KAZELLE, J. Insertion of cations into WO<sub>3</sub> investigated by QCM techniques. Journal of Solid State Electrochemistry, 2007, vol. 11, no. 10, pp. 1459-1462. ISSN: 1432-8488.

WANDROL, P. New Scintillation Detector of Backscattered Electrons for the Low Voltage SEM. Journal of Microscopy, 2007, vol. 227, no. 1, pp. 24-29. ISSN: 0022-2720.

## Bachelor's Programme

Computer Projecting of Productions, Logistic and Ecology (Miroslav Cenek)

Design Systems of Printed Circuit Boards (Petr Bača)

Diagnostics and Testing (Josef Jirák)

Electrotechnical Materials and Production Processes (Jiří Kazelle)

Materials and Technical Documentation (Josef Jirák)

Printed Circuits and Surface Mount Technology (Jiří Starý)

Quality Management and Checking (Helena Polsterová)

Quality Management and Metrology (Helena Polsterová)

Reliability in Electrical Engineering (Helena Polsterová)

Special Diagnostics (Josef Jirák)

## Master's Programme

3D modeling (Jiří Maxa)

Alternative Energy Sources (Jiří Vaněk)

CAD 1 (Pavel Procházka)

CAD 2 (Jiří Maxa)

CADDS5 Advanced Model (Jiří Maxa)

CADDS5 Basic 3D Model (Jiří Maxa)

CADDS5 Manufacture (Jiří Maxa)

Climatotechnology in Electrical Engineering (Karel Liedermann)

Computer Aided Scheme Systems (Vítězslav Novák)

Computers System for Projects (Vítězslav Novák)

Control and Data Administration (Jiří Maxa)

Design of Production Systems and Logistic (Jiří Špinka)

Design View (Jiří Maxa)

Diagnostic Methods in Electroengineering (Josef Jirák)

Diagnostics and Testing in Electrical Engineering (Josef Jirák)

Ecology in Manufacturing (Miroslav Cenek)

Electroinsulation Systems (Helena Polsterová)

Fundamentals of Reliability in Electrical Engineering (Helena Polsterová)

Graphic Systems 2 (Pavel Procházka)

Interconnection and Assembly Technology (Jiří Starý)

Materials for Biomedical Applications (Marie Sedlaříková)

Mechanical Desktop (Jiří Maxa)

Production Processes (Jiří Kazelle)

Reliability and Quality (Helena Polsterová)

Structure and Properties of Materials (Josef Jirák)

Technological Projecting and Logistic (Jiří Vaněk)

## Doctoral Programme

Electrotechnical Materials, Material Systems and Production Processes (Jiří Kazelle)

Selected Diagnostic Methods, Reliability and Quality (Josef Jirák)

## Laboratories

**Library** (access to electronic texts and instruction databases, a joint workplace shared with the department of Microelectronics, Petr Bača)

**Air-Conditioned Laboratory of Dielectric Materials with Highly Stabilized Environment** (research in dielectric properties of electroinsulating materials, measurement at stabilized temperature and relative air moisture, Svatopluk Havlíček)

**Laboratory of Dielectric Materials** (research, instruction and diploma theses on dielectric properties of electroinsulating materials, Svatopluk Havlíček)



**Electron Microscopy Laboratory** (instruction in Diagnostics and Testing in Electrical Engineering, research of detection of signals in environmental scanning electron microscopy of accumulator mass and surfaces of electrotechnical materials, namely insulators, Josef Jiráček)

**Laboratory of Electrotechnical Materials I** (instruction in Materials and Technical Documentation, electrotechnology - for Faculty of Mechanical Engineering, Materials for Biomedical Applications, Petr Křivák)

**Laboratory of Electrotechnical Materials II** (instruction in measurement and computer modelling of the parameters of semiconductor and dielectric materials in Electrotechnical materials and Electrotechnical Materials and Manufacturing, Material Structure and Properties, Climatotechnology, Zdenka Rozsivalová)

**Laboratory of Electrotechnical Materials III** (laboratory for work on Bachelor and diploma theses, and for doctoral students, Martin Frk)

**Laboratory of Chemical Sources of Electric Energy** (research of lead-acid accumulators, Milan Calábek)

**Chromatographic Laboratory** (research, instruction, Bachelor and diploma theses focused on application of gas chromatography in technical practice, Marie Sedlaříková)

**Ion Laboratory** (research, instruction and diploma theses in the field of measurement of air ions concentration, Zdeněk Buřival)

**Laboratory of System Design and Surface Mount Technology** (instruction in Printed Circuits and Surface Mounting, Jiří Starý)

**Laboratory for Research of Accumulator Batteries for Electric Vehicles** (long-term tests of Ni-Cd accumulator batteries, alternative transport, Miroslav Cenek)

**Laboratory for Research of Photovoltaic Cell-Accumulator Battery Systems** (Jiří Vaněk)

**CAD Laboratories** (2) (instruction in Materials and Technical Documentation, in subjects focused on parameter design and large CAD systems and systems for scheme design, Petr Bača)

**Chemical Laboratories** (2) (research for Bachelor, diploma and doctoral theses focused on fuel cells, lithium-ion batteries and supercapacitors, absolutely dry atmosphere workplace, Marie Sedlaříková)

**Computer Laboratory** (2) (instruction in subjects focused on reliability in electrical engineering, computer-aided design of manufacturing processes and logistics, computer-aided design of printed circuit boards, Petr Bača, Helena Polsterová)

# Department of Physics

## **Doc. Ing. Lubomír Grmela, CSc.**

Head

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## **Professors**

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Prof. RNDr. Pavel Tománek, CSc.

## **Associate Professors**

Doc. RNDr. Milada Bartlová, Ph.D.  
Doc. Ing. Lubomír Grmela, CSc.  
Doc. RNDr. Pavel Hruška, CSc.  
Doc. RNDr. Milena Kheilová, CSc.  
Doc. Ing. Pavel Koktavý, CSc., Ph.D.  
Doc. Ing. Karel Liedermann, CSc.  
Doc. RNDr. Marian Štrunc, CSc.

## **Lecturers**

Ing. Jitka Brüstlová, CSc., RNDr. Pavel Dobis, CSc., RNDr. Eva Hradilová, Mgr. Jan Pavelka, CSc., Ing. Vlasta Sedláková, Ph.D., RNDr. Naděžda Uhdeová, Ph.D., RNDr. Oldřich Veverka, RNDr. Vladimír Zdražil, Ph.D.

## **Postgraduate Students**

Mustafa M. Abdalla Ahmed, Ing. Alexey Andreev, Ing. Martin Bláha, Ing. Salem Omar Saeid El-Fakhri, Ing. Jan Havránek, Ing. Štěpán Hefner, Ing. Vladimír Holcman, Ing. Jaroslav Kala, Ing. Jiří Majzner, Mgr. Dana Otevřelová, Ing. Tomáš Palai-Dany, Ing. Jaromír Pelčák, Ing. Michal Raška, Ing. Petr Sedlák, Ph.D., Ing. Rostislav Stráník, Ing. Pavel Tofel, Ing. Jiří Zajaček

## **Administrative and Technical Staff**

Lenka Horká, Miroslav Sadovský, Ing. Petr Sadovský, Ph.D., Ing. Alena Václavíková, Ing. Vít Vrba

## Main Interests

The department provides tuition in the basic courses of the Bachelor degree programme Physics 1 and Physics 2, Physics for Information Technology, Physics 1 and Physics 2 for the programme Biomedical Technology and Bioinformatics, and in the Master degree programme in subjects Nanotechnology, Modern Physics, Solid Phase Physics and Non-Destructive Diagnostics of Materials and Semiconductors and Physics of Dielectrics. The department is responsible for the new four-year doctoral specialization Physical Electronics and Nanotechnology.

The tasks for Physical Practice and multimedia study materials were updated for instruction in the computer room and for student self-study. Within the framework of the department's FRVŠ projects laboratory tasks are being innovated and updated.

Research is centred on basic and applied research of the physical parameters of semiconductor and dielectric materials. The main areas of interest are noise spectroscopy, measurement of nonlinearities and design of the quality and reli-

ability indicators for non-destructive assessment of each technological stage in mass production. Very good results have been achieved in research of the characteristics of acoustic and electromagnetic emission sensors, local spectroscopy, topography, photoluminescence of semiconductor and photonic structures and dielectric relaxation spectroscopy of anorganic and organic materials. The department cooperates with European and Japanese laboratories in the field of noise spectroscopy and nanotechnology, extends cooperation with Augsburg University, Germany in research of dielectrics, and cooperates with the leading Czech laboratories in the development and enhancement of the parameters of CdTe radiation detectors.

Added to the equipment of research laboratories were a number of up-to-date devices, and a workplace for experimental study of semiconductor and dielectric samples at low temperatures (up to 10 K) and of optical nanometrology with resolution up to 40 nm was established.

## Major Achievements

In 2007, there was one research plan, seven GAČR projects, two FRVŠ projects, two KONTAKT projects, one INGO and one Development project of the Ministry of Education at the department. The GAČR projects are focused on nonlinear defectoscopy of solids, cold emission cathodes, irreversible processes in dielectrics, and processes with impact on energy transport in arc charge with liquid stabilization. An important subject of research is the reliability of Si solar cells.

The two international projects KONTAKT (chief investigators J. Šikula – 'Piezoelectric sensors for detection of biological substances: signal/noise ratio optimization' and L. Grmela – 'Cadmium-telluride sensors for detection of X-ray and gamma radiation: signal/noise ratio optimization') were carried out in cooperation with Gdansk University, University of Florida and University of Missouri I. Cooperation with MEISEI university, Tokyo, Grenoble University and Gdansk University, where the department can use unique technology for experiments, was extended for work on the projects.

Following participation in the INGO project, Professor Tománek was elected one of the six members of the Executive Board of European Optical Association – a reputable European science organization and a highly regarded partner of the European Commission in preparation of the 7th FP.

Two of the FRVŠ projects dealt with upgrading of laboratories for tuition in Bachelor subjects and for introduction of the subject 'Nanotechnology'.

Laboratory of Optical Nanometrology was invited to join, as a third party, the European Network of Excellence – NEMO in micro and nanooptics for 2007-2008. A majority of the department's research staff were involved in the research plan MSM 0021630503 – MIKROSYN, with co-investigator L. Grmela.

Research results were published in several impact journals and presented at international conferences.

A workplace for ultra-low temperature measurements on semiconductor and dielectric samples was built.

## Major Research Projects

**Diagnostics of PN Components By Means of Microplasma Noise – GAČR 102/06/1551**

**102/06/1551**

Investigator: Pavel Koktavý

**Diagnostics of Schottky and Cold Emission Cathodes By Means of Electric Noise – GAČR**

**102/07/0113**

Investigator: Lubomír Grmela

**Non-Linear Electroacoustic Spectroscopy in Solids – GAČR 102/06/0866**

Investigator: Josef Šikula

**Radiation Transport of Energy in Arc Plasma – GAČR 202/06/0898**

Investigator: Milada Bartlová

**Sources of Noise in Semiconductor Materials and Components – GAČR 102/05/2095**

Investigator: Josef Šikula

## Selected Publications

GRMELA, L.; DOBIS, P.; BRÜSTLOVÁ, J.; TOMÁNEK, P. Optoelectronic noise and photocurrent measurement on GaAs/AlGaAs laser diode with single quantum well. International Journal of Optomechatronics, 2007, vol. 1, no. 1, pp. 73-80. ISSN: 1559-9612.

GRMELA, L.; TOMÁNEK, P.; ŠKARVADA, P. Near-field study of hot spot photoluminescence decay in ZnS:Mn nanoparticles. Materials Science Forum, 2007, vol. 2007, no. 567, pp. 241-244. ISSN: 0255-5476.

MACKŮ, R.; GRMELA, L.; TOMÁNEK, P. Near-field measurement of ZnS:Mn nanocrystal and bulk thin-film electroluminescent devices. Journal of Microscopy, 2008, vol. 229, no. 2, pp. 275-280. ISSN: 0022-2720.

SEDLÁKOVÁ, V.; ŠIKULA, J. Thick Film Resistors Testing by Electro-Ultrasonic Spectroscopy. Passive Component Industry, 2007, vol. 2007, no. Nov/Dec, pp. 16-20.

TOMÁNEK, P.; GRMELA, L.; ŠKARVADA, P. Optical fiber Bragg grating used in the sensing of surface plasmon resonance. Proceedings of SPIE, 2007, vol. 6715, no. 6715, pp. 215-223. ISSN: 0277-786X.

VANĚK, J.; KOKTAVÝ, P.; JANDOVÁ, K.; SADOVSKÝ, P. Usage of micro-plasma signal noise for solar cells diagnostic. Proceedings of SPIE, 2007, vol. 2007, no. 6600, 17-1 (8 p.)ISSN: 0277-786X.

## Bachelor's Programme

Physics 1 (Pavel Dobis)

Seminar of Physics (Eva Hradilová)

Physics 2 (Milada Bartlová)

## Master's Programme

Modern Physics (Milena Kheilová)

Non-Destructive Diagnostics and Physics of Dielectrics (Karel Liedermann)

Nanotechnology (Pavel Tománek)

Solid State Physics (Lubomír Grmela)

## Doctoral Programme

Junctions and Nanostructures (Pavel Tománek)

Spectroscopic Methods for Non-Destructive Diagnostics (Karel Liedermann)

## 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 Spectroscopy** (dielectric relaxation spectroscopy, monitoring molecular dynamics of dielectric materials, Karel Liedermann)

**Laboratory for 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** (contactless investigation of local optical and electrical characteristics of optoelectronic and photonic structures with horizontal superresolution by optical scanning near-field microscopy , Pavel Tománek)

# Department of Languages

## **PhDr. Milena Krhutová, Ph.D.**

Head

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## **Lecturers**

Mgr. Marie Bartošová, Mgr. Ladislav Baumgartner, PaedDr. Alena Baumgartnerová, Mgr. Petra Boková-Filová, PhDr. Marcela Borecká, Mgr. Přemysl Dohnal, M. A. Kenneth Froehling, Ing. Martin Jílek, Mgr. Gabriela Kolčavová, PhDr. Milena Krhutová, Ph.D., Mgr. Petra Langerová, PhDr. Dagmar Malíková, Mgr. Jana Malíková-Kopecká, PhDr. Ludmila Neuwirthová, Ph.D., Ing. Helena Pálková, PAED IGIP, Mgr. Věra Pražáková, Mgr. Šárka Rujbrová, Mgr. Pavel Sedláček, Mgr. Veronika Svobodová, Mgr. Jaroslav Trávníček

## **Administrative and Technical Staff**

Miroslava Purová, Hana Vondráčková

## Main Interests

In 2007, the department increased significantly the quality of tuition in language courses and courses concerning social sciences, which were highly appreciated by students. Within the framework of the development project 'Development of Language Teaching with Focus on English', semester and examination tests were innovated and new electronic course materials were made accessible to students including an audio dictionary for the International Express Intermediate textbook. The standardization of language courses was completed in accordance with the European Reference Framework. Six language classrooms were equipped with new multimedia devices owing to the FRVŠ project. New teaching methods are applied by using an interactive board, the Internet and instruction DVDs and CDs, which increases students' motivation.

Our professional knowledge, library book fund and material equipment enable the department to offer the students instruction comparable with the best equipped language laboratories.

## Major Achievements

Krhutová, M. Pragmatic Aspects of English for Engineering. International Conference on Engineering Education ICEE-2007, Portugal, Coimbra, ISBN 978-972-8055-14-1.

Krhutová, M. The Language of Engineering as a Special Province. Monograph. Akademické nakladatelství CERM, s.r.o., Brno. ISBN 978-80-7204-562-4.

Neuwirthová, L. Constructing a Foreign Language Standard for Technically-Oriented Universities. International Conference on Engineering Education ICEE-2007, Portugal, Coimbra, ISBN 978-972-8055-14-1.

Pálková, H.; Svobodová, V. Engineering Ethics. International Conference on Engineering Education ICEE-2007, Portugal, Coimbra, ISBN 978-972-8055-14-1.

An international Pedagogic workshop on the outlooks of humanities being taught at technical

The department provides tuition for 3 500 students at three faculties of Brno University of Technology (Faculty of Electrical Engineering, Faculty of Information Technology and Faculty of Business and Management). Within the framework of lifelong learning, teacher training courses and English language courses for beginners are held. In the following academic year, intermediate students of the Master degree programme will be offered an innovated list of language courses. The courses will comprise not only language exercises but also valuable virtual information important for future professional success, including cultural differences, which will enable our students and graduates to live and work in the international environment.

The department members regularly attend the international conferences ICEE where they present papers on language instruction methodology and ethics. Other contributions are presented at linguistic conferences. Moreover, the department staff provide the investigators of research projects with language support.

universities was held at the Department of Languages of FEEC BUT from 24th to 25th 2007.

Neuwirthová, L. Evropská kompatibilita jazykového vzdělávání na FEKT VUT v Brně. Pedagogic workshop, FEEC BUT, ISBN 978-80-214-3392-2.

Krhutová, M. Investigator of the development project Development of Language Teaching with Focus on English – 3rd phase.

Krhutová, M. Investigator of FRVŠ project Multimedia language classrooms.

Neuwirthová, L. Leonardo da Vinci CZ/06/B/F/PP-168022 E-Learning Distance Interactive Practical Education, language support.

Krhutová, M., Neuwirthová, L. Research project MSM0021630503 New trends in Microelectronic Systems and Nanotechnologies (MIKROSYN), language support, investigator: Prof. Ing. Radoomír Vrba, CSc.

## Bachelor's Programme

Bookkeeping for Managers (Martin Jílek)  
Business English (Dagmar Malíková)  
Culture of Speech and the Generation of Texts (Petra Boková)  
Double-Entry Bookkeeping (Martin Jílek)  
Engineering Pedagogy and Didactics (Helena Pálková)  
English for Bachelors- Intermediate 2 (Jaroslav Trávníček)  
English for Bachelors- Intermediate 1 (Petra Langerová)  
English for Bachelors- Pre-Intermediate 1 (Šárka Rujbrová)  
English for Bachelors- Pre-Intermediate 2 (Marie Bartošová)  
English for Europe (Přemysl Dohnal)  
German for Beginners (Ladislav Baumgartner)

## Master's Programme

Bookkeeping for Managers (Martin Jílek)  
Business English (Dagmar Malíková)  
Culture of Speech and the Generation of Texts (Petra Filová)  
Double-Entry Bookkeeping (Martin Jílek)  
English for Europe (Přemysl Dohnal)  
English for Intermediate Students (Přemysl Dohnal)  
English for Upper-Intermediate Students (Kenneth Froehling)  
Ethics in Making the Business (Martin Jílek)  
German for Beginners (Ladislav Baumgartner)  
German for Intermediate Students I. (Ladislav Baumgartner)

## Doctoral Programme

English for post-graduates (Dagmar Malíková)

German for Intermediate Students I. (Ladislav Baumgartner)  
German for Lower-Intermediate (Ladislav Baumgartner)  
Laboratory Didactic (Helena Pálková)  
Pedagogical Psychology (Věra Pražáková)  
Present Philosophy - Postmodernism (Milan Klapetek)  
Professional English for Electrical Engineering and Computer Science (Ludmila Neuwirthová)  
Reading Skills (Marcela Borecká)  
Russian for Beginners (Alena Baumgartnerová)  
Russian Pre-Intermediate (Alena Baumgartnerová)  
Spanish for Beginners (Marcela Borecká)  
Spanish for Lower-Intermediate Students (Marcela Borecká)

German for Lower-Intermediate (Ladislav Baumgartner)  
Present Philosophy - Postmodernism (Milan Klapetek)  
Professional English for Electrical Engineering and Computer Science (Ludmila Neuwirthová)  
Russian for Beginners (Alena Baumgartnerová)  
Russian Pre-Intermediate (Alena Baumgartnerová)  
Spanish for Beginners (Marcela Borecká)  
Spanish for Lower-Intermediate Students (Marcela Borecká)  
History and Philosophy of Technology (Milan Klapetek)



# Department of Mathematics

## **Doc. RNDr. Zdeněk Šmarda, CSc.**

Head

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## **Professors**

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

## **Associate Professors**

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

## **Lecturers**

RNDr. Lubomír Bajgar, Mgr. Helena Durnová, Ph.D., RNDr. Mgr. Břetislav Fajmon, Ph.D., 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

## **Postgraduate Students**

Ing. Jaroslav Klimek, Ing. Olga Filippova

## **Administrative and Technical Staff**

Eva Šimečková

## Main Interests

The Department of Mathematics is responsible for tuition in mathematical subjects in full-time and part-time Bachelor degree programme (Mathematics 1, Mathematics 2, Mathematics 3), in full-time and part-time Master degree programme (Modern Numerical Methods, Matrices and tensors calculus, Differential Equations in Electrical Engineering, Probability, Statistics and Operations Research), in two postgraduate courses (Discrete Processes in Electrical Engineering, Probability, Stochastic Processes, Operations Research) and in a number of courses for the Faculty of Information Technology.

Research is focused especially on the study of discrete and continuous systems describing mathematical models of electrical processes, defining conditions for the existence of confined solutions of difference equations by means of retract and Lyapunov methods.

The characteristics of electrical circuits are studied by means of integrodifferential equations with differential cores with confined and unconfined delays. Stochastic methods of solution, especially the application of continuous Kalman-Bucy filter,

## Major Achievements

The department was involved in solution of two GAČR projects and two FRVŠ projects. The department members were involved in research plans MSM0021630503 New Trends in Micro-electronic Systems (MIKROSYN) and MSM0012630529 Intelligent Systems in Automation.

International cooperation on solutions to research tasks was a significant factor. Within the framework of the mentioned projects, notable world experts (Anashkin, Simferopol, Khusainov, Kiev, Rodkina, Jamaica) were visiting professors in our department in 2007.

Thinning ability of discrete-delay systems and stability of the trivial solution for systems of differential equations in critical case were investigated. Some results of the research were accepted to be published in impact magazines 'Computers and Mathematics with Applications' and 'SIAM J.

are used to describe the mathematical model of electrical circuits.

Research also focuses on construction of multi-automates on the basis of subhypergroup and hypergroup actions. Attention is centred on bottleneck algebras of preferential relations as well as on the apparatus used in decision process modelling. Fuzzy preference relations, fuzzy metrics and fuzzy set operations were applied in the area of methods for criteria ordering and the follow-up objective function. The general Choquet integral is also studied as the evaluator appropriate to the modelling of interaction among criteria. Cauchy's integral formula is used to find a solution to the image data compression. Laguerre's functions are used to define transfer functions.

Within the framework of the above mentioned research, the department cooperates with the Matematisches Institute Universität Stuttgart and the mathematical departments at technical universities in Klagenfurt, Dresden, Kiiiv, Udine and Žilina.

Control Optimizations'. Seventeen articles were published in international review magazines.

The department staff participated in preparation and organization of the following international conferences – the Fifth International Mathematical Workshop, Brno; XXVth International Colloquium on Education Process, Brno; Dynamical Systems Modelling and Stability Investigations, Kiiiv, Ukraine; Sixth International Conference on Education of Mathematics and Physics, Brno.

The accreditation of a new Doctoral degree programme 'Mathematics in Electrical Engineering' was a significant step towards further research in theoretical and applied mathematics.

Within the framework of the innovative FRVŠ project, computer laboratories were equipped with new control computers with the interactive systems Onfinity CM2 and a new image-forming file.

## Major Research Projects

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

Investigator: Josef Diblík

### Software for Europe – GAČR INE/07/E008

Investigator: Helena Durnová

## Selected Publications

BAŠTINEC, J.; DIBLÍK, J.; RŮŽIČKOVÁ, M. Initial data generating bounded solutions of linear discrete equations. *Opuscula Mathematica*, 2007, vol. 26(2006), no. 3, pp. 395-406. ISSN: 1232-9274.

DIBLÍK, J.; BAŠTINEC, J. Multipoint singular boundary-value problem for system of semilinear differential equations. *Communications in Applied Analysis*, 2007, vol. 10(2006), no. 4, pp. 413-430. ISSN: 1083-2564.

DIBLÍK, J.; HLAVIČKOVÁ, I.; RŮŽIČKOVÁ, M. A General Version of the Retract Method for Discrete Equations. *Acta Mathematica Sinica*, 2007, vol. 23, no. 2, pp. 341-348. ISSN: 1439-8516.

DIBLÍK, J.; KHUSAINOV, D. Representation of solutions of linear discrete systems with constant coefficients and pure delay. *Advances in Difference Equations*, 2007, vol. 2006, no. 4, pp. 1-13. ISSN: 1687-1839.

DIBLÍK, J.; RŮŽIČKOVÁ, M. Asymptotic behaviour of solutions and positive solutions of differential delay equations. *Functional Differential Equations*, 2007, vol. 2007, no. 14, pp. 85-105. ISSN: 0793-1786.

DIBLÍK, J.; VÁCLAVÍKOVÁ, B. Bounded solutions of discrete equations on discrete real time scales. *Functional Differential Equations*, 2007, vol. 14, no. 1, pp. 67-81. ISSN: 0793-1786.

CHVALINA, J., HOŠKOVÁ, Š. Modelling of Join Spaces with Proximities by First-Order Linear Partial Differential Operators. *Italian Journal of Pure and Applied Mathematics*, 2007, vol. 2007, no. 21, pp. 177-190. ISSN: 1126-8042.

CHVALINA, J.; HOŠKOVÁ, Š. Transformation tolerance hypergroups. *Thai Journal of Mathematics*, 2007, vol. 4(2006), no. 1, pp. 67-72. ISSN: 1686-0209.

NEUMAN, F. Structure of solution spaces via transformations. *Applied Mathematics Letters*, 2007, vol. 2007, no. 10, pp. 23-27. ISSN: 0893-9659.

NOVÁK, M. Presentation of a new bilingual mathematical dictionary. *Scientific Issues, Jan Dlugosz University of Czenstochowa*, 2007, vol. 2007, pp. 81-86. ISSN: 1896-0286.

ŠMARDA, Z. A singular initial value problem for implicit integrodifferential equations. *Journal of Basic Science*, 2007, vol. 3, no. 2, pp. 25-28. ISSN: 1735-0611.

ŠMARDA, Z. Asymptotic stability of solutions of nonlinear Volterra integrodifferential equations. *Department of Mathematics Report Series*, 2007, vol. 14, no. 1, pp. 245-249. ISSN: 1214-4681.

## Bachelor's Programme

Mathematical Seminar (Petr Fuchs)

Mathematics 1 (Vlasta Krupková)

Mathematics 2 (Jan Chvalina)

Mathematics 3 (Břetislav Fajmon)

Selected Parts from Mathematics (Zdeněk Šmarda)

## Master's Programme

Differential Equations in Electrical Engineering (Josef Diblík)

Matrices and Tensors Calculus (Martin Kovár)

Matrix Calculus (Martin Kovár)

Modern Numerical Methods ( Jaromír Baštinec)

Probability, Statistics, Operations Research  
(Jaromír Baštinec)

### Doctoral Programme

Discrete Processes In Electrical Engineering  
(Josef Diblík)

Statistics, Stochastic Processes, Operations  
Research (Jaromír Baštinec)

### Laboratories

**Computer Laboratories** (2) (instruction in Computers and Programming 2, simulation of application mathematical thematic wholes by means of the Matlab, Maple and Mathematica software in all study programmes of FEEC BUT, Lubomír Bajgar)

# Department of Microelectronics

## **Prof. Ing. Vladislav Musil, CSc.**

Head

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## **Professors**

Prof. Ing. Dalibor Biolek, CSc.  
Prof. Ing. Jaromír Brzobohatý, CSc.  
Prof. Ing. Vladislav Musil, CSc.  
Prof. Ing. Radimír Vrba, CSc.

## **Associate Professors**

Doc. Ing. Arnošt Bajer, CSc.  
Doc. Ing. Jaroslav Boušek, CSc.  
Doc. Ing. Pavel Legát, CSc.  
Doc. Ing. Ivan Szendiuch, CSc.  
Doc. Ing. František Urban, CSc.

## **Lecturers**

Ing. Martin Adámek, Ph.D., Ing. Daniel Bečvář, Ph.D., Ing. Lukáš Fajcik, Ph.D., Ing. Jiří Háze, Ph.D., Ing. Edita Hejátková, RNDr. Michal Horák, CSc., Ing. Jaromír Hubálek, Ph.D., Ing. Jaroslav Kadlec, Ph.D., Ing. et Ing. Fabián Khateb, Ph.D., Ing. Radek Kuchta, Ph.D., Ing. Radovan Novotný, Ph.D., Ing. Jan Prášek, Ing. Roman Prokop, Ing. Milan Recman, CSc., Ing. Ondřej Sajdl, Ph.D., Ing. Josef Šandera, Ph.D., Ing. Pavel Šteffan, Ph.D.

## **Postgraduate Students**

Ing. Marek Bohrn, Ing. Tomáš Brich, Ing. Issa El Dbib, Ing. Richard Ficek, Ing. Tomáš Fořt, Ing. Tomáš Havlíček, Ing. Ondřej Hégr, Ing. Radek Helán, Ing. Jiří Hladík, Ing. Jan Hrdý, Ing. R.H. Ben Ayad Ibrahim, Ing. Petr Kosina, Ing. Martin Laža, Ing. Anar Mammadov, Ing. Filip Mika, Ing. Břetislav Mikel, Ing. Ferar Moualla, Ing. Kamil Nováček, Ing. Marek Novotný, Ing. Vít Ondruch, Ing. Michal Pavlík, Ing. Jiří Stehlík, Ing. Olga Russkikh, Ing. Mahmoud Shaktour, Ing. Assaid Sharon, Ing. Viktor Švéda, Ing. Jaroslav Týnek, Ing. Cyril Vaško, Ing. Jiří Vávra

## **Administrative and Technical Staff**

Ing. Jan Břínek, Iva Doušková, Jarmila Fučíková, Ing. Petr Hub, Petra Jedličková, Hana Jelínková, PhDr. Jarmila Jurášová, Ing. Kateřina Klosová, Ing. Zdeněk Kozáček, Ing. Martin Magát, Ing. Břetislav Mikel, Ph.D., David Nejezchleb, Bc. Petr Novák, Vladislav Pliska, Ing. Marek Šimčák, Ph.D., Ing. Jan Vaněk

## Main Interests

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

Research is centred on basic and applied research of integrated circuits and sensors. The main areas of interest are the design of switching current circuits and evaluation of signals from chemosensors and biosensors, mainly gases and pesticides, nanostructures (nanotubes, nanocolumns) in modified microelectrodes and advanced nanotechnology, simulation and evaluation of the reliability of 3D linking systems. A unique four-zone burning kiln and a laser cutting apparatus AUREL Protomat are used for the preparation of thick-layer sensors. A methodology for reliability measurement of microelectronic and electronic assemblies is elaborated. The department has close mobility cooperation with Bournemouth

## Major Achievements

In 2007, the department staff were involved in two projects of the 5th FP EU, four GAČR projects, three projects of Academy of Sciences, 17 FRVŠ projects and five projects of the Ministry of Trade and Industry.

In September 2007, the department organized the international conference 'Electronic Devices and Systems EDS2007' with the participation of Czech and foreign experts.

Within the framework of the projects of Ministry of Industry and Trade, the group involved in microelectronic technology, headed by Ivan Szendiuch, achieved significant results in the research on the characteristics and applications of lead-free solders and thermal stress modelling for solder joints and cases, including bonding semiconductor chips. Moreover, solution to the unique thermal balance sensor was initiated. Ivan Szendiuch was given the Fellow Award from the International Microelectronics and Packaging Society for his merits in research and instruction in microelectronic technology and the promotion of this field in the world.

The group of electrochemical sensors, led by Jaromír Hubálek, tested a new unique system for electrochemical analysis. In the use of nanotech-

University in Great Britain and with KHBO Oostende, Belgium. There is research cooperation with BVT Technologies, Brno, Autoflug Hamburg, Catalanian University Rovira i Virgili, Tarragona, the research laboratory IMEC-KHBO in Belgium, Yeditepe University Istanbul and King Mongkut's Institute of Technology, North Bangkok.

In 2008, the department will be engaged in the design methods for integrated current mode circuits and smart sensors, advanced methods for modelling and computer simulations of special electronic systems with focus on switched circuits for communication technology and power electronics. As far as technology is concerned, the department will concentrate on reliability assessment of lead-free solders and the linking of solar cells. Research on microsystems will concentrate on the use of nanotechnology for modification of microsystems in sensing of mechanical and chemical properties. Increased attention will be paid to student placements abroad.

nology in construction of electrochemical sensors, members of the research team achieved first positive results.

The group headed by Jaroslav Boušek worked out novel ways of using various wavelengths of light for measurement of photovoltaic cells by the LBIC (Light Beam Induced Current) method. The response of the cell can be measured in the wavelength range from 900nm to 400nm. It is, therefore, possible to study not only the volume, but also the surface processes. In our workplace for dynamic diagnostics of cells by means of transient processes we can, with a high accuracy, determine the barrier and diffusion capacity of the transition, volume recombination, serial resistance of the cells and cut-off characteristics up to 15A.

A workplace for diagnostics of partial discharge in electronic apparatus was set up. A partial discharge can be observed in the device with an operating frequency up to 50Hz and operating voltage amplitude up to 8kV.

In the area of integrated circuit (IO) design, a bandpass sigma-delta modulator for sensing applications was designed and implemented as well as a chip for testing the bond characteristics

for currents up to 10A. Intelligent pressure sensors, including differential sensors based on the optoelectronic principle, represent other major achievements.

A new fast structure of the CDTA circuit element was developed by Dalibor Biolek in cooperation

with Yeditepe University, Istanbul. In cooperation with the American company Spectrum Software, new functions were implemented in the worldwide spread simulation environment Micro-Cap 9, including the environment for digital filter modeling.

## Major Research Projects

### **Digitally Controlled Analog Operating Blocks – GAČR 102/05/0934**

Investigator: Vladislav Musil

### **Impedimetric Chemical Sensors with Nano-Mechanized Electrode Surface – AVČR 1QS201710508**

Investigator: Jaromír Hubálek

### **A Smart Biosensoric System for Detection of Pesticides and Herbicides in the Environment – MPO FT-TA/089**

Investigator: Radimír Vrba

### **Micro- and Nano- Sensoric Structures and Systems with Embedded Intelligence – GAČR 102/06/1624**

Investigator: Radimír Vrba

### **Multifunction Composites with Excellent Properties Based on Anorganic Nanocomponents – MPO FT-TA3/027**

Investigator: Radimír Vrba

### **Low-Power Structures of Photovoltaic Cells and Elements in FV Systems – MŽP VaV-SN-172-05**

Investigator: Ivan Szendiuch

### **New Principles of Low-Voltage and Low-Input AD Converters in Submicron Technologies – GAČR 102/05/0869**

Investigator: Radimír Vrba

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

Investigator: Radimír Vrba

### **Current and Integrated Mode Circuits for Analog Signal Processing – GAČR 102/05/0277**

Investigator: Dalibor Biolek

### **Research of Novel Mechatronic Systems MEMS for Measurement of Pressure – 2A-1TP1/143**

Investigator: Radimír Vrba

### **Research and Development of Machinery for Surface and Volume Forming – MPO FT-TA2/101**

Investigator: Radimír Vrba

### **Research of New Methods for Pressure Measurement with Galvanic Separation for Electromagnetic Interference and Explosive Industrial Environment – MPO FT-TA2/087**

Investigator: Radimír Vrba

### **Research of New Technologies and Methods for Pressure Difference Measurement and Verification on an Operating Sample of Intelligent Ceramic Sensor with a New Principle of Measurement – MPO FT-TA/050**

Investigator: Radimír Vrba

### **Research of New Technologies for Bonding of Chips in Integrated Circuits and Development of a Measuring System for Reliability Analysis – MPO FT-TA3/013**

Investigator: Ivan Szendiuch

## Selected Publications

ADAM, V.; BEKLOVÁ, M.; PIKULA, J.; HUBÁLEK, J.; TRNKOVA, L.; KIZEK, R. Shapes of Differential Pulse Voltammograms and Level of Metallothionein at Different Animal Species. *Sensors*, 2007, vol. 7, no. 1, pp. 2419-2429. ISSN: 1424-8220.

ADÁMEK, M., PRÁŠEK, J. 3-D Electrodes Design For Thick-Film Sensors. *Electronics*, 2007, vol. 16, no. 4, pp. 148-152. ISSN: 1313-1842.

ADÁMEK, M., PRÁŠEK, J. Some Aspects In Thick-Film Capillary Production. *Electronics*, 2007, vol. 16, no. 4, pp. 148-152. ISSN: 1313-1842.

BIOLEK, D.; BIOLKOVÁ, V.; KOLKA, Z. New algorithm of numerical inversion of D-transform. *WSEAS Transactions on Signal Processing*, 2007, vol. 3, no. 1, pp. 38-43. ISSN: 1790-5022.

BIOLEK, D.; HANCIOGLU, E.; KESKIN, A. High-performance current differencing transconductance amplifier and its application in precision current-mode rectification. *AEU - International Journal of Electronics and Communications*, 2007, vol. 61, no. 8, pp. 1-10. ISSN: 1434-8411.

HUBÁLEK, J. Microelectrodes. In *Utilizing Bio-Electrochemical and Mathematical Methods in Biological Research*. 37/661 (2). Fort P.O., Trivandrum-695 023, Kerala, India: Research Signpost, 2007. pp. 21-33. ISBN: 81-308-0163-9.

HUBÁLEK, J.; HRADECKÝ, J.; ADAM, V.; KRYŠTOFOVÁ, O.; HUŠKA, D.; MASAŘÍK, M.; TRNKOVA, L.; HORNA, A.; KLOSOVÁ, K.; ADÁMEK, M.; ZEHNÁLEK, J.; KIZEK, R. Spectrometric and Voltammetric Analysis of Urease: Nickel Nanoelectrode as an Electrochemical Sensor. *Sensors*, 2007, vol. 7, no. 1, pp. 1238-1255. ISSN: 1424-8220.

NOVOTNÝ, R. 2k factorial experiments for quality improvement and statistical process analysis purposes. *WSEAS Applied Informatics & Communications*, 2007, vol. 2, no. 1, pp. 199-202. ISSN: 1790-5117.

PETRLOVÁ, J.; KRŽIŽKOVÁ, S.; ZÍTKA, O.; HUBÁLEK, J.; PRŮŠA, R.; ADAM, V.; WANG, J.; BEKLOVÁ, M.; SURES, B.; KIZEK, R. Utilizing a chronopotentiometric sensor technique for metallothionein determination in fish tissues and their host parasites. *Sensors and Actuators B: Chemical*, 2007, vol. 127, no. 1, pp. 112-117. ISSN: 0925-4005.

PRÁŠEK, J.; ADÁMEK, M.; HUBÁLEK, J.; JAŠEK, O.; ZAJÍČKOVÁ, L. Thick-film electrochemical sensor with deposited carbon nanotubes. *Electronics*, 2007, vol. 16, no. 4, pp. 125-130. ISSN: 1313-1842.

PRÁŠEK, J.; ADÁMEK, M.; KŘIVKA, J. Examination of the thick-film electrochemical sensor electrodes properties. *Electronics*, 2007, vol. 16, no. 4, pp. 131-136. ISSN: 1313-1842.

PROKOP, R.; FUJCIK, L. ASIC for electro-chemical sensor conductivity measurement using bipolar pulse method. *Electronics*, 2007, vol. 16, no. 9, pp. 43-48. ISSN: 1313-1842.

PROKOP, R.; MUSIL, V. New modular current devices for true current mode signal processing. *Electronics*, 2007, vol. 16, no. 4, pp. 36-42. ISSN: 1313-1842.

ZÍTKA, O.; HUŠKA, D.; KRŽIŽKOVÁ, S.; ADAM, V.; GRACE, C.; TRNKOVA, L.; HORNA, A.; HUBÁLEK, J.; KIZEK, R. An Investigation of Glutathione-Platinum(II) Interactions by Means of the Flow Injection Analysis Using Glassy Carbon Electrode. *Sensors*, 2007, vol. 7, no. 1, pp. 1256-1270. ISSN: 1424-8220.

## Bachelor's Programme

Analogue Electronic Circuits (Dalibor Biolek)

Design and Technology of Electronic Instruments (Vladislav Musil)

Design of Analog Integrated Circuits (Daniel Bečvář)

Diagnostics and Testing of Electronic Systems (Milan Recman)

Digital Circuits and Microprocessors (Radimír Vrba)

Electronic Devices (Jaroslav Boušek)



Electrovacuum Instruments and Cryogenic Technique (Jaroslav Boušek)  
Management Minimum (Pavel Legát)  
Microelectronic Practicals (Josef Šandera)  
Microelectronics and Assembly Technology (Ivan Szendiuch)

Microsensors and Micromechanical Systems (Radimír Vrba)  
Modelling and Computer Simulation (Dalibor Bielek)  
Optoelectronics and Optical Communications (František Urban)  
VLSI Digital IC Design and VHDL (Daniel Bečvář)

### Master's Programme

Analogue Integrated Circuits (Jiří Háze)  
Applied Computer Technology (Radovan Novotný)  
Design and Technology of Electronic Equipments (Vladislav Musil)  
Design of Analogue CMOS Circuits (Vladislav Musil)  
Design of Digital CMOS Circuits (Vladislav Musil)  
Design of Electronic Instruments (Radimír Vrba)  
Digital Integrated Circuits (Vladislav Musil)  
Electronic Components Production (Ivan Szendiuch)  
Integrated Optoelectronics (František Urban)  
Management Minimum (Pavel Legát)  
Methods of Analog Integrated Circuits Design (Vladislav Musil)  
Methods of Digital Integrated Circuits Design (Vladislav Musil)

Microelectronic Devices and Structures (Michal Horák)  
Microelectronics Circuits (Daniel Bečvář)  
Microelectronics in English (Jaromír Brzobohatý)  
Modelling and Simulation in Microelectronics (Dalibor Bielek)  
New Circuit Principles for Integrated System design (Jaromír Brzobohatý)  
New Technology for Microelectronic Circuits (Ivan Szendiuch)  
PC Technology and Communication (Jaromír Hubálek)  
Quality Control (Radovan Novotný)  
Technological Process Control (Radovan Novotný)  
Theory of AD and DA Signal Conversion (Radimír Vrba)  
Vacuum Technology (Jaroslav Boušek)

### Doctoral Programme

Microelectronic Systems (Vladislav Musil)

Microelectronic Technology (Jaromír Hubálek)

### Laboratories

**Laboratory of Electronic Components** (instruction in Electronic Components, Arnošt Bajer, Jaroslav Boušek)

**Laboratory of Chemical Sensors** (research laboratory, Jaromír Hubálek)

**Laboratory of Microelectronic Technology** (thick films, soldering surface mounting, lead-free soldering, casing, instruction in Microelectronics and Assembly Technology, Modern Technology of Electronic Circuits and Systems, student projects, Ivan Szendiuch)

**Laboratory of Microsensors and Vacuum Technology** (instruction in Microsensors and Microelectromechanical Systems, Jaromír Hubálek, Vacuum Technology and Cryotechnology, Jaroslav Boušek, Josef Šandera)

**Design Laboratory of Electronic Devices and Systems** (instruction in Digital Circuits and Microprocessors, Electronic Systems, student projects, Radek Kuchta)

**Integrated Circuit Design Laboratory** (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)

**Laboratory of Vacuum Technology and Development of Electronic Devices** (research and development laboratory, Jaroslav Boušek, Josef Šandera, Jaromír Hubálek)

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

# Department of Radioelectronics

## **Prof. Dr. Ing. Zbyněk Raida**

Head

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## **Professors**

Prof. Ing. Tomáš Dostál, DrSc.  
Prof. Ing. Stanislav Hanus, CSc.  
Prof. Ing. Miroslav Kasal, CSc.  
Prof. Dr. Ing. Zbyněk Raida  
Prof. Ing. Václav Říčný, CSc.  
Prof. Ing. Milan Sigmund, CSc.  
Prof. Ing. Jiří Svačina, CSc.  
Prof. Ing. Vladimír Šebesta, CSc.  
Prof. Ing. Otakar Wilfert, CSc.

## **Associate Professors**

Doc. Ing. Lubomír Brančík, CSc.  
Doc. Dr. Ing. Zdeněk Kolka  
Doc. Ing. Jaromír Kolouch, CSc.  
Doc. Ing. Zdeněk Nováček, CSc.  
Doc. Ing. Aleš Prokeš, Ph.D.

## **Lecturers**

Ing. Viera Biolková, Ing. Jiří Dřínovský, Ph.D., Ing. Zbyněk Fedra, Ph.D., Ing. Tomáš Frýza, Ph.D., Ing. Ivana Jakobová, Ing. Marta Krátká, Ing. Tomáš Kratochvíl, Ph.D., Ing. Jaroslav Láčík, Ph.D., Ing. Zbyněk Lukeš, Ph.D., Ing. Roman Maršálek, Ph.D., Ing. Václav Michálek, CSc., Ing. Jiří Petržela, Ph.D., Ing. Jan Prokopec, Ph.D., Ing. Jiří Šebesta, Ph.D., Ing. Tomáš Urbanec

## **Postgraduate Students**

Ing. Vladimír Axman, Ing. Ondřej Baran, Ing. Marek Bobula, Ing. Lucie Dordová, Ing. Ondřej Dvořák, Ing. Pavel Dýmal, Ing. Lukáš Džbánek, Ing. Jakub Džubera, Ing. Filip Gleissner, Ing. Martin Hampl, Ing. Jiří Horák, Ing. Pavel Hovořák, Ing. Rostislav Hučka, Ing. Jana Jilková, Ing. Ladislav Józsa, Ing. Petr Kejík, Ing. Peter Kovács, Ing. Michal Kováč, Ing. Jan Kovář, Ing. Martin Kravka, Ing. Vítězslav Krčmář, Ing. Tomáš Krzák, Ing. Petr Křivák, Ing. Michal Kubíček, Ing. Petr Kučera, Ing. Radek Kvíčala, Ing. Pavel Matějka, Ing. Zdeněk Mikéska, Ing. Jan Mikulka, Ing. Lukáš Oliva, Ing. Ondřej Pirochta, Ing. Michal Pokorný, Ing. Václav Pospíšil, Ing. Jan Puskely, Ing. Jaroslav Rumánek, Ing. Bohdan Růžička, Ing. Zdeněk Řezníček, Ing. Martin Slanina, Ing. Josef Slezák, Ing. Martin Sloboda, Ing. Vladimír Smejkal, Ing. Petr Stančík, Ing. Michal Strýček, Ing. Tomáš Sutorý, Ing. Václav Šádek, Ing. Radek Šebela, Ing. Jiří Špaček, Ing. Radim Štukavec, Ing. Dalibor Štverka, Ing. Petr Tošovský, Ing. Josef Urban, Ing. Petr Vágner, Ing. Václav Valenta, Ing. Michal Vavřda, Ing. Rostislav Vídenka, Ing. Pavel Vyskočil, Ing. Luděk Závodný

## **Administrative and Technical Staff**

Květuška Bílá, Ing. Jiří Dřínovský, Ing. Martin Horák, Ph.D., Anna Kalná, Ing. Jaroslav Láčík, Ph.D., Ing. Vishwas Lakkundi, Ph.D., Ing. Zbyněk Lukeš, Ph.D., Dora Šebestová, Petra Šířová, Aleš Vanžura, Jaroslav Voráč

## Main Interests

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

Funding for research comes especially from two MŠMT research plans, projects of the National Research Programme II, Research Centre, GAČR projects (eight standard, two postdoctoral and three doctoral grant programmes) and GAAV projects (two junior research grants). The department participates in the projects of the Czech Ministry of Industry and Trade and projects for the National Security Office.

Research results are reflected in instruction in Bachelor, Master and Doctoral study programmes. Updating and modernization of education are financed from 19 FRVŠ research projects.

Pedagogical activities of the department are not restricted to the university only. In 2007, special

## Major Achievements

Three academics from the department won significant awards. Miroslav Kasal was granted the Research Award of the Ministry of Education for his work in the field of cosmic research, Vladimír Šebesta was awarded the Silver medal of BUT for his lifelong contribution to the university development and Jiří Dřínovský won the Emil Skoda Award for his excellent doctoral thesis.

Significant scientific results were achieved in the research on planar microwave structures with defective earth (Microwave and Optical Technology Letters), in the development of antennas with extreme bandwidth for terahertz spectroscopes (Journal of Molecular Spectroscopy), in the research on atmospheric optical connections (Journal of Optoelectronics and Advanced Materials) and in the research on physical effects connected with thermal processes in fluids (Temperature Material Processes: An International Journal).

The department became a member of the consortia of two huge research projects of the 7th FP EU (more than 50 partners). They are the project

trainings for teachers at Secondary Schools of Electrical Engineering were prepared (coordinated by the Secondary Industrial School in Uherský Brod) as well as a number of trainings for development workers in the companies Siemens, Honeywell and Foxconn.

Specialists from industrial companies (e.g. TheNet and T-Mobile) are invited to participate in instruction provided by the department, in the education within the framework of radioelectronic seminars (AMIS and Freescale) and in supervision of Bachelor and Master theses.

The department cooperates with many professional and amateur organizations. Lubomír Brančík is the head of the Czechoslovak section of the IEEE. Within the framework of the National Research Programme 2, the activities of Radio-club OK2KOJ and of the IEEE student branch at BUT are supported. We cooperate actively with the Czech Electrotechnical Society. The department is a collective member of the International Organization AMSAT.

COST IC0603 Antenna Systems & Sensors for Information Society Technologies and the integrated project High Intensity Radiated Field Synthetic Environment.

The department staff were involved in a number of research and development projects for cooperating companies, e.g. Škoda-Auto (communication, navigation and entertainment electronics for automobiles), Andrew (numerical studies of microwave components) and APOS (development of the electronics for RFID reader). Long-term cooperation with the company T-Mobile continues.

In April 2007, the department organized the 17th International Scientific Conference Radioelectronics 2007.

Within the framework of the National Research Programme 2, the department prepared and organized a range of popularization lectures and workshops focused on the latest development in their branch of science.

## Major Research Projects

**Algorithms for Increased Efficiency of Digital Predistorters in Basic Zone – GA AV ČR KJB208130601**

Investigator: Roman Maršálek

**Analytic Research of Threats in Electro-Magnetically Integrated Systems – MPO FT-TA4/043**

Investigator: Zbyněk Raida

**Safe Optical Wireless Links for Municipal Networks – 2C06012**

Investigator: Otakar Wilfert

**Near Field of Aerial Systems – GAČR 102/07/1084**

Investigator: Zdeněk Nováček

**Center of Quasioptical Systems and Terahertz Spectroscopy – ČR LC06071**

Investigator: Zbyněk Raida

**New Generation Electronic Communication Systems and Technologies (ELKOM) – ČR MSM0021630513**

Investigator: Jiří Svačina

**Electronics and Communication Technology – Adventure and Challenge for Young Generation – NPV II - 2E06007**

Investigator: Jiří Svačina

**Communication Systems for Experimental Satellites – GAČR 102/06/1672**

Investigator: Miroslav Kasal

**Compression and Wireless Transfer of Video Signals at Low Bit Rates – GA AV ČR KJB208130704**

Investigator: Tomáš Frýza

**Methodology of the Design of High Reliability Optical Wireless Links – GAČR 102/06/1358**

Investigator: Aleš Prokeš

**Methods Increasing the Reliability of Optical Directional Links – GAČR 102/05/0571**

Investigator: Otakar Wilfert

**Methods, Structures and Components of Electronic Wireless Communication – GAČR 102/03/H109**

Investigator: Stanislav Hanus

**Models of Mobile Networks and Their Parts – GAČR 102/07/1295**

Investigator: Stanislav Hanus

**Modern Methods of the Design and Application of Electronic Circuits – GAČR 102/03/H105**

Investigator: Zdeněk Kolka

**Computer-Aided Modelling and Synthesis of Digital and Integrated Analog-Digital Systems – GAČR 102/05/0732**

Investigator: Jaromír Kolouch

**Advanced Optimization and Design of Microwave Aerials – GAČR 102/07/P385**

Investigator: Zbyněk Lukeš

**Advanced Methods of Computer-Aided Design of Circuits – GAČR 102/05/0771**

Investigator: Zdeněk Kolka

**Advanced Microwave Structures on Nonconventional Substrates – GAČR 102/07/0688**

Investigator: Zbyněk Raida

**Multiple Functions of Locomotive Recording Tachometer – MPO IM2/038**

Investigator: Jiří Svačina

**Development of Modem for Higher Sensitivity Zone Measurement – National Security Office,  
44-4/2007/NBÚ/07**

Investigator: Jiří Šebesta

**Research of Digital Detection Methods of Low Energy Radio Signals – GAČR 102/07/P514**

Investigator: Jiří Šebesta

### **Selected Publications**

BRANČÍK, L. Modified Technique of FFT-Based Numerical Inversion of Laplace Transforms with Applications. *Przeglad Elektrotechniczny*, 2007, vol. 83, no. 11, pp. 53-56. ISSN: 0033-2097.

BRANČÍK, L. Procedures for Matrix Exponential Function Derivative in Matlab. *Przeglad Elektrotechniczny - Konferencje*, 2007, vol. 5, no. 2, pp. 7-10. ISSN: 1731-6103.

KOLKA, Z.; BIOLKOVÁ, V.; WILFERT, O. Availability Assessment of Optical Wireless Links in Central Europe. *WSEAS Transactions on Communications*, 2007, vol. 6, no. 2, pp. 295-300. ISSN: 1109-2742.

KOLKA, Z.; WILFERT, O.; FIŠER, O. Achievable Qualitative Parameters of Optical Wireless Links. *Journal of Optoelectronics and Advanced Materials*, 2007, vol. 9, no. 5, pp. 2419-2423. ISSN: 1454-4164.

SIGMUND, M. Spectral Analysis of Speech under Stress. *International Journal of Computer Science and Network Security*, 2007, vol. 2007, no. 4, pp. 170-172. ISSN: 1738-7906.

ŠEBESTA, J. Discrete-time Phase and Delay Locked Loops Analyses in Tracking Mode. *International Journal of Electronics, Circuits and Systems (IJECS)*, 2008, vol. 1, no. 4, pp. 207-210. ISSN: 1307-4156.

URBANEC, T. Novel Approach for Wideband VNA by Sixport Principle. *International Journal of Electronics, Circuits and Systems (IJECS)*, 2008, vol. 1, no. 4, pp. 203-206. ISSN: 1307-4156.

VÁGNER, P.; KASAL, M. Design of Novel Microstrip Lowpass Filter Using Defected Ground Structure. *Microwave and Optical Technology Letters*, 2007, no. 1, pp. 1-3. ISSN: 0895-2477.

LUKEŠ, Z.; LÁČÍK, J.; RAIDA, Z. Optimized wideband horn antenna for terahertz spectroscopy applications. *Journal of Molecular Spectroscopy*, 2007, vol. 12, no. 241-246, pp. 1-8. ISSN: 0022-2852.

### **Bachelor's Programme**

Analogue Electronic Circuits (Lubomír Brančík)  
Audiofrequency Electronics (Tomáš Kratochvíl)  
CAD of Communication Systems (Zbyněk Raida)  
CAD of Electronic Circuits (Zdeněk Kolka)  
Communication Systems (Aleš Prokeš)  
Computers and Programming 2 (Zbyněk Raida)  
Electrical Filters (Tomáš Dostál)  
Electronic Instruments Feeding (Jiří Šebesta)  
Electromagnetic Compatibility (Jiří Svačina)  
Electronic Practice (Marta Krátká)  
EM Waves, Antennas and Lines (Zdeněk Nováček)

Fundamentals of TV Technology (Stanislav Hanus)  
HF and Microwave Techniques (Jiří Svačina)  
HF Techniques and Antennas (Miroslav Kasal)  
Microprocessor Techniques (Tomáš Frýza)  
Optoelectronics (Otakar Wilfert)  
Pulse and Digital Techniques (Jaromír Kolouch)  
Radio and Mobile Communication (Stanislav Hanus)  
Radio Receivers and Transmitters (Aleš Prokeš)  
Signals and Systems (Milan Sigmund)  
Special Electronic Devices and Their Applications (Jiří Svačina)

### **Master's Programme**

Advanced radio communication systems (Zbyněk Raida)

Antennas and Radio Waves Propagation (Zdeněk Nováček)

CAD in HF and Microwave Techniques (Zbyněk Raida)  
Computer and Communication Networks (Zdeněk Kolka)  
Computer Systems and their Applications (Zdeněk Kolka)  
Digital television systems (Tomáš Kratochvíl)  
Electronic Circuits Theory (Tomáš Dostál)  
Electronics in German (Milan Sigmund)  
Microcomputers for Instrumental Applications (Zbyněk Fedra)  
Microwave Integrated Techniques (Jiří Svačina)  
Mobile Communication Systems (Jan Prokopec)

Photonics and Optical Communications (Otakar Wilfert)  
Programmable Logic Devices (Jaromír Kolouch)  
Quantum and Laser Electronics (Otakar Wilfert)  
Radars and Navigation (Jiří Šebesta)  
Radioelectronic Measurements (Jiří Dřínovský)  
Radio Links Design (Jaroslav Láčik)  
Radio Relay and Satellite Communication (Miroslav Kasal)  
Speech Signal Analysis and Synthesis (Milan Sigmund)  
Videotechnology (Václav Říčný)  
Wireless Communication Theory (Roman Maršálek)

### Doctoral Programme

Modern Digital Wireless Communication (Milan Sigmund)

Modern Electronic Circuit Design (Zdeněk Kolka)

### Laboratories

**Laboratory of Analog Electronic Circuits** (instruction in analog technology, Ivana Jakubová)

**Laboratory of Aerials and Electromagnetic Field** (research and instruction in EM fields, antennas and design of radio links, Zdeněk Nováček)

**Laboratory of Communication Systems** (research and instruction in communication systems and data transmission, Aleš Prokeš)

**Laboratory of Microprocessor Technology** (instruction in microprocessor and microcomputer technology, Tomáš Frýza)

**Laboratory of Microwave Technology** (research and instruction in microwave technology and special electronic components, Jiří Svačina)

**Laboratory of Low-Frequency Applications** (instruction in audioteknik, IF electronics and feeding of electronic devices, Jiří Šebesta)

**Laboratory of Optoelectronics and Photonics** (instruction in optoelectronics, photonics and optical communications, Otakar Wilfert)

**Laboratory of Signals and Digital Technology** (instruction in signals and digital technology, Viera Biolková)

**Laboratory of Radio Relay and Satellite Communication** (instruction in radio and satellite communication, radiolocation and navigation, Miroslav Kasal)

**Laboratory of TV and Video Technology** (instruction in analog and digital TV and video technology and TV cable distribution system, Tomáš Kratochvíl)

**Laboratory for Student Research** (laboratory for student projects, diploma and Bachelor projects, self-study, Jiří Šebesta)

**Service Laboratory of Microprocessor Technology** (service laboratory for computer technology, Václav Michálek)

**Joint Laboratory of Mobile Communication** (research and instruction in mobile wireless communication and systems, Stanislav Hanus, Jan Prokopec)

**PC Laboratories** (two laboratories for computer-aided exercises in circuits, signals and systems of special areas of radioelectronics and communication technology, Zdeněk Kolka)

**Research and Development Laboratory of Digital TV and Video Technology** (research of digital and compression methods of image signal processing, design of a device for digital video technology, Václav Říčný)

**Research Laboratory of Experimental Satellite Communication** (research and development of sub-systems for satellite communication and navigation, telemetric and command station of experimental satellites of AMSAT, Miroslav Kasal)

**Research Laboratory of Optical Communications** (research and development of laser optical atmospheric links and optical communication systems, Otakar Wilfert)

**Research Laboratory of Digital Signal Processing** (research of the methods and techniques for digital image processing, processing of speech signals and digital radiotechnology, Roman Maršálek)

**Research Laboratory of Numerical Methods** (research of the methods of analysis, design and optimization of microwave planar structures and antennas, Zbyněk Ráida)

**EMC pre-Compliance Test Laboratory** (laboratory for pre-compliance measurement of interference emissions and electromagnetic resistance testing, Jiří Dřínovský)



# Department of Telecommunications

## **Prof. Ing. Kamil Vrba, CSc.**

Head

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## **Professors**

Prof. Ing. Zdeněk Smékal, CSc.  
Prof. Ing. Kamil Vrba, CSc.

## **Associate Professors**

Doc. RNDr. Milan Berka, CSc.  
Doc. Ing. Karel Burda, CSc.  
Doc. Ing. Miloslav Filka, CSc.  
Doc. Ing. Vladimír Kapoun, CSc.  
Doc. Ing. Ivo Lattenberg, Ph.D.  
Doc. Ing. Karel Němec, CSc.  
Doc. Ing. Jiří Mišurec, CSc.,  
Doc. Ing. Vít Novotný, Ph.D.  
Doc. Ing. Ivan Rampf, CSc.  
Doc. Ing. Vladislav Škorpil, CSc.  
Doc. Ing. Václav Zeman, Ph.D.

## **Lecturers**

Ing. Miroslav Balík, Ph.D., Ing. Lubomír Cvrk, Ph.D., Ing. Petr Číka, Ing. Radim Číž, Ing. Otto Dostál, CSc., Ing. Ivo Herman, CSc., Ing. Ladislav Káňa, Ing. Dan Komosný, Ph.D., Ing. David Kubánek, Ph.D., Ing. Karol Molnár, Ph.D., Mgr. Pavel Rajmíc, Ph.D., Ing. Kamil Říha, Ph.D., Ing. Jiří Schimmel, Ph.D., Ing. Michal Soumar, Ing. Petr Sysel, Ph.D., Ing. Pavel Šilhavý, Ph.D., Ing. Radek Zezula, Ph.D.

## **Postgraduate Students**

Ing. Hicham Atassi, Ing. Kamil Bodeček, Ing. Radim Burget, Ing. Milan Březina, Ing. Petr Daněček, Ing. Pavel Hanák, Ing. Dušan Havelka, Ing. Norbert Herencsár, Ing. Jiří Hošek, Ing. Filip Janovič, Ing. Jan Jeřábek, Ing. Jan Kacálek, Ing. Michal Kohoutek, Ing. Vítězslav Kot, Ing. Jaroslav Koton, Ing. Jiří Kouřil, Ing. Martin Koutný, Ing. Ivan Koula, Ing. Petr Kovář, Ing. Ondřej Krajsa, Ing. Vítězslav Křivánek, Ing. Martin Kyselák, Ing. František Kyselý, Ing. Petra Lambertová, Ing. Tomáš Langer, Ing. Tomáš Lukl, Ing. Jan Malý, Ing. Ivan Miča, Ing. Martin Minarčík, Ing. Galal Abdo Awad Murshed, Ing. Lukáš Palko, Ing. Tomáš Pelka, Ing. Václav Pfeifer, Ing. Michal Polívka, Ing. Jiří Přinosil, Ing. Radim Pust, Ing. Anna Shklyaeva, Ing. Michal Skořepa, Ing. Vojtěch Stejskal, Ing. Martin Sýkora, Ing. Milan Šimek, Abdurrrzag Giuma A Tamtam, Ing. Jan Vlach, Ing. Vít Vrba

## **Administrative and Technical Staff**

Jitka Halousková, doc. MUDr. Václav Chaloupka, CSc., Jaroslav Klou, Ondřej Kratěna, Mgr. Otakar Kříž, Magda Lounková, Jaroslav Meixner, Bc. Jakub Müller, MUDr. Svatopluk Nehyba, Pavel Novotný, Lukáš Pazdera, Bc. Lucie Pernicová, Zdeněk Procházka, Bohuslava Raidová, Jitka Šichová, MUDr. Iva Tomášková, Ing. Robert Vích, DrSc., Ing. Martin Vondra, Ph.D.

## Main Interests

The Department of Telecommunications develops the Bachelor programme study area Teleinformatics whose conception reflects the current convergence of communication and information technologies. Instruction provided in the department seeks balance between mobile and stationary communications, computer systems and networks, design of network applications in various programming languages. Students are instructed in the design of analog and digital circuits, microprocessors and signal processors, and their applications. They can specialize in multimedia, i.e. digital processing of speech, music or images. The Bachelor study programme is followed by the Master study programme Telecommunication and Information Technology and the Doctoral study programme Teleinformatics.

The department is successful in obtaining sufficient funding from various research and education projects. The research and development teams in the department were involved in projects

## Major Achievements

The main interest of the department are communication systems oriented to mobile and wireless network technologies.

Members of the department won 'Best paper award' from the companies IARIA for the contribution 'Pure Current-Mode Frequency Filter for Signal Processing in High-Speed Data Communication' presented at the international conference ICONS 2007 and the same award from the companies IFIP for 'RF Pure Current-Mode Filters using Current Mirrors and Inverters' presented at the international conference PWC 2007. Many prototypes of unique electronic devices, e.g. a system of the digital multi-channel processing of audio signals, a device for precise micrometric testing of sieves for building and foodstuffs industries, a device GP-P1 for treatment of the skin disease Adipositas oedematosa, a treatment device LMG-4 for combined magnetic and optical therapy and a prototype of communication terminal with a GSM module, were carried out for industrial companies.

relating to basic and applied research in the total amount of nearly 52 million CZK. A research team is engaged in providing up-to-date multimedia services via mobile and wireless networks. Some members of the team are involved in a research and development programme of the Ministry of Industry and Trade. Close cooperation was established with GiTy a.s., DISK Multimedia s.r.o. WESTCOM s.r.o., ENJOY s.r.o., SEV Litovel, URE, Academy of Sciences, MEG A-Měřicí Energetické aparáty, s.r.o., GTS Czech a.s., AIS s.r.o. and Saturn Holešov. Practical outcomes of the research are the development of user-friendly videoconferencing, modular architecture for information and videoconferencing systems, the development of a new generation communication system, universal architecture for DTV multicast for IP networks and others. The department gained the international project European Tempus – Erasmus Mundus for the implementation of the study area Teleinformatics in Syria.

Authorized software D-Console for the processing of audio signals in real time by means of local networks TCP/IP and Modular Digital V-DSP Crosspoint software for remote control of 128 audio signals were developed for industrial needs. A new specialized research and instruction laboratory, which is equipped with necessary technical devices for research in safety technologies, was constructed. Technology for cryptographic protection of communication and its management is the main part of the laboratory. The whole system consists of individual modules, the so-called Hardware Security Modules (HSM), in such a way to meet safety demands according to the standards FIPS 140-2 Level 3 and Level 2. The efficient HSM server with the certificate authority SafeNet Luna for a public key infrastructure is the core of the system. In 2007, the department organized the International Conference on Telecommunications and Signal Processing.

## Major Research Projects

**Applied Research of Protected Internet Communication with Remote End Power Devices – GA AV ČR 1ET110530523**

Investigator: Jiří Mišurec

**Distributed User Services for New Generation Mobile Networks – 1K04116**

Investigator: Karol Molnár

**Non-Linear Methods of Speech Enhancement – COST OC 28753**

Investigator: Zdeněk Smékal

**New Diagnostic Methods of the Measurement of Parameters of the Circulatory System Based on Infrared Recording of Blood Bed Images – MŠMT 2B06111**

Investigator: Milan Chmelař

**Novel Approaches to Equalization in Modern Digital Transmission Systems – GAČR 102/06/P160**

Investigator: Pavel Šilhavý

**Circuits with Universal Current and Voltage Conveyors and Operating Current Amplifiers – GAČR 102/06/1383**

Investigator: Kamil Vrba

**Optimization of Algorithms for Digital Processing of Audiosignals – GAČR 102/06/1233**

Investigator: Jiří Mišurec

**Optimization of Multicast Methods in IP Networks – GA AV ČR 1ET301710508**

Investigator: Dan Komosný

**Optimal Algorithms for Accurate Calculation of Wavelet Transform of Real-Time Signal – GAČR 02/06/P407**

Investigator: Pavel Rajmic

**Spatial Acoustic Effects for Systems of Multi-Channel Digital Processing of Sound – MPO FT-TA3/010**

Investigator: Kamil Vrba

**Sophisticated Methods of Support Services in New Generation Mobile Networks – GAČR 102/06/1569**

Investigator: Vít Novotný

**Sophisticated Noise and Interference Suppressors in Speech Signal Transmission for New Generation Fixed and Mobile Networks – GA AV ČR 1ET301710509**

Investigator: Zdeněk Smékal

**Synchronization of Cipher Block Modes for Modular Cryptographic Systems BRI ISDN a PRI ISDN – ST200520005002**

Investigator: Karel Burda

**Universal Architecture for Interactive Information Services for Terrestrial Digital TV – GA AV ČR 1ET301710510**

Investigator: Karol Molnár

**Universal Architecture for Quality Assurance in New Generation Mobile Network – GAČR 102/05/P585**

Investigator: Vít Novotný

**Research and Application of Time-Frequency Analysis in Logopaedy – MPO FT/072**

Investigator: Kamil Vrba

**Research and Verification of a System for Recording and Long-Term Archivation of Multimedia Data with Intelligent Search – MPO FT-TA3/121**

Investigator: Kamil Vrba

**Research and Development of Architecture for Information and Videoconferencing Systems – MPO FT-TA/081**

Investigator: Kamil Vrba

**Research and Development of an Internet Telephone Exchange – MPO FT-TA3/011**

Investigator: Zdeněk Smékal

**Research and Development of Two-Way Communication Technology for Information of Citizens – MPO FT-TA3/001**

Investigator: Kamil Vrba

**Research and Development of Secured GPRS Data Communication System – MPO FT2/073**

Investigator: Kamil Vrba

**Research of New-Generation of Centre-Controlled Infusion Pumps – GA AV ČR 1ET110540521**

Investigator: Pavel Šilhavý

**Research of Technologies and Systems for Real-Time Processing of Sound – MPO FD-K3/036**

Investigator: Jiří Schimmel

**Research into Effects of Digitally Controlled Pulse-Magnetic-Laser Field and Development of New Type Medical Apparatus – MPO FT-TA/007**

Investigator: Kamil Vrba

**Research of User-Friendly Videoconferencing Technology – MPO FD-K3/045**

Investigator: Václav Zeman

### **Selected Publications**

BODEČEK, K.; BŘEZINA, M. Data hiding error concealment for JPEG2000 images. Springer Verlag. Mobile and Wireless Communication Networks, 2007, vol. 245, no. 2, pp. 505-513. ISSN: 1571-5736.

BODEČEK, K.; NOVOTNÝ, V.; BŘEZINA, M. Image compression in digital video broadcasting. Springer Verlag. Mobile and Wireless Communication Networks, 2007, no. 9, pp. 477-487. ISSN: 1571-5736.

BURDA, K. Modification of the OCFB mode for fast data links. International Journal of Computer Science and Network Security, 2007, vol. 7, no. 12, pp. 228-232. ISSN: 1738-7906.

BURDA, K. Resynchronization interval of self-synchronizing modes of block ciphers. International Journal of Computer Science and Network Security, 2007, vol. 7, no. 10, pp. 8-13. ISSN: 1738-7906.

BURGET, R.; KOMOSNÝ, D.; ŠIMEK, M. Simulation of Large-Scale IPTV Systems for Fixed and Mobile Networks. Springer Verlag. Mobile and Wireless Communication Networks, 2007, vol. 2007, no. 9, pp. 445-1123. ISSN: 1571-5736.

BURGET, R.; KOMOSNÝ, D.; ŠIMEK, M. Transmitting Hierarchical Aggregation Information Using RTCP Protocol. International Journal of Computer Science and Network Security, 2007, vol. 7, no. 10, pp. 27-31. ISSN: 1738-7906.

CVRK, L.; VRBA, V. Secure Networking with NAT Traversal for Enhanced Mobility, Springer Verlag. Mobile and Wireless Communication Networks, 2007, vol. 245, no. 1, pp. 355-365. ISSN: 1571-5736.

ČÍKA, P. New watermarking scheme for colour image. Springer. Mobile and Wireless Communication Networks, 2007, vol. 2007, no. 9, pp. 497-504. ISSN: 1571-5736.

ČÍKA, P. The improvement of the method for digital image watermarking in frequency domain using BCH codes. International Journal of Computer Science and Network Security, 2007, vol. 2007, no. 3, pp. 151-154. ISSN: 1738-7906.

DOSTÁL, O.; JAVORNÍK, M. Improving Education and Cost - Effectiveness in Medical Imaging. IT@Networking Communications, 2007, vol. 2007, no. 1, pp. 14-15. ISSN: 1784-0716.

DOSTÁL, O.; SLAVÍČEK, K. Wireless Technology in Medicine Applications. Springer Verlag. Mobile and Wireless Communication Networks, 2007, vol. 2007, no. 14, pp. 316-324. ISSN: 1571-5736.

FILKA, M.; KŘEPELKA, V. Conditions of Cable Tree. Springer Verlag. Mobile and Wireless Communication Networks, 2007, vol. 2, no. 1, pp. 595-600. ISSN: 1571-5736.

HERENCŠÁR, N.; VRBA, K. Circuit Transformation Method from BOTA Circuits into UCC-based Circuits. International Transaction on Computer Science and Engineering, 2007, vol. 43, no. 1, pp. 9-16. ISSN: 1738-6438.

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## Bachelor's Programme

Accesses and Transports Networks (Vladislav Škorpil)

Analog Technology (Kamil Vrba)

CISCO Academy I,II (Dan Komosný)

Communication Technology (Ivo Herman)

Data Communication (Karel Němec)

Design of Electronic Devices (Kamil Vrba)

Digital Filters (Petr Sysel)

Digital Signal Processing (Jiří Mišurec)

Electroacoustics (Jiří Schimmel)

Hardware of Computer Networks (Karol Molnár)

High-speed Communications Systems (Vladislav Škorpil)

Introduction to Computer Typography and Graphics (Pavel Rajmic)

Multimedia Services (Otto Dostál)

Network Architecture (Vít Novotný)

Network Operating systems (Dan Komosný)

Practical Exercises in Information Networks (Karol Molnár)

Signals and Systems Analysis (Zdeněk Smékal)

Studioengineering (Ladislav Káňa)

Terminal Equipment (Vít Novotný)

Transmission Media (Miloslav Filka)

## Master's Programme

A/D and D/A Converters (Kamil Vrba)

Advanced Communication Techniques (Jan Jeřábek)

Advanced Data Transmission Technology (Václav Zeman)

Advanced Techniques of Image Processing (Kamil Říha)

CISCO Academy I,II (Dan Komosný)

Computers and Peripheral Devices (Miroslav Balík)

Computer-Supported Solution of Engineering Problems (Jiří Mišurec)

Cryptography (Václav Zeman)

Digital Audio Signal Processing (Miroslav Balík)

Digital Signal Processing (Zdeněk Smékal)

Digital Signal Processors (Petr Sysel)

Graphic and Multimedia Processors (Zdeněk Smékal)

Information System Security (Karel Burda)

Mobile Network Communication Systems (Vít Novotný)

Modern Network Technologies (Karol Molnár)

Multimedia (Otto Dostál)

Optical Networks (Miloslav Filka)

Parallel Computing Under Operating Systems. (Ivo Herman)

Projecting, Administration and Security (Karel Burda)

Security Systems (Karel Burda)

Sensor Systems (Ivan Rampf)

Services of Telecommunication Networks (Vladislav Škorpil)

Speech Processing (Zdeněk Smékal)

Theoretical Informatics (Radim Burget)

Theory of Communication (Karel Burda, Milan Berka)

## Doctoral Programme

Applied Cryptography (Karel Burda)

Modern Network Technology (Karol Molnár)

## Laboratories

**Laboratory of Analog Techniques** (research of non-conventional current-mode circuits, Kamil Vrba)

**Laboratory of Wireless Computer Networks and XoIP** (operation in wireless computer networks based on standards IEEE 802.11, access part of second generation mobile networks using Motorola station and controller, Karol Molnár, Vít Novotný)

**Laboratory of CISCO Academy** (instruction in CISCO Academy courses for all study areas at FEEC BUT)

**Laboratory of Digital Music Studio** (research and instruction in synthesis, analysis, processing and reproduction of music signals including the multi-channel 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 and testing of electroacoustic devices, anechoic room, Ladislav Káňa)

**Laboratory of Modern Network Technologies** (instruction in network technology, research of the management of switches and indicators, analysis of stationary and wireless local computer network, modeling of algorithms used in modern data networks, Karol Molnár)

**Laboratory of Multimedia Services** (research into design and multimedia communication services including digital processing of multimedia data, Ing. Petr Číka)

**Laboratory of Optical Links** (research and instruction in optical transmission, mechanical work with fibres, special measurements, Miloslav Filka)

**Laboratory of Data Transmission** (instruction in Data Communication, research of modems, modelling of the characteristics of access networks and end devices, Karel Němec)

**Laboratory of Access Networks** (research and instruction in end devices, efficiency of access networks with regard to wire and wireless media, Vladimír Kapoun)

**Laboratory of Communication Systems** (instruction in the theory of systems and signals, and theory of communication, Jiří Schimmel)

**Laboratory of Sensoric Systems** (measurement of the characteristics of sensors, smart sensors and circuits, sensor signal processing, demonstration line of industrial system ADAM, research of ICA and BSS, Ivan Rampl)

**Laboratory of Telecommunication Systems** (instruction in Telecommunication Systems, research of error-free transmission of messages, modelling of anti-error code systems, Karel Němec)

**Laboratory of High-Rate Communication Systems** (research and instruction in high-rate data transmission up to a minimal rate of 10 Gb/s, Vladislav Škorpil)

**Laboratory of Mutual Analog-Digital Conversion** (research and instruction in 'mixed mode' circuits, Kamil Vrba)

**Laboratory of Acoustic Signal Processing** (research of design, optimization and implementation of algorithms for speech and acoustic signals, DVD matrix, Miroslav Balík)

**Research and instruction laboratory of Safety Systems** (research and development of cryptographically protected extensive data files, research of authentication methods based on biometrics, research on security of multifunction two-way communication technology for information of citizens, Karel Burda)

**Research Laboratory of Motorola Signal Processors** (research and development of 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)



# Department of Theoretical and Experimental Electrical Engineering

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## **Professors**

Prof. Ing. Karel Bartušek, DrSc.  
Prof. Ing. Libor Dědek, CSc.  
Prof. Ing. Jarmila Dědková, CSc.

## **Associate Professors**

Doc. Ing. Pavel Fiala, Ph.D.  
Doc. Ing. Eva Gescheidtová, CSc.  
Doc. Ing. Pavel Kaláb, CSc.  
Doc. Ing. Milan Murina, CSc.  
Doc. Ing. Jiří Rez, CSc.  
Doc. Ing. Jiří Sedláček, CSc.

## **Lecturers**

Ing. Petr Drexler, Ph.D., Ing. Eva Kroutilová, Ph.D., Ing. Miloslav Steinbauer, Ph.D., Ing. Miroslav Veselý,  
Ing. Radek Kubásek, Ph.D.

## **Postgraduate Students**

Ing. Radim Kadlec, Ing. Vratislav Michal, Ing. Jan Mikulka, Ing. Michal Zycháček

## **Administrative and Technical Staff**

Ing. Tibor Bachorec, Ph.D., Eva Cupáková, Ing. Michal Hadinec, Ing. Tomáš Jirků, Ing. Petr Koňas,  
Ph.D., Ing. Taťána Krajčírovičová, Bc. Tomáš Kříž, Veronika Raabová, Ing. Jan Rychnovský, Ing. Zoltán  
Szabó, Ing. Alice Špérová

## Main Interests

Research is focused on impedance tomography methods in numerical modelling. In cooperation with the Institute of Instrument Technology, Academy of Sciences Brno, the evaluation of MR images with the aid of numerical modelling is investigated as well as the evaluation of NMR signals in strongly disturbed or distorted NMR signals. Cooperation with ABB EJV s.r.o. Brno continues in computer-aided design of measuring transformers. The two-processor stations ALTIX and the 16-processor station WOOD are used for extensive tasks. Cooperation with ESB is developed in technology solutions for revitalization of power machines and devices of Masaryk University and Mendel University of Agriculture and Forestry in Brno. Within the framework of projects of the Ministry of Industry and Trade, research on pulse sources on the principle of Faraday induction law up to 20GW is carried out. Cooperation

with VOP 026 Štenberk, VTUPV continues in research on a microwave source – vircator in TESLA Hloubětín.

Within the framework of filter research, students are placed abroad. In 2007, one student working on his diploma thesis was granted a placement at I.S.E.P. and six students from ISEP Paris were in placements at UTEE. The department cooperates with the company Optaglio and the Institute of Instrument Technology, Academy of Sciences Brno in research on nanomaterials. Basic research in numerical models of elementary particle mass was commenced in cooperation with the Institute of Instrument Technology, Academy of Sciences Brno. The department is also involved in research on measurement methods for the concentration of air ions and in basic and applied research on the measurement of single electromagnetic pulses.

## Major Achievements

A unique prototype of a sensor for the recording of pulse voltage with a pulse length under 100ns was implemented – VOP026 VTUPV. An innovated prototype of a pulse power generator PGV-II was assembled and tested in cooperation with PROTOTYPA a.s. Brno. Different designs of prototypes of vibration mini- and microgenerators were implemented in cooperation with 6RP EADS and a patent application for the solution of a vibration generator was registered. A prototype of a high-voltage pulse resistance voltage divider for measurement on the PGV-II was completed. In cooperation with VTUPV, a prototype of an unreflective chamber for filter diagnostics was implemented. A prototype of a special light source was carried out for basic research of Masaryk University, research into arctic flora.

A prototype for the recording of one-shot action on the induction principle and a prototype of the light pulse source  $T=100\text{ns}$ ,  $E=30\text{kLx}$  were completed. A prototype for the electromagnetic modification of holograms of the company Optaglio was also implemented. A unique calculation system for the design of temperature ratios in distribution boards for the company Moller was carried out. A prototype of multi-processor grid station WOOD with 16 processors was put into service. A unique method for numerical analysis of noise effects on the measuring voltage transformer TJP6 and the measuring current transformer TPU6 of ABB EJV s.r.o. was devised. In cooperation with VOP Štenberk, the department completed a study on filter modelling in EMC testing.

## 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 Methods for Study of Porous Material Structure – GAČR GA102/07/0389**

Investigator: Eva Gescheidtová

## Selected Publications

- BARTUŠEK, K.; DOKOUPIL, Z.; GESCHEIDTOVÁ, E. Mapping of magnetic field around small coils using the magnetic resonance method. *Measurement Science and Technology*, 2007, vol. 18, no. 6, pp. 2223-2230. ISSN: 0957-0233.
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- BĚHUNEK, I.; BACHOREC, T.; FIALA, P. Properties and Numerical Simulation of CaCl<sub>2</sub>.6H<sub>2</sub>O Phase Change. *Progress In Electromagnetics*, 2007, no. 1, pp. 550-554. ISSN: 1559-9450.
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- DREXLER, P.; FIALA, P. Methods for HP EM pulse measurement. *IEEE Sensors Journal*, 2007, vol. 7, no. 7, pp. 1006-1011. ISSN: 1530-437X.
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- FIALA, P.; JIRKŮ, T.; KUBÁSEK, R.; DREXLER, P.; KOŇAS, P. A Passive Optical Location with Limited Range. *Progress In Electromagnetics*, 2007, vol. 2007, no. 1., pp. 537-540. ISSN: 1559-9450.
- FIALA, P.; KROUTILOVÁ, E.; STEINBAUER, M.; HADINEC, M.; BARTUŠEK, K. Inversion reconstruction of signals measured by the NMR techniques. *Progress In Electromagnetics*, 2007, vol. 1, no. 1, pp. 363-366. ISSN: 1559-9450.
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- GESCHEIDTOVÁ, E.; BARTUŠEK, K. Measurement of Radio Frequency Magnetic Field. *PIERS ONLINE*, 2007, vol. 2, no. 6, pp. 555-558. ISSN: 1931-7360.
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- GESCHEIDTOVÁ, E.; KUBÁSEK, R.; SMĚKAL, Z.; BARTUŠEK, K. Equiripple Digital Filter in Quadrature Mirror Filter Banks for Nuclear Magnetic Tomography. *International Transaction on Computer Science and Engineering*, 2007, vol. 37, no. 1, pp. 141-151. ISSN: 1738-6438.
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ŠUPÁLKOVÁ, V.; PETREK, J.; BALOUN, J.; ADAM, V.; BARTUŠEK, K.; TRNKOVÁ, L.; BEKLOVÁ, M.; DIOPAN, V.; HAVEL, L.; KIZEK, R. Multi-instrumental Investigation of Affecting of Early Somatic Embryos of Spruce by Cadmium(II) and Lead(II) Ions. Sensors, 2007, vol. 7, no. 7, pp. 743-759. ISSN: 1424-8220.

## Bachelor's Programme

Electrical Engineering 1 (Jiří Sedláček)

Safe Electrical Engineering (Pavel Kaláb)

Electrical Engineering 2 (Jiří Sedláček)

Seminar of Electrical Engineering (Miloslav Steinbauer)

Measurement in Electroengineering (Karel Bartušek)

The C++ Programming Language (Pavel Fiala)

## Master's Programme

Electrical Installations (Pavel Kaláb)

Safe Electrical Engineering (Pavel Kaláb)

Electromagnetic Field Modeling (Jarmila Dědková)

## Doctoral Programme

Numerical Computations with Partial Differential Equations (Libor Dědek)

Special Measuring Methods (Karel Bartušek)

## Laboratories

**Laboratory for Measurements in Electrical Engineering A and B** (instruction in BMVA, Eva Gescheidtová)

**Laboratory of Electrical Engineering** (instruction in subjects BEL1, BEL2, Milan Murina)

**Laboratory of Electrical Engineering and Electrical Installations** (instruction in subjects BELS and MEIC, Miloslav Steinbauer)

**Laboratory of Prototype Development** (laboratory for student projects and prototype development, basic measuring devices, Miloslav Steinbauer)

**Computer Laboratory** (instruction in subjects BPC2, BSCP and BELS, Miloslav Steinbauer)

**Computer Laboratory for Electrical Engineering** (instruction in subjects BEL1 and BEL2, Miloslav Steinbauer)

**Research Laboratory of Electrical Circuits** (research laboratory of electrical engineering, prototype development, construction and measurement workplace, Jiří Sedláček)

**Research Laboratory of Electro-Optics** (laboratory of laser technology and optoelectronics, Eva Kroutilová)

**Research Laboratory of Magnetic Measurement** (research laboratory with special measuring devices for magnetic measurement, Jiří Rez)

**Research Laboratory for Modelling and Optimization in Electromechanical Systems** (basic and applied research of numerical methods, Pavel Fiala)

**Research Laboratory of Pulse Sources and Microwave Devices** (laboratory for research of high-frequency technology, electromagnetic shielded chamber (EMSK), air-conditioning, high-frequency measuring device, Pavel Fiala)

**Research Laboratory of Light Technology** (research laboratory of light technology, E. Kroutilová)

# Department of Power Electrical and Electronic Engineering

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## **Professors**

Prof. RNDr. Vladimír Aubrecht, CSc.  
Prof. Ing. Vítězslav Hájek, CSc.  
Prof. Ing. Karel Hruška, DrSc.  
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. Jaromír Vaněk, CSc., Ing. Jaromír Vrba, CSc.,  
Ing. Ondřej Vítek, Ph.D., Ing. Dalibor Červinka, Ph.D.

## **Postgraduate Students**

Ing. Mustafa Osman Elrayah Aboelh, Ing. Josef Běloušek, Ing. Jan Hejkrlík, Ing. Rostislav Huzlík, Ing. Marcel Janda, Ing. Petr Mazur, Ing. Aleš Mikulčík, Ing. Vladimír Minárik, Ing. Jan Němec, Ing. Jan Ondrák, Ing. Ivo Pazdera, Ing. Petr Procházka, Mohamed Abdusalalam Shaban, Ing. Miroslav Skalka, Ing. Jakub Žajdlík, Ing. Alice Špérová, Ing. Tomáš Cibulka

## **Administrative and Technical Staff**

Josef Daněk, Ing. Jiří Duroň, Ph.D., Ing. Zdeněk Feiler, Ph.D., Ing. Marcel Janda, Zdeněk Koráb, Zdeněk Liška, Ing. Petr Melichar, Ph.D., Alena Šmídková

## Main Interests

The department provides instruction in the study area Power Electrical and Electronic Engineering in Bachelor, Master and Doctoral degree programmes. Besides theoretical subjects, instruction is provided in basic disciplines such as theory and construction of electrical machines and devices, recently also CAS systems, including solution methods for electromagnetic and thermal fields and optimization methods for construction designs. Modern disciplines in the focus of attention are power electronics and its applications in electric drives and supply systems, management control theory and its application in the design of complicated dynamic systems and technological processes, automotive technology and electronics and automated measurement systems.

Research and development are centred on basic research on theoretical modelling of radiation energy transport in thermal plasma. Applied research and development are focused on low-voltage electric machines for automotive industry, optimization and identification of parameters of electric machines using artificial intelligence, development of special machines such as

startergenerators, controlled magnetic bearings, levitation systems, etc. In the field of electric devices, the use of the circuit energy itself is developed to create conditions for electric arc blowout in low and high-voltage devices. The department is also engaged in research on electric energy converters of extreme parameters, utilization of ultracapacitors in cooperation of electronic converters, batteries and electric machines especially in electric traction. Long-term research and innovation of sliding contacts, targeted at improvement of operating characteristics of electric machines, are conducted. The department cooperates with a number of technical universities, e.g. TU Gliwice, TU Delft, TU Košice, TU Žilina, MU Brno, TU Pskov, TU Omsk, Polytechnical University Saint-Petersburg and industrial companies and institutions, e.g. Siemens AG - Corporate Technology, JSC Electrocontact (Kineshma-RF), Siemens Elektromotory Drásov, Magnetron Kroměříž, OEZ Letohrad, APS Světlá nad Sázavou, ATAS Náchod, EMP Slavkov u Brna, JULI Motorenwerk Moravany u Brna, VUES Brno a.s. and others.

## Major Achievements

In cooperation with the Faculty of Mechanical Engineering, a glandless centrifugal pump was developed and implemented. It was granted the Utility Model Registration Certificate.

In cooperation with IVEP a.s. Brno, the project FI IM/158, which resulted in a prototype of high-voltage switch at 25kV and 400A with a gasmaking blowout system, was completed.

On the basis of present study results of innovations of sliding contacts, we managed, in cooperation with VUES Brno, CARBONE LORRAINE and DITTRICH companies, to prepare a complex innovation of the sliding contact for an asynchronous slip ring generator for airport operation.

In cooperation with the company Juli-Motorenwerk, a converter for a special two-phase switched reluctance motor with demagnetization winding was developed and implemented. The nominal current of the converter is 200A, the drive is supplied with a 24V battery. Control algorithms were implemented on the signal processor

Freescale MC56F8356. A converter for asynchronous motor was completed.

An exciter for two transistors IGBT 1700V/1000A was developed. It can be used for galvanic separation with great resistance to  $dU/dt$  – the use of optical fibres, separation of current supply with a very low mutual capacity. It has saturation and other protections. The output cascade with a current source is used.

An electric bicycle with an asynchronous motor was put into practice. The running distance after charging is circa 60km, the output 800W, the weight 32kg, with Li-ion accumulator. An intelligent fast battery charger, 700W and 1.5kg, on the basis of the switched power source was developed and implemented for accumulator charging.

A new research and instruction laboratory with hydrogenous fuel bundles Ballard 1200W was completed.

A test stand for the measurement of the process of switching and breaking actions of power tran-

sistors IGBT with parameters up to 1200V and 6000A was implemented.

A digital state regulator for a levitation electromagnet with the carrying capacity of 200kg was developed and implemented. In this way, the characteristics of positional regulation of the

electromagnet were improved significantly. The magnet is regulated at a distance of 5mm from a bearing rail.

The department organized the international conference 'XVIIth Symposium on Physics of Switching Arc'.

## Major Research Projects

### **Asynchronous Chain Saw Engines – MPO FI-IM2/094**

Investigator: Vítězslav Hájek

### **Automation of a Universal Lock for Ballistic Meters – FI-IM2/050**

Investigator: Čestmír Ondrůšek

### **Axial Starter with 2 kW Epicyclic Gear – MPO FI-IM3/202**

Investigator: Vítězslav Hájek

### **Wireless Sensing – 6th FP EU WISE (Wireless Sensing) AST-CT-2004-516470-WISE**

Investigator: Čestmír Ondrůšek

### **Alternator without Slip Rings for Agricultural and Special Machinery – MPO FI-IM/199**

Investigator: Vítězslav Hájek

### **Electric Engines with Electronic Control – MPO FI-IM3/023**

Investigator: Vítězslav Hájek

### **Assessment of Constructions Exposed to Extremely Rapid Loading – FT-TA3/073**

Investigator: Čestmír Ondrůšek

### **Low-Load Drive of Lift with Switched Reluctance Motor – MPO FI-IM3/153**

Investigator: Vítězslav Hájek

### **Optimization of Small Electrical Machines – GAČR GA102/06/1320**

Investigator: Vítězslav Hájek

### **Direct Drive for Material Handling Truck – MPO FT-TA3/120**

Investigator: Vítězslav Hájek

### **Control of Converters in Electric Drives for Ecological Transport Systems – GAČR 102/03/D222**

Investigator: Bohumil Klíma

### **Methods and Procedures for Assessment of the Piercing and Blasting Effect of Ammunition – FT-TA/029**

Investigator: Čestmír Ondrůšek

### **Synchronous Drives of Wiper Mechanisms – MPO FI-IM3/035**

Investigator: Vítězslav Hájek

### **Impact of External Fields on the Characteristics of Electric Arc – GAČR 102/04/2090**

Investigator: Zdeněk Vávra

### **Exploitation of Fuel Cells in Ecological Sources of Electrical Power and in Traction Drives – GAČR 102/06/1036**

Investigator: Miroslav Patočka

### **Research and Development of Generators over 800 mm – MPO FI-IM2/033**

Investigator: Čestmír Ondrůšek

## Selected Publications

BAUER, P.; DUDÁK, J.; MAGA, D.; HÁJEK, V. Distance Practical Educatin For Power Electronics. International Journal of Engineering Education, 2007, vol. 2007, no. 6, pp. 1210-1216. ISSN: 0949-149X.



KUCHYŇKOVÁ, H.; HÁJEK, V. Modern 3D Modelling, Visualization and Animation at Power Electrical Engineering Study Programme. EPQU - Electric Power Quality and Utilisation Magazine, 2007, vol. 2, no. 2, pp. 57-60.

VÍTEK, O.; HÁJEK, V. Detection of the dynamic rotor eccentricity based on the external magnetic field analysis. Prace Naukowe Politechniki Śląskiej. Elektryka, 2007, vol. 2007, no. 203, pp. 63-70. ISSN: 1897-8827.

## Bachelor's Programme

Automobile Electric and Electronic Systems (Vítězslav Hájek)

Computer Visualization and Animation (Hana Kuchyňková)

Computer aided Design (Hana Kuchyňková)

Computer methods in High Power Engineering (Radek Vlach)

Computer Science in High Power Engineering (Vladimír Aubrecht)

Control Electronics (Miroslav Patočka)

Control Theory (Jiří Skalický)

Design of Electrical Drives (Jiří Skalický)

Electrical Drives (Josef Koláčný)

Electrical Machines (Čestmír Ondrůšek)

Electrotechnical Inspection and Supervision (František Veselka)

Microprocessor Technics for Drives (Miroslav Patočka)

Power Electronics (Jaromír Vrba)

## Master's Programme

AC Drives (Jiří Skalický)

Adaptive and Optimal Control of Drives (Jiří Skalický)

Computer Modelling in Power Electrical Engineering (Hana Kuchyňková)

Connection and Protection of Indoor Installations. (Jaromír Vaněk)

Control Elements in Electrical Drives (Pavel Vorel)

Control Elements of Electrical Drives in Heavy Current Engineering (Zdeněk Feiler)

Control of Dynamic Systems (Petr Huták)

Design of Electrical Drives (Jiří Skalický)

Electrical Controlled Drives (Jiří Skalický)

Electrical Microdrives (Josef Koláčný)

Electric Equipments for Motor Vehicles (Vítězslav Hájek)

Electric Machines and Apparatus Design (Zdeněk Vávra)

Electromechanical System Dynamics (Čestmír Ondrůšek)

Electromechanical Systems (Čestmír Ondrůšek)

Electrotechnical Inspection and Supervision (František Veselka)

Industrial Electronics (Pavel Vorel)

International Cooperation of Quality Assurance (Karel Hruška)

Laboratory of Electrical Machines and Apparatuses (František Veselka)

Laboratory of Electric Drives (Josef Koláčný)

Microcomputer Control of Electrical Drives (Miroslav Patočka)

Microcomputer Control of Electrical Drives (Jiří Skalický)

Micromachines (Vítězslav Hájek)

Nondestructive Testing and Monitoring (Karel Hruška)

Plasma Physics and Diagnostics (Vladimír Aubrecht)

Power Converter Design (Miroslav Patočka)

Power Converter Technique (Miroslav Patočka)

Principles of Power Electronics (Miroslav Patočka)

Project Management of Innovation (Bohuslav Bušov)

Protection in Heavy Current Engineer (Jaromír Vaněk)

Quality Assurance and Metrology (Karel Hruška)

Special Technology (František Veselka)

Technical Requirements on Production  
Evaluation (Karel Hruška)

TIPS-Theory of Inventive Problem Solving  
(Bohuslav Bušov)

## Doctoral Programme

Selected Problems from Power Electronics and  
Electrical Drives (Jiří Skalický)

Topical Issues of Electrical Machines and  
Apparatus (Čestmír Ondrůšek)

## Laboratories

**Laboratory of Automotive Electrical Machines** (research of alternators, starters and low-voltage engines, Vítězslav Hájek)

**Laboratory of Electric Arc** (non-electric characteristics measurement, optical diagnostics of switching arc in low-voltage and high-voltage switches, Zdeněk Vávra)

**Laboratory of Electrical Drives** (research of non-linear dynamic systems with changed parameters, Josef Koláčný)

**Laboratory of Electrical Apparatus** (research of switching device, Jaromír Vaněk)

**Laboratory of Electrical Machines** (research of commutation of electrical machines, measurement of medium-power outputs, magnetic bearings, automated measurements, Čestmír Ondrůšek)

**Laboratory of Holometric Interferometry** (optical stand for holographic interferometry for e.g. diagnostics of torque vibrations, Vladimír Aubrecht)

**Laboratory of Small Electrical Machines** (measurement of DC motors and high-revolution commutator universal motors, Josef Lapčík)

**Laboratory of Mechatronics** (Čestmír Ondrůšek)

**Laboratory of Microprocessor Technology** (control of converters for ecological transport systems by digital signal processors, Bohumil Klíma)

**Laboratory of Power Engineering Electronics** (research of DC/DC transformers, alternators and low-voltage brushless drives, Pavel Vorel)

**Laboratory of Special Diagnostics and Recording of Fast Processes** (digital high-speed camera scanning of fast processes and and equidensitometric evaluation of images, Vladimír Aubrecht)

**Laboratory of Power Electronics** (research of pulse converters, Miroslav Patočka)

**High-Voltage Laboratory** (research of high-voltage switching phenomena, Zdeněk Vávra)