

# ANNUAL REPORT 2004

**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 this 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.

## The Faculty in 2004

In 2004 the Rector of Brno University of Technology was Prof. Jan Vrbka. The Vice-Rector for External Relations was Jiří Kazelle, Professor at the Department of Electrotechnology and one of the leading personalities of the Faculty.

In 2004, Prof. Radimír Vrba was in the office as elected Dean of the Faculty of Electrical Engineering and Communication, together with four vice-deans. At the end of 2004, there were 169 teachers and 3,763 students in all forms of state-supported study programmes. Moreover, education was provided to 229 students of the Faculty of Information Technology and 15 students of the

Electrotechnical disciplines were first taught at the university in 1905. Since 1959 when an independent 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 seven then existing 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 foundation of a new 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 foundation 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 of Mechanical Engineering. On the other hand, tuition was purchased from the Faculty of Business and Management for 44 students and from the Faculty of Information Technology for 12 students. As a result, education activities of FEEC can be quantified by the total number of 3,951 students. Education was provided in the ending study programmes Electrical Engineering and Computer Science (EI) on one hand, and in the newly composed structured programmes Electrical Engineering, Electronics, Communication and Control Technology (EECR) accredited in 2001 in accordance with the Bologna Declaration. 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 ensured. Among the FEEC graduates in 2004 there were 12 students who completed their studies in the parallel Bachelor's degree programme, 328 Master's degree graduates, and 29 postgraduates completed their doctoral stud-

ies. There were 1,635 new students who started their studies at the Faculty, and 87 graduates entered the doctoral degree programme. Tuition in English was provided to 36 foreign students paying their fees. Eight academics (two women and six men) were habilitated and appointed associate professors with the title Docent. Three academics were appointed to professorship.

## Events and Activities

- meeting of the former deans of FEEC and the Rector of the Brno University of Technology on the occasion of the 99th birthday of Prof. Jiří Brauner, one of the first deans of the Faculty of Electrical Engineering of the Brno University of Technology
- traditional faculty ball for the first time held at the Voroněž hotel
- meeting of the leaderships of the Czech and Slovak faculties of electrical engineering and associated faculties in Tatranská Lomnica
- commencement of the third academic year of the Bachelor's degree programme EECR as an implementation of the long-term plan of the dynamic development of the Brno University of Technology
- commencement of preparations for the first year of the Master's degree programme EECR in the academic year 2005/06
- start of revising and innovating documents for the Master's degree programme EECR for submission of an application for prolonged accreditation to the Ministry of Education
- participation in GAUDEAMUS 2004 and presentation of the new study programmes offered at FEEC
- activities of Assoc. Prof. Pavel Jura, Vice-Dean for the Master's degree programme, focused on the development of the combined and distance formats of study in the new structured study programme supported by the Development and Transformation Project of the Ministry of Education
- creation of 18 electronic texts of the total extent of 1,703 pages, modification and extension of the 37 already existing texts of the total extent of 1,560 pages, extension of tasks for virtual laboratories in 10 subjects, and creation of 32 new tasks
- activities of Assoc. Prof. Jarmila Dědková, Vice-Dean for the Bachelor's degree programme, focused on widening the range of Bachelor's study programmes and on increasing the standards of study in the new structured programmes EECR
- preparatory courses for secondary-school students interested in study at FEEC in order to help them prepare for entrance examinations in mathematics (110 applicants) and physics (39 applicants) organized by the Departments of Mathematics and Physics.
- Organizing Open Door Days (15 January and 29 January 2004), visits of students and teachers to secondary schools, participation of the faculty in the 11th higher education fair GAUDEAMUS from 19 to 22 October 2004 to promote FEEC and arise interest of secondary-school students in studies at the faculty
- activities of Prof. Zbyněk Raida, Vice-Dean for Research focused on lifelong education, mainly in procedures leading to granting the title of docent or professor
- STUDENT EEICT 2003 Conference and Competition organized in cooperation with the Faculty of Information Technology, with one Bachelor's paper, 87 participants in the Master's section, and 141 participants in the Doctoral section

- acquisition of significant financial support from the firm HONEYWELL for research targeted at the area of the firm's professional interest and for purchasing mechatronic laboratory equipment
- activities of Assoc. Prof. Ivo Provazník, Vice-Dean for External Relations, and Prof. František Zezulka, focused on participation in the ERASMUS-SOCRATES programme as well in other European programmes,
- meetings with the representatives of the firm HONEYWELL and with managers of leading technical schools with the aim to match the supply and demand for students and graduates in particular study areas and specializations
- activities of the faculty secretary Miloslav Morda mainly concerned with the completion of the reconstruction of integrated premises in the campus Pod Palackého vrchem, which will accommodate the Department of Biomedical Engineering, the Department of Electrotechnology and the Department of Control and Instrumentation
- opening of the reconstructed integrated premises at the presence of the Minister of Transport and Communications and representatives of the Ministry of Education
- negotiations of the Dean Prof. Radimír Vrba and the faculty secretary Miloslav Morda with the management of the Brno University of Technology leading to acceptance of the construction plan to the investment plan of the University - Construction of new FEEC premises Technická 10 in the campus Pod Palackého vrchem (completion in 2007)
- obtaining of three new research plans of FEEC for the period 2005-2009 (2011) with the main investigators Jiří Kazelle, Jiří Svačina and Radimír Vrba
- activities of the Chairman of the Academic Senate of FEEC Vlasta Krupková in her capacity as a member of the Higher Education Council
- activities of the members of the Academic Senate, mainly the Chairman Vlasta Krupková focused on the organizational and economic aspects of the development of FEEC
- activities of the 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
- activities of Prof. Jiří Skalický and namely Prof. Jaromír Brzobohatý and Jarmila Jurášová concerned with the 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

## Achievements

In 2004 the economic results of FEEC were very good despite the fact that the faculty obtained less funding for the development programmes than in the previous year. The trend in wages and material supply was again favourable, to a great extent due to involvement in research projects of the Grant Agency of the Czech Republic, the Higher Education Development Fund and mainly owing to the efforts of all those who under the leadership of the main investigators participated

in three faculty and one inter-faculty research plans and the Research Centre.

In 2004 the number of students increased by over 600, and thus the Faculty contributed to the declared dynamic development of the Brno University of Technology confirmed by the long-term plan. 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**

Doc. Ing. Pavel Jura, CSc.

Acting Dean, Vice-Dean for Master's Degree Programme

Doc. Ing. Jarmila Dědková, CSc.

Vice-Dean for Bachelor's Degree Programme

Prof. Dr. Ing. Zbyněk Raida

Vice-Dean for Research and Doctoral Degree Programme

Doc. 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**

Jan Mertl

## **Advisor for Equal Opportunities**

RNDr. Naděžda Uhdeová

## **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. Ing. Libor Dědek, CSc.  
Doc. Ing. Jarmila Dědková, CSc.  
Doc. Ing. Evžen Haluzík, CSc.  
Prof. Ing. Tomáš Hruška, CSc.  
Prof. RNDr. Jan Chvalina, DrSc.  
Prof. Ing. Jiří Jan, CSc.  
Doc. Ing. Pavel Jura, CSc.  
Prof. Ing. Jiří Kazelle, CSc.  
Doc. RNDr. Milena Kheilová, CSc.  
Prof. Ing. Vladislav Musil, CSc.  
Doc. Ing. Čestmír Ondrůšek, CSc.

Doc. Ing. Ivo Provazník, Ph.D.  
Prof. Dr. Ing. Zbyněk Raida  
Doc. Ing. Karel Rais, CSc., MBA  
Prof. Ing. Václav Řičný, CSc.  
Prof. Ing. Jiří Skalický, CSc.  
Prof. Ing. Zdeněk Smékal, CSc.  
Prof. Ing. Jiří Svačina, CSc.  
Prof. Ing. Petr Vavříin, DrSc.  
Prof. Ing. Kamil Vrba, CSc.  
Prof. Ing. Radimír Vrba, CSc.

### External Members

Ing. Milan Findura, Ph.D.  
RNDr. Luděk Frank, DrSc.  
Ing. Aleš John  
Prof. Ing. Vladimír Kučera, DrSc.  
Doc. Ing. Aleš Richter, CSc.  
Ing. Ivan Skalka

Prof. Ing. Zbyněk Škvor, CSc.  
Doc. RNDr. Vítězslav Veselý, CSc.  
Ing. Robert Vích, DrSc.  
Ing. Rostislav Vinkler  
Ing. Jiří Winkler, CSc.

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# Study Programmes

## Bachelor's and Master's Degree Programme Electrical Engineering and Computer Science

In 2004, 266 students graduated from the first-level study of the ending programme Electrical Engineering and Computer Science (EI). Out of these students 213 continue their studies in the Master's programme, 50 students applied for transfer to the three-and-a-half-year Bachelor's degree programme EI, other students finished their studies.

Ending in 2004 was the full-time five-year Master's degree programme EI, the follow-up three-year Master's programme EI and the three-and-a-half-year Bachelor's degree programme EI. In these three study programmes 340 students graduated at FEEC in study areas Electrotechnical Manufacturing and Management (EVM), Cybernetics, Automation and Measurement (KAM), Electronics and Communications (EST) and Power Electrical and Electronic Engineering (SEE).

In the three-year follow-up Master's degree programme EI there were 24 graduates in 2004, 5 in EST, 1 in KAM, 3 in SEE and 15 in EVM.

Statistics of the numbers of graduates in individual Master's specializations are shown in Table 1.

In the three-and-a-half-year Bachelor's degree programme EI there were 12 graduates, 2 in EST, 2 in KAM, 4 in SEE and 4 in EVM.

In the study programme for students paying their fees there were 36 students from abroad, 24 of them in the ending five-year study programme EI (5 in SEE, 6 in EVM and 13 in EST) and 12 students in the new three-year Bachelor's degree programme EECR (specialization TLI).

Following the 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. Having completed these courses and earned the prescribed number of credits, the students can start full-time study at FEEC without being required to pass the entrance examination, and the earned credits will be recognized. In 2004, there were 18 students in the lifelong education programme.

The teachers of FEEC participated in tuition organized by the University of the Third Age, which has entered its fourth year at the Brno University of Technology.

Table 1: Graduates in the study programme Electrical Engineering and Computer Science

<b><i>Master Study Areas</i></b>	<b><i>2001</i></b>	<b><i>2002</i></b>	<b><i>2003</i></b>	<b><i>2004</i></b>
<b><i>EVM</i></b>	37	53	37	71
<b><i>KAM</i></b>	64	61	68	67
<b><i>EST</i></b>	108	105	130	132
<b><i>SEE</i></b>	48	72	59	58
<b><i>Total</i></b>	257	291	294	328

A priority in 2004 was the preparation and launch of the Bachelor's part-time study programme EECR. Within the framework of preparation for

this programme work continued on electronic lecture notes and other electronic study texts and exercises for this programme. There are 160

subjects in this Bachelor's degree programme, out of which 144 are taught by teachers from FEEC and 16 subjects are provided by other faculties and centres of the Brno University of Technology (FIT, Centre of Education and Counselling, Centre of Sports Activities, etc.) In 2004 new 18 texts containing 1,703 pages were written. The existing 37 electronic texts containing 1,560 pages were modified and supplemented to be ready for use in part-time and distance study programmes. Work continued on virtual laboratories to be used as a support for real laboratory

exercises. Thirty-two new tasks were created and 17 tasks were modified.

The regular assessment of the quality of teaching by students took place in 2004, and the results were published on the websites of the Student Chamber of Academic Senate.

Transition from the formerly used administration system STUDENT to the new information system continued. In 2004 enrolment in courses and classes (the students prepared their own timetables) and recording of examination results were done in the new system.

### **Bachelor's degree programme Electrical, Electronic, Communication and Control Technology**

In 2004 there were 451 students in the third year of the new Bachelor's degree programme Electrical, Electronic, Communication and Control Technology (EECR). The degree programme was implemented in five study areas: Automation Technology (B-AMT), Electronics and Communications (B-EST), Microelectronics (B-MET), Power Electrical and Electronic Engineering (B-SEE) and Teleinformatics (B-TLI). There were 63 students in the study area B-AMT, 156 in B-EST, 39 in B-MET, 44 in B-SEE, and 149 in B-TLI.

A two-year follow-up Master's degree programme Electrical, Electronic, Communication and Control Technology will be launched in the academic year 2005/06.

Considering the growing interest in the part-time format of the Bachelor's degree programme EECR, this form of study was offered in the academic year 2004/05.

The admission procedure is a priority of the Faculty. It took place on 7 and 8 June 2004. Applications for both full-time and part-time formats of study were accepted. As in the previous year, applicants were required to do tests only in an optional combination of mathematics and physics or of mathematics and fundamentals of informatics. Exempt from the entrance examination were applicants who had passed the school-leaving examination in physics or mathematics with grade 1 or 2, and achieved the highest average grade 2.0. The maximum possible number of points to be attained in each subject was 50. Those who had attained at least 12 points in each subject were admitted. Also admitted at FEEC were applicants who had passed the entrance examination, and those who were exempt from

the examination. 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 494 points out of the required 1000 points.

In 2004 there were 2,170 applicants for study at FEEC, 1474 were admitted in full-time study and 161 in part-time study. Finally, 1,148 students enrolled in full-time study and 153 students in part-time study. These numbers confirm the rather high interest in part-time study format.

Admission statistics have been done for many years. Chart 1 shows the numbers of applicants, admitted and enrolled students since 1992. It is apparent from the chart that owing to newly offered part-time study the number of admitted students is higher than in the previous year.

The preliminary interest of applicants in individual areas was recorded at enrolment, and then at the end of the first semester after presentations of study areas. Statistics from academic years 2002/03 and 2003/04 are in Table 2.

The quality of incoming students has been monitored for several years. A long-term factor is the percentage of applicants who have taken the school-leaving examination in mathematics or physics, see Graph 2. Contrary to the previous academic year, the number of applicants who had taken the school-leaving examination in both mathematics and physics has substantially increased. This increase is probably due to the newly introduced condition for exemption from entrance examination.

Another indicator is the percentage of applicants coming from certain types of secondary schools –

gymnasium-type secondary schools (G), technical secondary schools (SPŠ) and technical training centres with school-leaving examination (SOU), see Graph 3.

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. The course in mathematics was attended by 110 and the course in physics by 39 applicants.

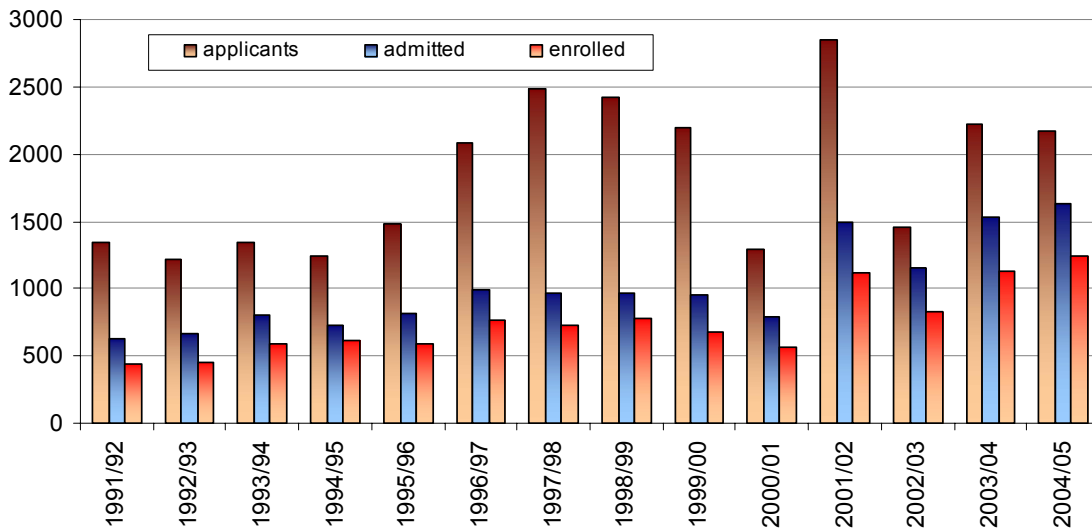
Other activities were focused on promoting the study programmes offered at FEEC and on in-

creasing 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 11th GAUDEAMUS fair.

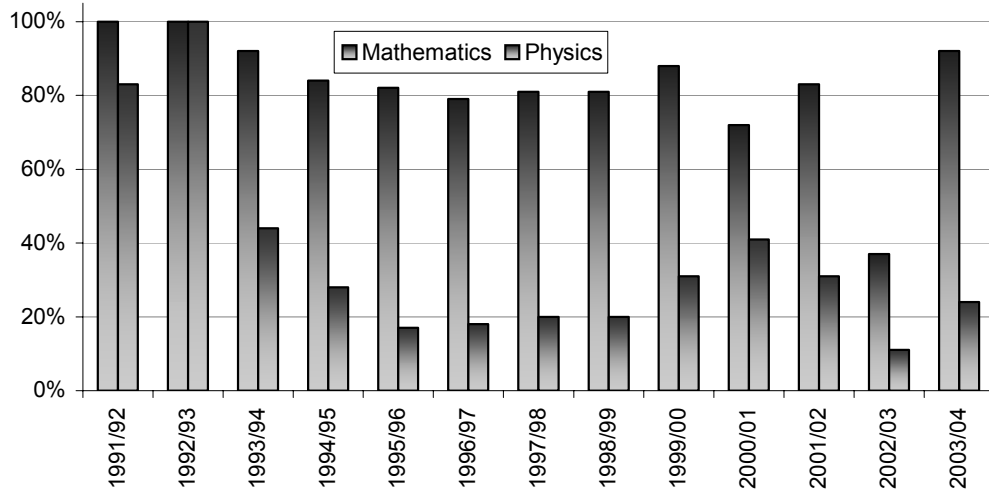
Study administration became part of the FEEC information system (electronic registration and enrolment in courses, electronic recording of study results, study reports, recording of interest in study areas), which simplified administration increasing with the growing numbers of students, and made relevant information accessible to students.

Table 2: Interest in study areas

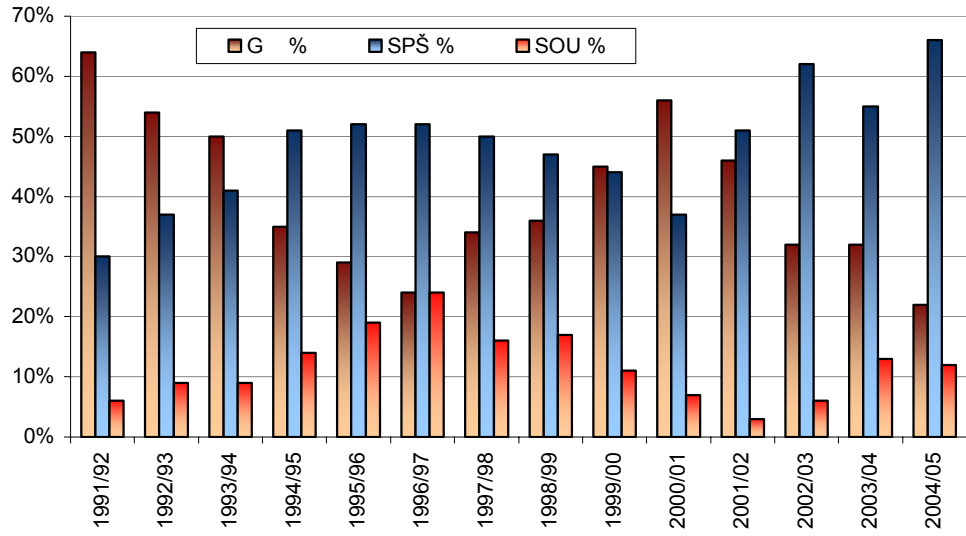
<i>Academic year</i>		<i>B-AMT</i>	<i>B-EST</i>	<i>B-MET</i>	<i>B-SEE</i>	<i>B-TLI</i>	<i>not given</i>	<i>Total</i>
<b>2002/03</b>	enrolment	91	332	43	49	331	0	846
	meeting	76	250	38	51	295	76	786
<b>2003/04</b>	enrolment	134	428	68	92	371	39	1132
	meeting	120	248	73	77	329	130	977
<b>2004/05</b>	enrolment	165	431	76	121	397	58	1248
	meeting	155	243	77	96	362	119	1052



Graph 1: Applicants, admitted and enrolled students in the years 1992-2005 (before 2001 at the former FE or FEI before the founding of FIT)



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





# Research and Postgraduate Study

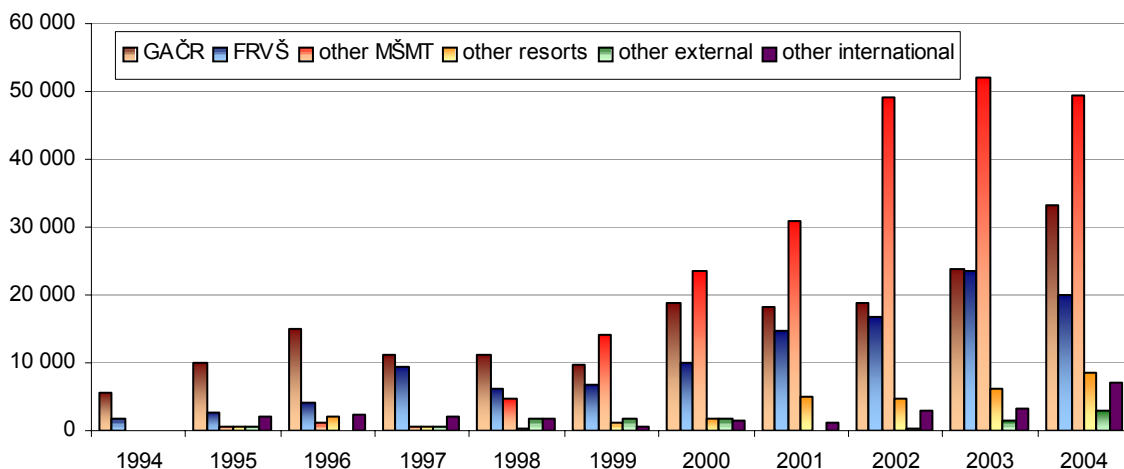
## Research

Growth in research activities was observed in 2004, both in terms of funding and quality of research results.

As compared with the previous year, the funding obtained for research (graph 4) increased by approximately 10%. The total amount was mainly obtained from research plans (23%), grants from the Grant Agency of Czech Republic (GACR, 27%), and projects of the Higher Education Development Fund (FRVS, 16%). There were 4 research plans (and FEEC participated in another

one), 52 GACR projects (including participations in projects of other universities), 82 FRVS projects and 10 projects of the Grant Agency of the Czech Academy of Sciences. Work was going on in a research centre, and FEEC teams worked on 16 projects of the Ministry of Industry and Trade and 7 projects supported from sources abroad.

Results of original research and professional work at FEEC were published in one international and one national monograph and in 32 articles in impact journals.



Graph 4: Research funds at FEEC (until 2001 FEI) in thousands of CZK in the period 1994 -2004

## Research Plans, Research Centre

In 2004 research conducted within the framework of research plans and the research centre was completed. Brief evaluation of research results is given below.

### Microelectronic Systems and Technologies

(investigator: Radimír Vrba)

Involved in research carried out in the years 2002-2004 were members of the academic staff and postgraduate students from the departments of Microelectronics, Radioelectronics, Control and

Instrumentation, Telecommunications, Physics, Mathematics, Theoretical and Experimental Electrical Engineering, Electrotechnology and Languages. Also taking part in the research plan were researchers from the Faculty of Civil Engineering and the Faculty of Information Technology. Each year of the research plan duration on

average 15 professors, 17 associate professors, over 30 lecturers and senior lecturers, a technical staff of 18 and around 56 full-time doctoral students participated in the research plan.

The research plan covered 8 professional fields in which the following results have been achieved (we give only a brief account of the main areas of interest):

#### *1. Design of integrated circuits*

Design of new topology of current conveyor current feedback. Design of a universal current conveyor UCC (for integration into large VLSI systems). Implementation of subsystems (RAM, special counters) using PLD and FPGA. Design of circuits for support of sensors (e.g. the special generator of triangular voltage form, precise controller of rotations and in an interface for capacity measurement working on the principle of switching capacitors). Design of an innovated type of sigma-delta converter implemented by means of FPGA. Design of a memory cell working on the principle of switching currents, for AD converters. Design and simulation of new working blocks operating in current mode. Design of a new method of correction of errors originating in IO operating with the switching capacitors technology. New low-voltage AD converter with switching capacitors technology, integrated structures CS-BA, CDBA, UCDBA on transistors. Design and implementation of wireless communication between a temperature sensor and control unit.

#### *2. Diagnostics and testing of IO systems*

Testing of CMOS circuits with low supply voltage and microstructures. Implementation of sample microsystems focused on high reliability and time stability of parameters. Testing methods and methods of measuring complete microsystems. Tolerance analysis of circuit and processing of current, voltage and optical responses. Diagnostics of the device for implementation of microstructures. Methodology of testing microstructures during implementation. Analysis and definition of marginal conditions of and internal diagnosing system.

#### *3. Modelling and simulation of integrated circuits and semiconductor structures*

Original numerical models of wire and planar aerials on dielectric substrates, hybrid models of microwave wiring, wide-band structures, and formulation of the parameters of wiring and aerials for time domain. Analytical models of two types of width-limited microband structures with

rectangular or trapezoidal dielectric substrate. A model of wide-band microwave hexagon, and calibration methods. Extraction of the parameters of the transistor model MOSFET in the HSPICE simulator. Simulation of nanoelectric structures (potential barriers and holes, transistors MOSFET and BJT) with a low THz signal in the THz band. Design and development of new analytical algorithms for analysis and synthesis of biplanar microwave structures.

#### *4. Mounting technology for modern concepts of electronic systems*

Research of the technological process for lead-free soldering: development of the new SBSA method for testing of soaking, design and verification of a new 3D construction utilizing the linking of ceramic substrate and FR4. Application of ANSYS for modelling MCM and MSM: optimization of the link between ceramics and FR4. Sensors: design of a new amperometric sensors, construction of a new rotating vessel for electrochemical analysis, development of thick-film materials with defined sensitivity to gases ( $\text{SnO}_2$  and  $\text{WO}_3$ ).

#### *5. Microsystems*

Modelling, implementation and testing of parameters of sensors developed using planar thick-film technology. Long-term testing of the parameters of new sensors of gases (testing on 6 technical gases). The first SMART sensor of thermal conductivity. New acoustic converters for holographic testing. Development and implementation of the world first single sensor of pressure equipped with Internet interface. Development and implementation of the world first single sensor with wireless interface based on the Bluetooth technology.

#### *6. Modern circuit principles for design of integrated circuits*

Development of several new circuit blocks based on new circuit principles: differential current transconductance amplifier. Optimized state models of chaotic systems. Universal multifunctional active filters. New generation of universal voltage circuits. CAD circuits with distributed parameters. New approaches to analysis and processing of audio and video signals: algorithms, compression by 3D discreet cosine transformation, data protection and water-marking, galvanically separated signal transmission. Application of a new circuit block CDTA in tunable filters in current mode. Application of the theory of

circuit transformation of new PWL VCVS higher-order blocks for chaos modelling. New multi-gate blocks in current mode (conveyors, inverters, converters) and their application in filters and oscillators. Testing of the until now developed and produced blocks. New methods of integrated circuits simulation. Automatic generation of macromodels. New applications of signal processors.

#### *7. Diagnosing of materials and components*

Application of noise spectroscopy for quality assessment of the technology of preparation of CdTe crystals and submicron MOS structures. The main source of fluctuations in low-frequency domain: 1/f noise (in submicron structures RTS noise generated on the interface between silicon and oxide). Oxidization by means of plasma: a reduced number of traps on the interface as compared with thermal oxidization. Application of Kolgomorov equations for the theoretical description of RTS noise. Diagnosing of defects by means of RTS noise and quantum transitions. Analysis of the three-state process, temperature and current characteristics: seeking parameters of traps by interpretation of results. Study of minority carriers diagnostics in semiconductors by optical superresolution and optoelectronic characteristics of zinc sulphide (basic material for electroluminescence lamps). Study of the Taylor series characteristics, possible improvements efficient applications.

#### *8. Optoelectronic systems*

Construction of an absolute laser interferometer with the laser source VCSEL, basic stability measurement, wavelength resolution and tunability. Development of a modular atmospheric optical transmitter with transmission velocity of 155 Mb/s. construction of a workplace for research of the photonic structure of the atmospheric optical transmitter in 1550 nm band. Development of a telecentric imaging system with digital calibration algorithms. Creation of an optical system for comparison measurement with the He-He interferometer focused on resolution and stability of the absolute interferometer. Development of an atmospheric transmitter operating with transmission velocity of 622 Mb/s. A new method of shaping a beam for optical cableless connections. Development of an automatic system for measurement and processing of data for telecentric imaging system.

#### *Summary*

The research results were published in more than 20 scientific monographs, in nearly 110 articles in international scientific and professional journals, in more than 620 papers presented at international conferences, seminars, workshops, and in over 340 national publications and at national conferences. The publications resulting from the research plan were cited in nearly 30 national and international books, journals, proceedings from conferences, research reports and lecture notes. The team received over 30 proven reactions, out of which 20 were from abroad. In connection with their research work within the framework of the research plan the members of the team are involved in 2 or 3 international research projects, 23-28 GACR projects, 6-8 projects of the Ministry of Industry and Trade with duration of several years, and during the three years of the research plan duration participated in 141 FRVS projects and in 10 one-year research and development projects for other organizations.

During the three years of the research plan institutional support amounted to 31.94 million CZK, out of which 6.27 million CZK in investment funds and 25.67 million CZK in non-investment money.

#### **Electronic Communication Systems and Technologies**

(investigator: Jiří Svačina)

The research plan was carried out in the period 1999-2004. The research team included academic staff and postgraduate students from the Departments of Radioelectronics, Telecommunications, Biomedical Engineering, Microelectronics and Theoretical and Experimental Electrical Engineering. Each year of the project duration there were on average 12 professors, 18 associate professors, over 25 lecturers and senior lecturers, a technical staff of 15 and about 100 students in full-time doctoral programmes.

The research plan covered five research areas, in which the following results were achieved (a brief listing of the main topics is given):

##### *1. Modern electronic circuits for communication systems*

Development of universal multi-operational active filters and oscillators with up-to-date multi-gate operational blocks. The new circuit element CDTA (Current Differencing Transconductance Amplifier). Research of symbolic approximation of large circuits based on block disintegration. Im-

plementation of dynamic systems with PWL controlled sources. Development of the generator of long pseudo-chaotic sequences and a special device for 'bit error rate' (BER) measurement of digital signals. Implementation into PLD and FPGA parts. Research and development of a common current conveyor and its new applications. Design of another filtering circuits in current, voltage and integrated mode with universal current conveyor. Research of numerical methods for simulation of hybrid non-linear circuits in Matlab. New applications of modern multi-gate operational blocks in current mode including the CDTA element. Minimization of parasitic effects in active high-frequency filters. New chaotic systems with PWL controlled sources. Piecewise quantification of linear and non-linear maps for studies of statistic chaos characteristics.

## *2. Digital methods of signal and image analysis and processing*

Research and development of new methods for processing and recording of medical ultrasound and ophthalmologic images. Setting-up of the laboratory of digital videotechnology and television technology. Development of new SW for simulation and testing of image signal transmission channels. Research and development of an identifier of language from spoken speech, research into speech recognition and registration of images. Study, development and testing of advanced methods of processing and recognition of signals and 2D and 3D images, including deconvolution, multiresolution analysis and optimal detectors. Research of new methodical approaches and algorithms for analysis, classification and reconstruction of speech and some medical signals and images. Development of a spoken speech classifier working in noise environment, methods for suppression of speckles in ultrasound images, algorithms for processing electrocardiogram images based on wavelet transformation, and for analysis of movements of objects by means of optical flow methods.

In this area of interest, research has been conducted since 2000 in the Laboratory of Digital Signal Processing opened in 1999 with support of the Ministry of Education project VS 97060. Research was focused on digital processing of speech signals including identification of speakers, and on up-to-date methods of processing communication signals in radioengineering.

## *3. Technology of multimedia signal processing*

Research of adaptive algorithms and verification of their possibilities in noise suppression in speech signals. Development of new methods of extending the spectrum of musical signals by means of newly designed algorithms using non-linear models. Research of the methods of detecting the direction of acoustic waves propagation and implementation of algorithms for identification of the direction of coming acoustic signals in space. New methods of recognition of images of human face for identification purposes. New methods of image pre-processing and methods of subpixel image analysis on DSP. Employment of digital signal processing methods for transmission channel equalization. Analysis of new signal processors with VLIW architecture, design and optimization of algorithms. An optimized computer model of the ADSL line with DMT modulations for simulation of NEXT and FEXT crosstalks.

## *4. Communication networks for integrated services*

Utilization of peer-to-peer technology in modern communication networks, analysis of the possibilities of backed-up communication of videoconferencing systems H.323 based on codec's with adaptable control. Research and development of new anti-error code systems by means of programmable logic fields. Development of the data transfer method in power non-compensated networks along power lines, successful development of a transmission system operating at 600 b/s at a distance of 800 m for driving vehicles. New approaches to adaptable control of codecs and their implementation for the purposes of multimedia communication. Design of new models for QoS evaluation for new communication sources in IP networks. Methods of increasing the quality of transmission velocities and increasing transmission velocity and reliability of wireless and optical transmission media, focus on extension of the range, capacity, noise resistance. Application to VDSL technology. Development of a neural network for control of switching processes in active network element. Development of a multimedia multi-point communication system supporting the distribution of text audio and video messages.

### *5. High-frequency, microwave and optical structures of communication systems*

Cooperation with the international organization AMSAT: building of the automatic ground station, telemetry reception and commanding the Phase 3D satellite, preparation of the Phase 3D and Phase 5A projects. Development of a two-band receiver for the P3E satellite with three command modules. Development of a current controller for semiconductor laser with protection against EM interferences. Development of a photon counter with avalanche photodiode for detection of optical signals from satellite. Development of single-photon optical receiver for signal transmission with the coding technique of 'quantum states distribution'. Research of optical waves coherence with multichannel and multibeam propagation. Development of new neural models for wide-band modelling of planar aerials based on Elman network. Development of an original method of Em structures analysis in time domain (FDTD with wavelet transformation, combination of envelope elements and complex flashovers). Analytical modelling of special high-frequency planar transmission structures. A numerical model of scanning a near field of aerials on flat planar surface. Development of a wide-band microwave hexagon for precise measurements. The methodology of measuring interference radiation in the presence of strong external interferences, and a methodology of measuring the efficiency of shielding tiny metal boxes. Measurements of the characteristics of aerials in the near field in impulse excitation.

#### *Summary*

The results achieved during the past six years of the project duration were published in more than 50 scientific books, 200 articles in international scientific and professional journals, 1,340 papers presented at international conferences, seminars, workshops, and more than 700 national publications. Sixty engineering works were completed, and over 40 members of the team habilitated or defended their doctoral thesis. The publications resulting from the research plan were cited in more than 75 international and 80 national books, journals, conference proceedings, research reports or lecture notes. The team received over 90 proven reactions, out of this number more than 70 came from abroad.

With reference to their work on the research plan the members of the team participated as investigators or co-investigators in more than 30 inter-

national research and development projects, more than 50 GACR research projects, more than 230 FRVS projects, 15 projects of the Ministry of Industry and Trade and nearly 40 research and development projects for other organizations.

Institutional funding allocated to the research plan during the six years of its duration amounted to 42.907 million CZK – 7.378 million CZK in investment resources and 35.529 million CZK in non-investment funds.

### **Resources, Accumulation and Optimization of Electric Power Exploitation in Environmental Applications**

(investigator: Jiří Kazelle)

Involved in the research plan in the period 1999 to 2004 were academic staff and postgraduate students of the Departments of Electrotechnology, Power Electrical and Electronic Engineering, Power Electrical Engineering and Microelectronics. Each year of the project duration on average 5 professors, 13 associate professors, more than 21 lecturers and senior lecturers, technical staff of 14 and around 35 students in full-time doctoral programmes. The following results were achieved (only the major areas are mentioned):

#### *1. Renewable sources (photovoltaic cells, fuel cells, wind-power power stations, small hydroelectric stations)*

Development of renewable electrical energy and heat sources). Analysis of the impact of operating conditions on the degree of exploitation of photovoltaic transducers with focus on the efficiency and importance of operative adaptability to their loading, operating temperature and illumination intensity. Work on the design and implementation of an operational model of hydro-accumulation heat reservoir with suppressed convection, and its incorporation in the system of effective exploitation of a solar heat source utilizing the reversible Stirling thermodynamic cycle in thermal pump mode.

#### *2. Optimization of electric energy processing (power supply semiconductor converters including control for an optimal connection of sources to an autonomous electric network and autonomous electric drives)*

Seeking ways to faster charging of accumulators and extension of their service life (in addition to the economic impact, the significant impact on the development of independent electric traction and therefore ecological impact should be em-

phasized). Proving the positive effect of fast-charging of Ni-Cd batteries during long-term operating tests of electric vehicles. Verification of the properties of prospective types of accumulators namely in ultrafast charging modes and in their discharging in electromobiles and other electric vehicles. Increased exploitation of electric energy in charging electric vehicles from small hydroelectric power stations in place of installation. Launching of production of the folding electric scooter ROTOBIC and production of single-track and three-track construction version of the folding electric scooter.

### *3. Accumulation of electric energy (accumulators, fuel cells, etc.)*

Study and enhancement of the properties of electrochemical sources of electrical energy, extension of their service life and development of new technologies and systems (significant economic impact). Notable results in research and development of gel electrolytes (on world scale): new frost-resistant gel electrolytes for application in electrochemical components including supercapacitors, verification of application also in electrochromic components. Fuel cells: development of new principles of preparation of electrode mass for oxygen-hydrogen fuel cells, substitution of costly fluorated membranes with cheaper and more corrosion resistant construction parts. Lithium batteries: development of new materials for positive electrodes attaining higher specific outputs than in conventional batteries. Lead accumulators: research and explanation of the effects of pressures and various separators, study of uneven distribution of current on electrode surfaces, explanation of the processes taking place in the oxygen cycle in valve-controlled lead accumulators (VRLA).

### *4. Electric energy conversion into mechanical energy, research and development of complete electric drives of small vehicles of independent traction (new types of low-voltage electromotors and their application in electromobiles, electric wheels, scooters, wheelchairs and other mobile devices). Study of the properties of electric devices the distribution and exploitation of electric energy from nonconventional or renewable resources*

Electromechanical energy conversion: development and optimization of special drives for independent traction (electric scooter, motorbike, startergenerator), a complex dynamic model of

synchronous machine (electromagnetic, thermal and ventilation).

### *5. Generation of low-temperature plasma and research of effects occurring in flowing plasma and its application, e.g. in destruction of hardly combustible and toxic substances and research of effects in switching high-voltage devices.*

Radiation energy transport in electric arc: significant results on world-scale (interest of Siemens). Study of the properties of the switching arc burning in SF<sub>6</sub> environment: explanation of the cause of corrosion and failures of high-voltage devices filled with SF<sub>6</sub>, construction of a kinetic model of chemical reactions in the system of dissociation and ionization SF<sub>6</sub> products. Optimization of electric arc plasma generator, unconventional methods of heat accumulation, thermodynamics and transport of particles in electric arc. Development of a new modular gas plasmatron with a wide range of parameters. Destruction of toxic substances by decay in plasma and transformation of organic waste into noble fuels: results significant from ecological viewpoint. Experimental verification of the possibility of depositing diamond layers on substrate intensively cooled in low-temperature plasma containing hydrocarbons.

### *Research in 2004*

In 2004 when the second stage of the research plan was approved, the research covered:

Development of laboratory specimens of electrochemical components (litho-ion cells, supercapacitors, electrochromic light modulators), testing of graphite electrodes for litho-ion batteries utilizing the developed gel electrolytes, development of membrane oxygen-hydrogen fuel cells with focus on substantial reduction in price and enhancement of the model fuel cells with new membrane.

Application of nickel-metalhydride and litho-ion batteries in the utility electric vehicle BETA for fast charging with resulting extended range and increased useful loading of vehicles. Applications of litho-ion batteries in single-track and three-track construction models of the folding electric scooter ROTOBIC in order to extend the daily range and decrease electric scooter mass.

Verification of the properties of a new scintillation detector of secondary electrons and new multi-electrode ionizing detector for electron microscopy and their application in specific conditions for accumulator mass observation.

Completion of experiments for verifying the cooperation of electric traction motor, accumulators and supercapacitors, and difficult simulations of a new method of magnetic bearing control by means of artificial intelligence.

Completion of experiments and verification of calculations of water-stabilized arc radiation, formulation and solution of models of energy processes in stabilized arc, exploitation of thermal plasma for transformation of organic waste into noble fuels.

Applications of the method of increasing electric energy exploitation in charging of accumulator batteries and in operating thermal pumps powered from small hydroelectric stations in place of their installations. Analysis of operation of individual solar model components and evaluation of their share on the efficiency of the whole, continuous monitoring of the entire complex of solar energy conversion and its evaluation, analyses of exploitation of scattered renewable and cogeneration electric energy sources for providing support service in the electrification system.

#### *Summary*

Owing to the research plan results the team obtained a number of new projects, both national (FRVS, GACR, Ministry of Industry and Trade, Ministry of the Environment and programme TECHNOS of the Ministry of Industry and Trade) and international (the Austrian-Czech project EUREKA E! 2521, ECOTRANS, WISE 6<sup>th</sup> framework programme, etc.)

In the past six years the research plan results were published in more than 10 scientific books, nearly 60 articles in international scientific journals, about 560 papers presented at international conferences, seminars, workshops, and in more than 430 national publications and conferences. Seven members of the team habilitated and more than 40 defended their doctoral theses. With reference to their research work within the research plan, the team members participated as investigators or co-investigators in more than 10 international research and development projects, 25 GACR research projects, over 50 FRVS projects, 27 projects of the Ministry of Industry and Trade and the Ministry of the Environment, and about 35 research and development projects for other organizations.

During the six years of the research plan institutional support amounted to 22.491 million CZK,

out of which 3.854 million CZK were investment and 18.637 million CZK non-investment funds.

#### **Automation of Industrial Processes and Technologies**

(investigator: Petr Vavřín)

Involved in the research plan were departments of three BUT faculties: Department of Control and Instrumentation and Department of Mathematics (FEEC), Department of Informatics and Cybernetics (FME) and Department of Automation and Management (Faculty of Technology in Zlín). With the founding of the Tomáš Baťa University the team from the Faculty of Technology separated, and the research plan was conducted by the three departments of BUT faculties.

Work was carried out in several working teams specializing in measurement techniques, control algorithms, robotics and artificial intelligence. The team of mathematical support (Department of Mathematics) cooperated in selected tasks.

##### *1. Measuring methods and instrumentation*

Three new specialized laboratories were set up: laboratory of infratechnology (mainly for contactless temperature measurements – free of charge acquisition of equipment at the value of 676, 000 CZK) for flow and pressure measurement (testing track JN 100 and simulation of impulse control of industrial differential pressure sensors) and for measurements based on acoustic emission (calibration of acoustic emission sensors, acoustic holography for measuring noise intensity in the near field, application of vibration and acoustic methods in agriculture, etc.).

As the most significant project outside the faculty can be considered the development of a special system for user-configurable and fully automated measurement of the parameters of precise planet gearbox. The system provides for statistical processing and archivation of data. Other significant results were achieved in cooperation with Mendel Agricultural University (Prof. Goliáš) in testing of fruits by vibration-acoustic methods, and the development and verification of a sensor of engine knocking for Auto-Škoda Mladá Boleslav.

The team cooperated with BMT Brno (conception of vaporizer), FMI of FME of BUT in Brno, GMC Blansko (environmental monitoring) Bruel & Kjaer, Spectris Vibro CZ, STI Systém s.r.o. Brno, EGU Brno, Safibra s.r.o. Praha, Optovít s.r.o. Jihlava, etc.

## 2. Control Algorithms

Research was focused on implementation of control algorithms in real-time, verification of new identification principles using artificial intelligence, and design of adaptive controllers based on knowledge regulations. Practical applications were concerned with thermal and power processes. During the research plan 4 doctoral theses were defended, several articles were published in reputed international journals, and a number of papers were presented at national and international conferences and congresses. There were tens of citations of published research plan achievements. The work of the team was presented by the B & R company, Austria in its international company journal Automation.

## 3. Robotics and artificial intelligence

Research dealt with artificial neural networks, expert systems, fuzzy logic, modelling and control of mobile robots.

Research of neural networks was focused on their utilization for control and identification of non-linear dynamic systems. An original scheme of a neural predictive controller with non-linear optimization for extraction of linearized parameters of a controlled system from the neural model NARX. In cooperation with the measurement team a neural network was devised and applied for location of acoustic emission signals in cracks in metals.

The neuro-expert system NEXS was created based on the hierarchy of neural networks connected in a neural tree. The ID3 algorithm (programme C4.5) was used for automated creation of the knowledge base, in the form of a decision tree, of this expert system. Using this expert system, basic tests were conducted over a set of data describing the behaviour of customers purchasing personal computers.

Research in fuzzy logic dealt with indeterminance modelling and verification of simulation results in practice in control of non-linear dynamic systems using fuzzy generators. Designed and implemented was a fuzzy controller of non-linear heterogeneous system – low-loss helium cryostate. Robotics was focused on modelling and control of mobile nonholonomic robots. A model of a two-wheel robot was made up, and ways of controlling it by non-linear feedforward methods and feedback linearization methods.

## Summary

During the research plan solution in the period 2000-2004 it has been proven that the original intention of the proposer – to integrate activities of research teams dealing with automation at BUT faculties and departments was right and brought valuable results. Due to cooperation of FEEC and FME specialized laboratories have become more effectively used for instruction.

## Information and Control Systems

(investigator: František Šolc)

Involved in the research plan were the Faculty of Information Technology (FIT) and the Faculty of Electrical Engineering and Communication (FEEC). The chief investigator was Prof. Jan M. Honzík from FIT. This report covers research conducted at FEEC.

Involved in the research plan were several teams specializing in the following specific areas: Industrial computer networks and industrial automation systems, Computer vision, Sensors, Digital processing and computer-aided analysis of measured signals and Computer-aided control.

### 1. Industrial computer networks and industrial automation systems

Two workplaces were established for verification of digital signature application in industrial automation, and a universal module was implemented of in-built interface Device/Net for control of peripheries by means of current loop in the Device/Net network. Designed and implemented was a data concentrator connected to Ethernet/Intranet enabling connection of 16-bit analog input and output. Developed on this basis was a www meteorological station. Statistic characteristics of pauses in networks communication were evaluated using the CSMA method, and based on these statistic characteristics was the method of data pre-selection and subsequent filtration aimed at increased precision of clock synchronization in regard to the referential time source.

Using the ASL language, the TLAKAN data concentrator constructed according to standards 1451.1 and 1451.2 was described. The concentrator collects data from pressure sensors (1451.1) and through the TCP/IP protocol provides the data to superior systems (1451.2).

Research of wireless communication of concentrators application in the Bluetooth technology was carried out with focus on data collection from



hardly accessible parts of industrial systems and mobile platforms. Based on this research, an experimental mobile platform with wireless communication was set up. Two GACR grants were obtained – Wireless communication technology Bluetooth and Zigbee in automation.

## 2. Computer vision

Research was focused on technical systems and sensors. The designed sensors are unique owing to freely programmable timing of scanning and extremely highly resolution, and therefore can be used for precise asynchronous camera control (with triggering signal). Scanning cameras and high-resolution cameras were experimentally used for detection and identification of vehicle category. In addition to up-to-date image sensors, laser light sources and narrow-band optical filters are used. The position of a laser beam falling on the measured vehicle was scanned. The computing modules with signal processors DSP TM320C611/6711 and FGPA Xilinx Virtex E-300 were used for processing of outputs from high-resolution sensors. Experiments in 10 and 12 bit image digitization were successfully performed using programmable logic circuits. From the viewpoint of application, the above computing modules perform image data pre-processing, laser beam trajectory classification, and having identified the presence and category of the vehicle provide output by through the TCP/IP protocol on the 100 Mb Ethernet interface. It is of importance that the systems with cameras are independent and can be used separately from other systems.

## 3. Sensors, digital processing and computer-aided signal analysis

Research was focused on technical means of electric energy quality monitoring, flow and pressure measurements and analysis of mechanical vibrations. Electric energy quality monitoring was performed in cooperation with JME – E.ON and MEG A Brno. Prototypes of monitors of individual parameters were designed as well as a prototype of a device for measuring the parameters of precise gearbox, including methods and software. A workplace for verification of scanners for scanning the flow of solid particles in industry, wide-band acoustic emission scanners and speed flowmeters. In 2001 a new laboratory for flow and pressure measurements was established in cooperation with the company VAVRA. A testing air track of Js 100 mm can be used for testing (mainly speed) flowmeters. When the Department

of Control and Instrumentation moved to new premises, laboratory tasks in the laboratory Measurements in Electrical Engineering were innovated within the framework of a FRVS grant.

## 4. Computer-aided control

Indeterminance and its description in mathematical models of systems, signals and control was studied with focus on two areas: 1. Methods of arithmetic operations with fuzzy numbers. As a result, a tool for arithmetic operation with fuzzy numbers was created in the programming environment MATLAB on the basis of the principle of expansion and convolution. A certain portion of research was aimed at a study of indeterminance in mathematical models of signals and systems, and results were applied in instruction. Another research area was control and monitoring of mechatronic systems. A microprocessor-controlled measuring device was implemented for measurements of characteristics of switching electromechanical relay contacts and their lifetime control. Investigated and developed were the methods of modelling mechatronic systems using the method of binding graphs. The methodology was incorporated in curricula. Also studied were the ways of modelling and control of drives based on metal alloys with shape memory, as a topic of a GACR grant.

## Research Centre of Applied Cybernetics

(investigator: Petr Vavřín)

The Centre of Applied Cybernetics was established at the Faculty of Electrical Engineering and Communication as a co-investigating workplace. The chief investigator is Prof. Vladimír Kučera from the Faculty of Electrical Engineering, Czech Technical University. The head of the Centre in Brno is Prof. Petr Vavřín, Department of Control and Instrumentation.

There were three research teams at the Centre:

### 1. Automatic control algorithms, P.Vavřín, P.Blaha and P.Václavek

The team was engaged in research of robust algorithms for sensorless control of asynchronous motors using up-to-date automatic control techniques. A control algorithm was designed for direct predictive control of asynchronous motor stator flow with computing simplicity and easy setting of parameters. The algorithms were implemented and tested on DSP56F80x signal processors.

2. *Artificial intelligence and robotics*, F.Šolc, L.Žalud, T.Neužil, L.Kopečný, J.Hrabec

In the period 2001-2004 the team achieved very good results namely in robotic football contests. Developed and implemented were rescue robotic teams UTAR and Orpheus (ranking first in the world championships in Padova 2003).

Also successful was basic research of artificial muscles, waking systems and other mobile robots. For more details visit [www.c-a-k.cz](http://www.c-a-k.cz)

3. *Machine vision*, J.Honec, P.Honec, P.Petrovský, S.Valach

The team focused on computer vision that is automatic scanning and processing of optical information. Among the team's achievements is

implementation of transport systems (measurement of speed in road transport, number plate identification etc.), visual inspection of technological processes (production of electrotechnical components, cleanness of bottles before filling).

#### *Summary*

In the period 2000-2004 there were 9 co-investigator in the investigating team. After successful evaluation the Centre will receive funding for further research conducted from 2005 to 2009. All 19 subjects will continue research. At the Faculty of Electrical Engineering and Communication there will be a new team which will focus on control systems (investigator Prof. F. Zezulka).

## Habilitations and Appointments to Professorship

In 2004 three members of FEEC staff were granted the title of professor and eight new associate professors were appointed:

**Prof. RNDr. Vladimír Aubrecht, CSc.**

Theoretical Electrical Engineering

**Prof. Ing. František Šolc, CSc.**

Technical Cybernetics

**Prof. Ing. František Zezulka, CSc.**

Technical Cybernetics

**Doc. Ing. Karel Bartušek, DrSc.**

Theoretical Electrical Engineering

**Doc. Ing. Jaroslav Boušek, CSc.**

Electrical and Electronic Technology

**Doc. Ing. Václav Jirsík, CSc.**

Technical Cybernetics

**Doc. Ing. Vladimír Kolařík, Ph.D.**

Electrical and Electronic Technology

**Doc. Dr. Ing. Zdeněk Kolka**

Electronics and Communications

**Doc. Dr. Ing. Hana Kuchyňková**

Power Electrical Engineering

**Doc. Ing. Marie Sedlářiková, CSc.**

Electrical and Electronic Technology

**Doc. Ing. Vladislav Škorpil, CSc.**

Electronics and Communications

## Postgraduate Study

In the academic year 2004/05 there have been 366 students in the doctoral study programme. Among them 11 students study in English and one international student receives government scholarship. The numbers of postgraduate students in individual years of study over the past six years are given in Table 3.

Table 4 shows the numbers of doctoral programme graduates at individual departments over

the past five years. While the numbers of students are growing, the numbers of graduates remain the same.

A list of the doctoral programme graduates in 2004 can be found on FEEC websites, links *Study, Doctoral study programme, Doctoral programme graduates*.

Table 3: Numbers of postgraduate students in the period 1999 - 2004

<b>Year</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>
<b>1.</b>	57	50	64	76	96	87
<b>2.</b>	56	56	45	59	70	80
<b>3.</b>	43	34	44	44	57	65
<b>4.</b>	40	40	35	41	31	48
<b>5.</b>	19	29	38	25	32	27
<b>6.</b>	37	20	22	33	31	28
<b>7.</b>	21	41	40	33	25	31
<b>Total</b>	<b>273</b>	<b>270</b>	<b>288</b>	<b>311</b>	<b>342</b>	<b>366</b>

## Student Creativity

The STUDENT EEICT Conference and Competition was jointly organized by FEEC and FIT on 29 April 2004. The abbreviation conceals the English words Electrical Engineering, Information and Communication Technology indicating the priority areas of research and education at the two faculties.

The winners of the faculty round advanced to the international round of the competition in 2004 organized by the Slovak Technical University in Bratislava.

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

Table 4: Doctoral programme graduates at FEEC departments in the period 1999 - 2004

	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>total</b>
<b>UAMT</b>	2	0	5	2	4	8	<b>21</b>
<b>UBMI</b>	2	2	2	1	1	2	<b>10</b>
<b>UEEN</b>	1	1	0	1	0	6	<b>9</b>
<b>UETE</b>	0	1	3	3	2	0	<b>9</b>
<b>UFYZ</b>	0	0	0	2	0	1	<b>3</b>
<b>UMEL</b>	1	2	4	4	1	3	<b>15</b>
<b>UREL</b>	3	1	4	1	3	1	<b>13</b>
<b>UTEE</b>	1	0	0	0	1	1	<b>3</b>
<b>UTKO</b>	1	3	6	1	11	4	<b>26</b>
<b>UVEE</b>	4	2	3	8	6	3	<b>26</b>
<b>Total</b>	<b>15</b>	<b>12</b>	<b>27</b>	<b>23</b>	<b>29</b>	<b>29</b>	<b>135</b>

# External Relations and International Cooperation

## International Activities

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 the Brno University of Technology. There has been a very good cooperation with the university Department of International Relations responsible for economic support and organization of international programmes, e.g. the Socrates programme. As a result, 42 students could study abroad in the extent of 165 student/months, and 28 teachers were on lecture stays at the length of 38 weeks.

Reciprocally, there has been an increased interest of foreign students. Within the Socrates pro-

grammes there were 17 students coming for placements in the total extent of 50 months.

In 2004 the funds for long-term study and research stays abroad of students of all degree programmes from the Development programme of the Ministry of Education amounted to 420,000 CZK.

Owing to the faculty's efforts and in cooperation with the BUT Department of International Relations, FEEC concluded several bilateral agreements in 2004, and renewed the existing agreements in the Socrates-Erasmus programme. The faculty concluded 41 bilateral agreements, which is 14 more than in 2003. A list of universities cooperating with FEEC on the basis of Socrates-Erasmus agreements for the academic year 2004/05 is given in Table 7.

Cooperation is supported of FEEC departments and academics with institutions abroad based on interfaculty and Socrates-Erasmus agreements and on newly established contacts. In 2004 the amount of 940,000 CZK was provided in support of these activities.

Table 5: Student and teacher placements at foreign universities within the framework of the Socrates/Erasmus programme in the period 2002 - 2004

<i><b>Socrates-Erasmus</b></i>	<i><b>2002</b></i>	<i><b>2003</b></i>	<i><b>2004</b></i>
<i><b>Students</b></i>	41	29	42
<i><b>Months</b></i>	201	128	165
<i><b>Lecture stays</b></i>	13	23	28
<i><b>Lecture weeks</b></i>	13	25	38

Table 6: Student placements at FEEC and abroad within the framework of various programmes in 2004

<i>Activity</i>	<i>Incoming students</i>		<i>Outgoing students</i>	
	<i>Students</i>	<i>Months</i>	<i>Students</i>	<i>Months</i>
<b><i>Socrates-Erasmus</i></b>	17	50	42	165
<b><i>CEEPUS</i></b>	1	3	1	1
<b><i>Interfaculty agreements</i></b>	2	2	5	13
<b><i>Development programme of the Ministry of Education</i></b>	-	-	6	9
<b><i>Other mobility programmes</i></b>	-	-	1	3

## External Relations

Activities were focused on presentation of FEEC by offering current and specific information to the public 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 the research and scientific potential of FEEC departments and workplaces, on habilitations and appointment to professorship, on research projects, research and development grant projects of the Grant Agency of the Czech Republic, Ministry of Education, Ministry of Industry and Trade, and EU projects.

In 2004 the new FEEC websites were completed in order to offer information to professionals and to the general public. Now two versions of websites are available - external websites containing basic information about FEEC and its activities for the public and internal websites for the academic community of FEEC, containing local news. Both versions are bilingual - Czech and English.

Also in 2004, FEEC took part in the annual meeting of the Czech and Slovak faculties of electrical engineering. The meeting dealt with transformation of the study programmes of Czech universities based on the Bologna Declaration and with accreditation of new study programmes. Also

discussed was the involvement of the faculties in the 6th Framework Programme, coordination of projects and cooperation with universities from other countries, etc.

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, Siemens A.G., Honeywell, Rockwell-Allen Bradley, JULI Motorenwerke, Škoda Volkswagen Mladá Boleslav, Telecom, Motorola, AMI Semiconductor, Schneider Group, Celestica, etc.

Close cooperation of many years has been maintained with the Institute of Instrumentation of the 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's and in Doctoral programmes. On the basis of an agreement between FEEC and Academy of Sciences the Academy's institutes can educate Ph.D. students.

Cooperation has been going on with other institutions as well. The academic staff, mainly of 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 7: Universities which concluded bilateral agreements with FEEC within the Socrates-Erasmus programme for the academic year 2004/05

<b>University</b>	<b>Country</b>
Katholieke Hogeschool Brugge-Oostende	Belgium
Katholieke Hogeschool Limburg	Belgium
Techničeski Universitët - Sofia	Bulgaria
Aalborg Universitet	Denmark
Danmarks Tekniske Universitet Lyngby	Denmark
Ingeniørhøjskolen i Århus	Denmark
Kuopion yliopisto	Finland
Tampereen teknillinen yliopisto	Finland
École Supérieure d'Ingénieurs en Electrotechnique et Electronique Amiens	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 di Roma „La Sapienza“	Italy
Università degli Studi di Genova	Italy
Fachhochschule Darmstadt	Germany
Fachhochschule Furtwangen	Germany
Fachhochschule Pforzheim	Germany
Fachhochschule Wiesbaden	Germany
FernUniversität Hagen	Germany
Friedrich-Alexander-Universität Erlangen	Germany
Hochschule für Technik, Wirtschaft und Kultur Leipzig	Germany
Technische Universität Dresden	Germany
Technische Universität Magdeburg	Germany
Universität Siegen	Germany
Universitetet i Bergen	Norway
Wyższa Szkoła Zarządzania w Gdańsku	Poland
Instituto Politécnico de Lisboa - ISEL	Portugal
Instituto Superior de Engenharia de Coimbra	Portugal
Žilinská univerzita	Slovakia

Universidad de Cantabria	Spain
Universidad de Zaragoza	Spain
Universitas Miguel Hernández Elche	Spain
Universitat Rovira i Virgili Tarragona	Spain
Malmö högskola	Spain
Uppsala Universitet	Sweden
Coventry University	Great Britain
University of Salford	Great Britain
University of Bournemouth	Great Britain
University of Huddersfield	Great Britain

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# Academic Senate

In 2004 the members of the Academic Senate of FEEC were:

## Chairwoman

RNDr. Vlasta Krupková, CSc., UMAT

## Academic Staff Chamber

Ing. Vladimír Kolařík, Ph.D., chairman, chairman of Legislative Committee, UMEL (until 15 June 2004)

Ing. Josef Bradík, Pedagogical Committee, UVEE

Ing. Ivana Jakubová, Pedagogical Committee, UREL

Ing. Jiří Kozumplík, CSc., chairman of Economic Committee, UBMI

RNDr. Vlasta Krupková, CSc., Economic Committee, UMAT

RNDr. Petr Fuchs, PhD., Economic Committee, UMAT (since 16 June 2004)

Ing. Vladimír Kutnohorský, CSc., Economic Committee, UVEE (until 31 May 2004)

PhDr. Ludmila Neuwirthová, Pedagogical Committee, UJAZ

Prof. Ing. Petr Pivoňka, CSc., Legislative Committee, UAMT

Ing. Helena Polsterová, CSc., Pedagogical Committee, UETE (since 16 June 2004),

Doc. Ing. Ivan Rampl, CSc., chairman of the Staff Chamber (since 16 June 2004), Legislative Committee, UTKO

Ing. Petr Toman, Ph.D., chairman of Legislative Committee (since 16 June 2004), UEEN

RNDr. Naděžda Uhdeová, chairwoman of Pedagogical Committee, UFYZ

## Student Chamber

Miroslav Kuruc, chairman of the Student Chamber, Economic Committee

Soňa Brudná, Pedagogical Committee

František Drtil, Legislative Committee, Economic Committee (until 30 June 2004)

Jiří Gajdošík, Economic Committee (since 14 December 2004)

Ing. Radek Kvíčala, postgraduate students' representative, Economic Committee (since 14 December 2004)

Jan Mertl, Pedagogical Committee, Economic Committee (until 30 June 2004)

Jiří Piškula, Pedagogical Committee, Legislative Committee

Petr Polách, Pedagogical Committee, Legislative Committee (since 14 December 2004)

Ing. Miroslav Zachariáš, postgraduate students' representative (until 30 June 2004)

Tomáš Žabka, Pedagogical Committee

As two members of Academic Senate, Vladimír Kutnohorský and Vladimír Kolařík left the faculty, and three student members, František Drtil, Jan Mertl and Miroslav Zachariáš finished their studies during 2004 and resigned from the membership in the Academic Senate of FEEC, two by-elections were held in 2004. The new members of Academic Senate are included in the list above. The Academic Senate held 9 regular meetings, with average attendance of 82%.

At the meetings of the Academic Senate legislative, economic and pedagogical matters were discussed.

The Academic Senate discussed and approved the proposal of Regulations for Admission to the Bachelor's degree programme including part-time study, to the follow-up Master's degree programme and the Doctoral programme for the academic year 2005/06.

Amendments to the Dean's regulation to the Study and Examination Regulations of Brno University of Technology – Study and Examination

Regulations for the Bachelor's degree programme were discussed and approved. The amendments concerned specification of conditions for appellations of entrance examination results.

The economic report for 2003 was approved as well as the budget for 2004 and allotment of education funds. Further discussed was the mechanism of distributing financial means for part-time study in the Bachelor's degree programme, which was started in the academic year 2004/05.

A significant event was the Pedagogical conference organized by the Pedagogical committee of the Academic Senate devoted to assessment of the newly introduced Bachelor's degree programme. The conference met with success and will again be organized in the future.

Discussions at the meetings were always constructive as the proposals were first sent to all members and departments for comments in order to avoid revocations of decisions.

# Campus Development

In 2004 construction of the integrated premises in the campus Pod Palackého vrchem was completed. In the second half of the year the faculty departments to be accommodated in the premises moved in and furnished lecture rooms and laboratories, for both teaching and research. This

all required large amounts from the faculty budget for 2004.

Modernization of the technical equipment of large-capacity lecture rooms and of the computer and information network continued.

## Modernization and Reconstruction at Údolní 53

Emergency reconstructions and repairs were carried out in some buildings. Besides regular maintenance, repairs in building U5 were carried out by agreement with Masaryk University. The costs were incorporated in the hiring contract concluded with Masaryk University. Emergency repairs were going on in building U4, and in the first half of the year reconstruction of building U7 was completed. Stores in building U11 were moved out and part of the building was adapted

for laboratories. More costly was adaptation and completion of the largest faculty lecture room U4-501. The lecture room was furnished in such a way that acceptable temperature and illumination are provided for multimedia aided instruction. Also by agreement with Masaryk University, premises were prepared in building U2 to accommodate a cafeteria. The reconstruction was completed at the end of the year and approved for use at the beginning of the following year.

## Adaptations at Technická 8

Increasing numbers of students in the first year of study brought up the need of new lecture rooms. It was necessary to close the faculty bookshop and build a meeting room in its place which can also be used as a background for

events held in lecture rooms. A computer room, laboratory and study for postgraduate students were built. The storage space was expanded and in self-study rooms nn sockets for mobile computers were set up.

## Construction Plans

In the second half of 2004 the faculty secretary together with the Departments of Microelectronics and Theoretical and Experimental Electrical Engineering cooperated with a construction agency in preparing a project of the building at Technická

10. The area management procedure will be going on in 2005.

In 2004 architectonic studies for reconstruction of the 5<sup>th</sup> and 6<sup>th</sup> floors of building A3 at Technická 2. The reconstruction will start at the beginning of 2005.

## Computer Networks and Information Systems

Priority was given to

- upgrading of servers at premises Brno-centre and Brno-north
- strengthening of the networks of Gb information and communication technologies
- network backup
- transfer of network management to the Department of Information Systems Administration
- innovation and administration of faculty websites
- building up the faculty information system over the central data store of BUT
- configuration of SW support to access system and interconnection with the regulation system of the integrated premises
- implementation of the information system SAP

## Information Systems and Services

FEEC is taking part in setting up the information system of the Brno University of Technology within which the information system of FEEC was established on the principle of Internet and Intranet using the XML/XSLT technology, over the central data store of the Brno University of Technology with the Oracle technology. In addition to the module for research data processing, the module for study administration was put in opera-

tion. This module is used by the Study Department, and also by the staff (attributes of subjects, assessment) and by students (electronic enrolment, study results). The technology of the module can cope with peak overloading of the system in certain periods of the academic year (the beginning and end of the semester, the examination period).

# 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 2004.

The Centre provides consultancy to female students, professional and personal, and organizes information events for the public aimed at removing the barriers female students face when choosing careers in technical fields. Support to 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.

However, equal opportunities can be understood in a broader sense. In 2004 the Centre focused

on equal opportunities in education of handicapped students.

The Centre therefore concentrates not only on increasing the number of female students, but also 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 to the specific needs of such students.

The Centre cooperates with the Department of Physics, the Student Union and with other faculty staff members.

Contact: 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 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.

The activities of the Institute cover participation in international and national organizations and institutions, publishing activities, research and grant projects, organizing of international conferences, local seminars and lectures. The achieved results, namely publications, are published in annual reports of the participating departments.

Institute Committee:

Coordinator:

Prof. Ing. Jiří Jan, CSc.,

Department of Biomedical Engineering

Members:

Doc. 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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## Student Union

As at each university, the Student Union is active at FEEC. It is a democratic organization with voluntary membership. The Student Union cooperates with the Academic Senate of FEEC and Academic Senate of the university in handling both short-term problems as well as long-term tasks. The Student Union is a partner to the faculty leadership in an effort to maintain communication and information exchange.

In 2004 the Student Union took part in organizing welcome information lectures for first year stu-

dents and presentation of study areas. The Union participates in preparation of the EEICT competition where student representatives are members of the jury. The faculty ball was nearly solely organized by the students. The Student Union helped with promotion of the faculty at the GAUDEAMUS fair and on Open Door Days. Together with the university club Terč the Union prepared a big Easter Party. On request of students, a university-wide exchange of lecture notes was organized.

# Department of Control and Instrumentation

## **Doc. Ing. Pavel Jura, CSc.**

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Prof. Ing. František Šolc, CSc.  
Prof. Ing. Petr Vavřín, DrSc.  
Prof. Ing. František Zezulka, CSc.

## **Associate Professors**

Doc. Ing. Ludvík Bejček, CSc.  
Doc. Ing. Jozef Honec, CSc.  
Doc. Ing. Václav Jirsík, CSc.  
Doc. Ing. Pavel Jura, CSc.  
Doc. Ing. Zdeněk Malec, CSc.

## **Lecturers**

Ing. Petr Beneš, Ph.D., Ing. Zdeněk Bradáč, Ph.D., Ing. Miloslav Čejka, CSc., Ing. Marie Havlíková, Ing. Radovan Holec, CSc., Ing. Tomáš Macho, Ph.D., Ing. Michal Polanský, Ing. Miloslav Richter, Ph.D., Ing. Soňa Šedivá, Ph.D., Ing. Petr Vaňous

## **Postgraduate Students**

Ing. Petr Cach, Ing. Miloš Čábel, Ing. Luděk Černý, Ing. Jiří Dohnal, Ing. Petr Fiedler, Ing. Pavel Fojtík, Ing. Michal Gajdušek, Ing. Petr Halva, Ing. Marie Havlíková, Ing. Zdeněk Havránek, Ing. Peter Honec, Ing. Petr Honzík, Ing. Karel Horák, Ing. Jakub Hrabec, Ing. Petr Hráček, Ing. Michal Hrouzek, Ing. Ondřej Hynčica, Ing. Martin Jandl, Ing. Ondřej Jež, Ing. Michal Jurosz, Ing. Ilona Kalová, Ing. Jiří Keprt, Ing. Stanislav Klusáček, Ing. Michal Knotek, Ing. Tomáš Kopecký, Ing. Lukáš Kopečný, Ing. Miroslav Krupa, Ing. Michal Krzemien, Ing. Pavel Kříž, Ing. Ondřej Lebeda, Ing. Jaroslav Lepka, Ing. Marek Lisztwan, Ing. Petr Nepevný, Ing. Tomáš Neužil, Ing. Lubomír Novák, Ing. Petr Petyovský, Ing. Michal Polanský, Ing. Michal Schmidt, Ing. Pavel Střítecký, Ing. Soběslav Valach, Ing. Markéta Vaňková, Ing. Petr Vaňous, Ing. Michal Vašina, Ing. Václav Veleba, Ing. Hynek Vychodil

## **Administrative and Technical Staff**

Ing. Luděk Anděra, Ing. Luděk Černý, Ing. Jiří Dohnal, Ing. Petr Fiedler, Ing. Michal Gajdušek, Ing. Zdeněk Havránek, Ing. Petr Honzík, Ing. Karel Horák, Ing. Michal Hrouzek, Ing. Ondřej Jež, Ing. Michal Jurosz, Ing. Ilona Kalová, Ing. Jiří Keprt, Ing. Stanislav Klusáček, Ing. Michal Knotek, Ing. Tomáš Kopecký, Ing. Lukáš Kopečný, Ing. Miroslav Krupa, Ing. Ondřej Lebeda, Ing. Petr Nepevný, Ing. Tomáš Neužil, Ing. Lubomír Novák, Lenka Petrová, Ing. Michal Schmidt, Ing. Pavel Střítecký, Ing. Radek Štohl, Ph.D., Ing. Michal Vašina, Ing. Václav Veleba, Jan Vodička, Miloš Zbořil, Ing. Luděk Žalud, Ph.D.

## Main Interests

The group involved in robotics and artificial intelligence has dealt with instruction of stationary and mobile robots and non-conventional drives for robots. The group has actively cooperated with the Laboratory of Advanced Robotics, University of Salford, UK. As for artificial intelligence, instruction is mainly focused on the general aspects of artificial intelligence, research has concentrated on artificial neural network, expert systems and fuzzy logic. The team is interconnected with the Centre of Applied Cybernetics at the Czech Technical University in Prague.

The team engaged in industrial automation has focused on industrial application of modern theory of control in industry. Their main interest is control of machines, production lines and technological processes through programmable automata and distributed control systems. The team is involved in research, development and implementation of industrial network and industrial Ethernet for automation. Good results have been achieved in the development of in-built sensor systems with direct wire and wireless connection to the Internet.

## Major Achievements

The staff of the department achieved the following outstanding results in research and development:

They ranked 3rd in the European Robot Soccer Championships FIRA, Munich, Germany. A knowledge base was created for the choice of the passenger vehicle for the expert system NPS32 in cooperation with Autonova Brno.

A physical AS-interface controlled model was completed and presented at the International Engineering Trade Fair Brno 2004 and Gaudeamus 2004.

Software TestXmess and a user-configurable measuring system were developed and implemented for fully automated measurements of parameters of precise planet gearboxes, including evaluation and statistic data processing. The work was done for the development department of Stoeber, Pforzheim, Germany.

A fast scanning camera and software support were developed for computer vision application in industry and transport.

The measurement group has focused attention on a system for measurement of gearbox (in cooperation with Stoeber Pforzheim, Germany), optimization of a measurement and control in technological processes (with SVCS and Ex limited), contactless temperature measurement (with TSI System and Raytek), testing of high-voltage sensors (with ABB) and development and testing of the sensor for engine knocking (with Škoda – Auto Mladá Boleslav).

The team for control technology has been engaged in implementation of control algorithms in real-time, research and verification of control and identification algorithms based on artificial intelligence principles, control and identification by means of conventional and advanced methods (PID, adaptive, optimal and predictive controllers and their comparison), mainly on thermal and power processes.

The team involved in computer vision has concentrated on technical applications of computer vision and HW support of image processing.

An outstanding achievement was the co-authorship of Prof. F. Zezulka of the book Introduction to Industrial Sensor Networking in the publication Handbook of Sensor Networks, CRC Press, N.Y., 2004 and publishing of his book: Prostředky průmyslové automatizace (Industrial Automation Systems), VUTIU, Brno, 2004.

A multifunctional laboratory of up-to-date methods of automatic control was set up in the new premise at Kolejní 4. A model of heat exchanger was set up for instruction and research of diagnostic prediction methods.

Also a specialized laboratory for infratechnology was set up – contactless temperature measurement (a gift from STI System and Raytek).

The work of the group Control Technology was presented by B&R, Austria in the international corporate journal Automotion, 2003, No. 12, p.11, where the abstract of the paper The Real-Time Communication between MATLAB and the Real Process Controlled by PLC was published.



## Major Research Projects

### **Automation of Industrial Processes and Technologies - MŠMT 26000013**

Investigator: Petr Vavřín

### **Research Centre of Applied Cybernetics - MŠMT 1M6840770004**

Investigator: Vladimír Kučera, co-investigator: Petr Vavřín

### **The Industrial Wireless Automation Network Bluetooth - GAČR 102/03/1097**

Investigator: František Zezulka

### **TALENT – coordinated instruction of doctoral degree students in control technology and robotics - GAČR 102/03/H116**

Investigator: Vladimír Kučera, co-investigator: Petr Vavřín

### **Research of the Behaviour and Control of Non-Conventional Action Robotic Elements – GAČR 102/02/0782**

Investigator: František Šolc

### **Research in Information and Control System – MŠMT 262200012**

Investigator: Jan M. Honzík, co-investigator: František Šolc

## Selected Publications

BLAHA, P., VÁCLAVEK, P. Predictive Direct Stator Flux Control of an AC Induction Motor Drive. *International Journal of Mechanics and Control*, ISSN 1590-8844, 2004, Vol. 4, No. 2, pp. 33 - 38.

JURA, P. Some remarks on mathematical models. *WSEAS Transactions on Information Science and Applications*, ISSN 1790-0832, 2004, Vol. 1, No. 5, pp. 1426 - 1 429.

JURA, P. Sugeno Fuzzy Controller of Helium Evaporation. *WSEAS Transactions on Systems*, ISSN 1109-2777, 2004, Vol. 3, No. 4, pp. 807 - 810.

PIVOŇKA, P., DOHNAL, J. On-line Identification Based on Neural Networks using of Levenberg-Marquardt Method and Back-propagation Algorithm. *WSEAS Transactions on Systems*, ISSN 1109-2777, 2004, Vol. 3, No. 2, pp. 381 - 385.

PIVOŇKA, P., VELEBA, V. Application of Neural Networks for Hot-Air System Control. *WSEAS Transactions on Systems*, ISSN 1109-2777, 2004, Vol. 3, No. 2, pp. 757 - 760.

ŠOLC, F., VAŠINA, M. Modelling and Control of SMA Actuator. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 3, No. 9, pp. 1840 - 1 845.

ŠVANCARA, K., PIVOŇKA, P. Possibilities of the Direct Implementation of Control Algorithms from Environment MATLAB/Simulink. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 3, No. 1, pp. 7 - 12.

VÁCLAVEK, P. System Modelling Using Generalized Orthonormal Base Functions. *DAAAM International Scientific Book*, ISSN 1726-9687, 2004, Vol. 2004, No. 9, pp. 611 – 625.

ZEZULKA, F., VRBA, R., BRADÁČ, Z. Wireless Networked Single Sensors. *WSEAS Transactions on Electronics*, 2004, Vol. 2, No. 1, pp. 359 - 361.

ŽALUD, L. *RoboCup 2003: Robot Soccer World Cup VII*. Chapter: Rescue Robot League - 1st Place Award Winner. Germany: Springer, 2004. pp. 1 - 12 . ISBN 3-540-22443-2

## Bachelor's Programme

Computer Control (Petr Pivoňka)

Computer Science in Automation (Petr Pivoňka)

Control Theory (Petr Vavřín)

Databases systems (Radovan Holek)

Electronic Measurement Systems (Miloslav Čejka)

Fibre Optics in Automation (Ludvík Bejček)

Fundamentals of Robotics (František Šolc)  
Industrial Automation (František Zezulka)  
Measurement in Electroengineering (Ludvík Bejček)  
Measurement of Physical Quantities (Ludvík Bejček)  
Microprocessors (Tomáš Macho)  
Modeling and Simulation (František Šolc)

### Master's Programme

Artificial Intelligence (Václav Jirsík)  
Automation in Measurement (Miloslav Čejka)  
Binary Control Systems (Zdeněk Malec)  
Components of Control Systems (Radovan Holec)  
Computer Graphics (Jozef Honec)  
Construction of Measuring Instruments (Petr Beneš)  
Database systems (Radovan Holec)  
Design of Control Systems (František Zezulka)  
Electronic Measuring Instruments (Miloslav Čejka)  
Electronics Measurements (Miloslav Čejka)  
Expert Systems (Václav Jirsík)  
Fuzzy Logic for Control and Modelling (Pavel Jura)  
Linear Control (Petr Vavřín)  
Machine Learning (Václav Jirsík)  
Means of Automation (František Zezulka)  
Measurement in Non-Electrical Quantities (Ludvík Bejček)

### Doctoral Programme

Advanced Control Theory and Praxis (Petr Vavřín)  
Hierarchical and decentralized control (František Zezulka)  
Intelligent Controllers (Petr Pivoňka)  
Machine Vision (Jozef Honec)

Modern means in Automation (Václav Jirsík)  
PC Systems (Jozef Honec)  
PCs in Instrumentation (Miloslav Čejka)  
Practical Programming in C++ (Jozef Honec)  
Programmable Logics Controllers (František Zezulka)  
Signals and Systems (Pavel Jura)

Microprocessors (Radovan Holec)  
Modeling and Identification (František Šolc)  
Modern Theory of Control (Petr Vavřín)  
Multivariable Signal Processing (Jozef Honec)  
Nonlinear Automatic Control (František Šolc)  
Optoelectronics in Control (Ludvík Bejček)  
PCs in Instrumentation (Miloslav Čejka)  
Practical Programming in C (Miloslav Richter)  
Programmable Logics Controller (František Zezulka)  
Programming Artificial Intelligence - PROLOG (Soňa Šedivá)  
Robotics (Luděk Žalud)  
Sensors of Non-Electrical Quantities (Ludvík Bejček)  
Servomechanisms (Zdeněk Malec)  
Signal Processors in Automation and Measurement (Jozef Honec)  
Subsystems of PC (Jozef Honec)  
System Analysis (Petr Pivoňka)

Modern Control Theory (Petr Vavřín)  
Optimum System Control and Identification (Jozef Honec)  
Reliability and Diagnostics (Zdeněk Malec)  
Selected Areas of Optoelectronic (Ludvík Bejček)  
Technical Robotics (František Šolc)

## Laboratories

**Laboratory of Automatic Control** (instruction in physical models of processes)

**Laboratory of Measurement Automation** (instruction in PCs in Measurement Technology, Electronic Measurement Systems)

**Laboratory of Contactless Temperature Measurement** (infratechnology, mainly contactless temperature measurement, student projects and theses)

**Laboratory of Electronic Measurement** (instruction in Measurements in Electrical Engineering, Electronic Measurement Instrumentation)

**Laboratory of Intelligent Controllers** (instruction and research in physical continuous and discrete models, verification of identification and control algorithms based on artificial intelligence methods, development and verification of both conventional and up-to-date adaptive, optimal and predictive controllers)

**Laboratory of Measurement of Non-Electrical Quantities** (instruction in Sensors of Non-Electrical Quantities and Measurement of Non-Electrical Quantities)

**Laboratory of Pressure and Flux Measurement** (experiments for student projects, testing track for flux measurements Js 100mm)

**Laboratory of Modern Control Methods** (research in physical models control in real-time, transmission properties of heterogeneous interconnected industrial networks, research of diagnostic methods of automatic control, Internet control of physical laboratory models and application of formal methods for verification of system design of control systems)

**Laboratory of Optoelectronics** (research and instruction in Fibre Optics in Automation, Optoelectronics in Automation and Measurement)

**Laboratory of Computer Vision** (instruction in Signal Processors in Automation and Measurement, Processing of Multidimensional Signals, and characteristics of HW support of computer vision)

**Laboratory of Programmable Automatics** (instruction in Programmable Automatics, training for industrial companies in industrial control systems and industrial network DeviceNet of Rockwell – Allen Bradley company)

**Laboratory of Robotics** (research and instruction in stationary and mobile robots, research in alternative drives of robots)

**Laboratory of Telepresence and Robotics** (research in mobile robot control)

**Laboratory of Vibrodiagnostics** (measurement of vibrations, acoustic emission and noise)

**Interdisciplinary Laboratory of Computer Vision Focused on Transport Applications** (research and development in cooperation with FIT and Masaryk University)



# Department of Biomedical Engineering

## **Prof. Ing. Jiří Jan, CSc.**

Head

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Prof. MUDr. Jindřich Vomela, CSc.

## **Associate Professors**

Doc. Ing. Aleš Drastich, CSc.  
Doc. MUDr. Václav Chaloupka, CSc.  
Doc. Ing. Milan Chmelař, CSc.  
Doc. Ing. Ivo Provazník, Ph.D.  
Doc. Ing. Jiří Rozman, CSc.  
Doc. RNDr. Ing. Jiří Šimurda, CSc.

## **Lecturers**

Ing. Jana Bardoňová, Ph.D., Ing. Miroslav Dvořák, CSc., Ing. Karel Jehlička, CSc., Ing. Radovan Jiřík, Ph.D., Ing. Radim Kolář, Ph.D., Ing. Jiří Kozumplík, CSc., Ing. Zoltán Szabó, Ph.D.

## **Postgraduate Students**

Ing. Asterios Anagnostoudis, Ing. Milan Blaha, Ing. Radovan Burhan, Ing. David Čermák, Ing. Tomáš Červinka, Ing. Petr Dub, Ing. Adam Filipík, Ing. Martin Hlaváč, Ing. Ferdinand Hodáň, Ing. Ladislav Hrubý, Ing. Marek Humhal, Ing. Lukáš Chmelka, Ing. Radim Chrástek, Ing. Josef Jaroš, Ing. Dina Kičmerová, Ing. Vladimír Kotala, Ing. Libor Kubečka, Ing. Radomír Kurečka, Ing. Pavel Leinveber, Ing. Vladimír Mahdal, Ing. Karel Matys, Ing. Michal Mikl, Ing. Jan Musil, Ing. Daniel Orel, Ing. Robert Paluch, Ing. Radim Petržela, Ing. Martin Pichút, Ing. Václav Prajzner, Ing. Jaroslav Rohel, Ing. Ivo Říha, Ing. Petr Sadovský, Ing. Daniel Schwarz, Ing. Martin Skokan, Ing. Viktor Svoboda, Ing. Jan Šandera, Ing. Milan Tannenberg, Ing. Petr Verner, Ing. Zbyněk Veselý, Ing. Roman Vopálka, Ing. Marek Vyklický, Ing. Jiří Začal, Ing. Miloslav Zdražil, Ing. Michal Závíšek, Ing. Roman Žák

## **Administrative and Technical Staff**

Ing. Petr Fedra, Anna Oujeská, Jaroslav Sedláček, Ing. Vlastimil Václavík

## Main Interests

The department provided 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's and Master's degree programmes. The department is involved in basic and applied research of engineering principles in medicine, biology and ecology. The main areas of interest were digital processing and analysis of cardiological and ophthalmological images, particularly 3D ultrasonographic data, digital processing and analysis of the records of the electric activity of ischemic heart. The department has closely cooperated with the University of Bergen, Norway, the Ophthalmological Clinic of the Friedrich-Alexander-University Erlangen, Germany, the Medical faculty of Masaryk University of Brno, the Faculty Hospital in Brno-Bohunice, and other institutions.

In 2005 the concept of instruction remains unchanged. Its centre now moves from the previous one to the new study system (the so called Bologna System (3 + 2 years). Sources and methods will be sought for optimizing the quality of instruction under the circumstances of high numbers of students and two-level study system.

An important change in research is the setting up of the division of the National Centre DAR fo-

cused on processing of medical images, which will be opened in spring 2005.

The department will be involved in research of the methods of ultrasound images restoration and analysis of cardiological 3D ultrasonographic data and analysis of ophthalmological images using multimedia data within the international project obtained for the period 2005-2006. Of equal importance is the development of a unique device for simultaneous optical and electrical recording of heart activity for detection of by-effects of drugs and analysis of achieved results. The plan is to further develop research laboratories and make use of grant support. The department concentrates on completion of a laboratory of biosystems for instruction in biomedical subjects with focus on implementation of clinical diagnostic methods, and a laboratory of multimedia signals and data. The department's instrumentation and computer laboratories will be upgraded. Cooperation with the University of Bergen, University of Erlangen and University of Zaragoza based on international agreements within the framework of the European programme Socrates/Erasmus aimed at regular reciprocal cooperation with medical workplaces and Czech environmentalist institutions will be focused on support of new ways of teaching technical principles in ecology.

## Major Achievements

The members of the department's staff were involved in several research projects the results of which were published in scientific journals and at prestigious international conferences, and also in an international monograph.

The department was invited to participate in the public competition for the National Research Centre DAR (Academy of Science Prague) focused on image processing. The application succeeded, and at the present time a division of the Centre is being set up at the department.

As far as didactic literature is concerned, the long expected lecture notes DRASTICH, A. Tomografické zobrazovací systémy (Tomographic Imaging Systems), Lecture notes of FEEC Brno, MJ Servis s.r.o., Brno 2004, ISBN 80-214-2788-4 were issued.

In 2004 the department obtained larger laboratory premises that were newly furnished. A new instruction laboratory of biosystems analysis (FRVS investment grant) and a new research laboratory of biophysics with a shielded chamber were established.

In 2004 the department again organized, under the auspices of the European Association EURASIP and the world organization IEEE, the biennial international conference BIOSIGNAL (the chairman of the organizing committee was I. Provazník) with 150 participants, two third of them international delegates from 31 countries. The conference has been for many years recognized as an important event among the international community in our field of science.

Within the framework of the congress and trade fair MEFA 2004 the department organized

a section for postgraduate students MediForum (the chairman of the organizing committee was M. Chmelař) in cooperation with the Medical Faculty of Masaryk University and the Veterinary and Pharmaceutical University in Brno. Within the framework of the section Telemedicine of the congress MEFA a telebridge was organized between IKEM Prague, regional hospital in Znojmo

and the Faculty Hospital in Brno-Bohunice M. Chmelař).

The senior of the department, associate professor Milan Chmelař, was appointed member of honour of the Society of Biomedical Engineering and Medical Informatics of J. E. Purkyně Czech Medical Society.

## Major Research Projects

### **Analysis and Suppression of Speckles in 3D Medical Ultrasound Images – GA AV B2813303**

Investigator: Radim Kolář

### **Analysis of Medical Ultrasound Data Focused on 3D Imaging in Cardiology – GAČR 102/02/0890**

Investigator: Jiří Jan

### **Deconvolution of Ultrasound Images – MŠMT 1K03017**

Investigator: Jiří Jan

### **Modulation Role of Sigma Signalling on Electromechanical Relations of Isolated Cardiomyocytes and Heart - GAČR 305/04/1385**

Investigator: Ivo Provazník

### **Optical Recording of High Resolution Action Potentials for an Analysis of Alterations of EKG Signal T-Wave– GAČR 102/04/0472**

Investigator: Ivo Provazník

### **An Optical System for Measurement of the Position and Orientation of the Ultrasound Probe for 3D Imaging in Cardiology – GAČR 102/03/D030**

Investigator: Zoltán Szabó

### **Computer Processing of Ophthalmological Image Data – KONTAKT 01/031**

Investigator: Jiří Jan

### **Processing and Analysis of 3D Ophthalmological Image Data Focused on the Enhancement of Prevention Glaucom Diagnostics – GAČR 102/03/P153**

Investigator: Radim Kolář

## Selected Publications

JAN, J. *Medical Image Processing, Reconstruction and Restoration - Concepts and Methods*. New York: CRC Press, 2004. pp. 1 - 601. ISBN 0-8247-5849-8

CHLEBUS, P., BRÁZDIL, M., HLUŠTÍK, P., MIKL, M., PAŽOURKOVÁ, M., KRUPA, P. Handedness Shift as a Consequence of Motor Cortex Reorganization After Early Functional Impairment in Left Temporal Lobe Epilepsy - An fMRI Case Report. *Neurocase*, ISSN 1355-4794, 2004, Vol. 10, No. 4, pp. 326 - 329.

JAROŠ, J., ROZMAN, J. 3D Simulation of Ultrasound Intensity Generated by Transducer Arrays. *WSEAS Transactions on Information Science and Applications*, ISSN 1790-0832, 2004, Vol. 6, No. 1, pp. 1751 - 1755.

JIRŮK, R. Superresolution of Ultrasound Images Using the 1st and 2nd Harmonic Signal. *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*, ISSN 0885-3010, 2004, Vol. 51, NO. 2, pp. 163 - 175.

JIRŮK, R., JAN, J. Imaging of Ultrasound Attenuation Coefficient. *Technology and Health Care, International Journal of Health Care Engineering*, ISSN 0928-7329, 2004, Vol. 12, No. 2, pp. 172 - 173.

OZER, M., ERDEM, R., PROVAZNÍK, I. A New Approach to Define Dynamics of the Ion Channel Gates. *Neuroreport*, ISSN 0959-4965, 2004, Vol. 15, No. 2, pp. 335 - 338.

OZER, M., PROVAZNÍK, I. A Comparative Tool for the Validity of Rate Kinetics in Ion Channels by Onsager Reciprocity Theorem. *Journal of Theoretical Biology*, ISSN 0022-5193, 2004, in print.

SKOKAN, M., KUBEČKA, L., JAN, J. Multimodal Retinal Image Registration for Optic Disc Segmentation. *Methods of Information in Medicine*, ISSN 0026-1270, 2004, Vol. 2004, No. 4, pp. 336 - 345.

SZABÓ, Z. Contour Image Data Compression Using Spline Wavelets. *Journal of Electrical Engineering*, ISSN 1335-3632, 2004, Vol. 55, No. 11-12, pp. 290 - 584.

ŠIMURDA, J. Quantitative modelling of interaction of propafenone with sodium channels in cardiac cells. *Medical & Biological Engineering & Computing*, ISSN 1400118, 2004, Vol. 2004, No. 42, pp. 151 - 157.

## Bachelor's Programme

Computers and Programming 1 (Ivo Provazník)

Digital Signal Processing and Analysis (Jiří Jan)

Ecology in Electrotechnical Profession (Jiří Rozman)

Human Biology (Nataša Honzíková)

Introduction to Medical Informatics (Ivo Provazník)

Medical Diagnostic Devices (Radim Kolář)

Multimedia Signals and Data (Jiří Jan)

Therapeutic and Prothetic Instruments (Jiří Rozman)

## Master's Programme

Bionics (Jiří Kozumplík)

Biophysics (Jiří Šimurda)

Clinical Physiology (Václav Chaloupka)

Digital Image Processing and Analysis (Jiří Jan)

Digital Signal Processing and Analysis (Jiří Jan)

Ecological Engineering (Jiří Rozman)

Environmental Diagnostics (Jiří Rozman)

Healthcare (Jindřich Vomela)

Human Biology (Nataša Honzíková)

Medical Diagnostic Devices (Milan Chmelař)

Medical Imaging Systems (Aleš Drastich)

Medical Information Systems (Ivo Provazník)

Medical Laboratory Devices (Milan Chmelař)

Medical Systems Design (Karel Jehlička)

Non-television Imaging Systems (Aleš Drastich)

Therapeutic Technique (Jiří Rozman)

## Doctoral Programme

Advanced Methods of Digital Image Processing (Jiří Jan)

Bioinformatics (Ivo Provazník)

Data in Image Systems (Jiří Jan)

Methods and Systems Used in Ultrasound Diagnostics (Jiří Rozman)

Neural Networks, Adaptive and Optimum Filtering (Jiří Jan)

Spectral Analysis of Digital Signals (Jiří Kozumplík)

## Laboratories

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

**Laboratory of Image Data Analysis** (a division of the Centre DAR, research in digital processing and analysis of image data, digitization and archiving of static images and videosequences, Radovan Jiřík)

**Laboratory of Biophysics** (laboratory with a shielded chamber, 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 for research and student projects, Jana Bardoňová)

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

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

**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, Modelling of biological Systems, Ivo Provazník)

**Laboratory of Ultrasonography** (measurement of ultrasonographic image data, calibration of instrumentation and ultrasound probes, Radim Kolář)

**Laboratory of Digital Signal and Image Processing** (instruction in Digital Signal Processing and Analysis, Multimedia Signals and Data, Signal and Image Analysis, Advanced Methods of Signal Processing, Multicycle Systems, Computers and Programming 1, Computers and Programming 2, Vlastimil Václavík)

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



# Department of Electrical Power Engineering

## **Doc. Ing. Antonín Matoušek, CSc.**

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## **Professors**

## **Associate Professors**

Doc. Ing. Vladimír Blažek, CSc.  
Doc. Ing. Evžen Haluzík, CSc.  
Doc. Ing. Antonín Matoušek, CSc.  
Doc. Ing. Jiří Raček, CSc.

## **Lecturers**

Ing. Petr Baxant, Ph.D., Ing. Michal Chmela, Ph.D., Ing. Jaroslava Orságová, Ph.D., Ing. Petr Toman, Ph.D.

## **Postgraduate Students**

Ing. Ivo Běhunek, Ing. Michal Bernard, Ing. René Borek, Ing. Petr Čambala, Ing. Jiří Drápela, Ing. Jaroslav Heinz, Ing. Radek Javora, Ing. Eva Kadlecová, Ing. Rostislav Kaleta, Ing. René Kameník, Ing. Milan Krátký, Ing. Ilona Lázničková, Ing. Jan Macháček, Ing. Jiří Malý, Ing. Petr Mastný, Ing. Zdeněk Matoušek, Ing. Tomáš Mendl, Ing. Ondřej Nepomucký, Ing. Alexej Nováček, Ing. Lubomír Petřek, Ing. Zdeněk Procházka, Ing. Petr Skala, Ing. Zdeněk Špéra, Ing. Jiří Uher, Ing. Libor Weidinger, Ing. Michal Závodný

## **Administrative and Technical Staff**

doc. RNDr. Oldřich Coufal, CSc., Ing. Jiří Drápela, Ing. Jan Gregor, CSc., Helena Karásková, Ing. Ilona Lázničková, Ing. Petr Mastný, František Matoušek, Ing. Josef Šenk, CSc., Ing. Miroslav Velísek, CSc.

## Main Interests

The continuity of the study programmes was maintained with focus on instruction of power electrical engineering in the Bachelor's degree programme B-SEE. In the academic year 2005/2006 the Master's degree programme Electrical Power Engineering will be launched. The department's staff participated in preparation of the research plan 'Resources, Accumulation and Optimization of Electric Energy Exploitation in Conditions of Permanently Sustainable Growth' (chief investigator Prof. Jiří Kazelle) in the part Optimization of electric energy conversion and exploitation in systems with ecological power sources. The development, implementation and analysis of the characteristics of a simple air thermal collector and its applications in thermal-air heating systems, optimization of the operation of the thermal pump with a solar system in accu-

## Major Achievements

The research results achieved at the department were presented at national and international conferences. The department in cooperation with JME a.s. (member of E.ON Group) and Teplárny Brno a.s. organized a successful international conference Elektroenergetika 2004.

The department cooperated with the Institute of Plasma Physics of the Academy of Sciences of the Czech Republic in the Joint plasma laboratory in experimental research on a unique modular gas plasmatron designed at the department.

The department participated in three GACR projects and one GAAV project. The database system TheCoufal, as a grant project result, containing programmes and a database of thermodynamic characteristics of 360 substances at temperatures of 298.15 – 50,000 K can be found at <http://www.feec.vutbr.cz/~coufal>. The department also participated in completion of a part of the research plan MSM 262200010. The FRVS

mulation and exploitation of low-potential heat continued.

Cooperation with JME a.s. continued, and informal contacts were established with the company E.ON in optimization and calculation of technical losses in distribution network and in evaluation of undelivered power.

Informal cooperation with departments of power electrical engineering of Czech and Slovak technical universities culminated by organizing the 30th meeting of the departments, and cooperation with foreign universities was increased. In cooperation with the distribution companies and the company MEgA s.r.o. a new laboratory Appliances-electric network compatibility was set up.

A contract was concluded with the company SOLARTEC a.s. on the research, development and verification of cogeneration converters of solar energy into heat and electricity.

project Innovation of the laboratory of electric networks was completed and work was carried out on two FRVS projects in category G1: Spectrophotometer evaluation of the quality of illumination and Heat accumulation in solar systems.

Research of solar energy exploitation continued in cooperation with SOLARTEC by evaluating measurements of progress optimization of the operating point of photovoltaic converters, which results in on average 20% increase in electric power production. A contract was concluded with distribution companies and the company MeGA on setting up the laboratory Appliances-electric network compatibility.

In 2004 five doctoral theses were defended. Ondřej Nepomucký, a 5th year student, won the faculty EEICT student competition and a student competition organized by ČEZ a.s.. One staff member started habilitation proceedings.

## Major Research Projects

### **New Methods of Localization of Earth Contacts in Electric Waves Networks – AVČR KJ B2813304**

Investigator: Petr Toman

### **An Expert System for Illumination in Deteriorated Conditions – GAČR 102/03/1162**

Investigator: Petr Baxant

### **Equilibrium and Kinetics in Switching Arc - GAČR 102/02/1414**

Investigator: Oldřich Coufal

### **Setting Physical, Technical and Technological Limits in Electrical Energy Transport Through Interconnected Power Systems – GAČR 102/03/P033**

Investigator: Petr Toman

## Selected Publications

COUFAL, O., BARTLOVÁ, M. Influence of concentration on the values of recombination and ionization rate coefficients of atoms S and F. *Czechoslovak Journal of Physics*, ISSN 0011-4626, 2004, Vol. 54, No. Suppl. C, pp 665 - 670.

GREGOR, J., JAKUBOVÁ, I., ŠENK, J. Theoretical Analysis of the Influence of Diffusion in Free Jet of Hot Gas Mixture. *Czechoslovak Journal of Physics*, ISSN 0011-4626, 2004, Vol. 54, No. Suppl. C, pp. 690 - 696.

GREGOR, J., JAKUBOVÁ, I., ŠENK, J., KONRÁD, M. Experimental Investigation of Hot Gas Mixture Free Jet. *Czechoslovak Journal of Physics*, ISSN 0011-4626, 2004, Vol. 54, No. Suppl. C, pp. 696 - 701.

GREGOR, J., KAVKA, T., CHUMAK, O., HRABOVSKÝ, M. Effect of Arc Power and Gas Flow Rate on Properties of Plasma Jet under Reduced Pressures. *Czechoslovak Journal of Physics*, ISSN 0011-4626, 2004, Vol. 54, No. Suppl. C, pp. 753 - 758.

HEINZ, J., ŠENK, J. Modelling of energy processes in intensively blasted electric arc. *Czechoslovak Journal of Physics*, ISSN 0011-4626, 2004, Vol. 2004, No. 54-C, pp. 702 - 708

LÁZNIČKOVÁ, I. Influence of collision integrals on the electrical conductivity of a gas system. *Czechoslovak Journal of Physics*, ISSN 0011-4626, 2004, Vol. 2004, No. 54, pp. 1 - 6.

## 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 (Petr Baxant)

Environmental Science in Electroenergetics (Antonín Matoušek)

High Voltage and Electric Apparatus (Vladimír Blažek)

Machinery of Power Plants (Jiří Raček)

Protection of Electrical Power Equipment (Evžen Haluzík)

Technical Mechanics (Jiří Raček)

## Master's Programme

Advances Power Engineering (Evžen Haluzík)

Applied Programming in Power Engineering (Petr Toman)

Design of Power Engineering 1 (Petr Toman)

Economy of Electrical Power Generation, Transmission and Distribution (Michal Chmela)

Economy of Power Engineering (Michal Chmela)

Electric Energy Transmission and Distribution 1 (Vladimír Blažek)  
Electric Energy Transmission and Distribution 2 (Evžen Haluzík)  
Electrical Heating and Light (Petr Baxant)  
Electrical Power Generation (Antonín Matoušek)  
Electrical Power Plants 1 (Antonín Matoušek)  
Electrical Power Plants 2 (Antonín Matoušek)  
Electroenergetics (Milan Ondrášek)  
Energy Use (Petr Baxant)  
Fittings of Light (Petr Baxant)  
High Voltage Technology (Vladimír Blažek)  
Lightings Systems (Petr Baxant)  
Measuring and regulation in Electroenergetics (Milan Ondrášek)

Mechanics (Jiří Raček)  
Nuclear Power Plant Operation (Jiří Raček)  
Power Engineering in Environment (Antonín Matoušek)  
Power Plant Automation (Michal Chmela)  
Power Plant Operation (Antonín Matoušek)  
Power Systems Control (Evžen Haluzík)  
Power Systems Development (Petr Toman)  
Protections and Automatics (Evžen Haluzík)  
Protective Devices (Evžen Haluzík)  
Technical Mechanics (Jiří Raček)  
Transient Phenomena in Power Network (Michal Chmela)  
Unconventional Conversions (Antonín Matoušek)

### Doctoral Programme

Application of Selected Mathematical Methods in The Power Engineering (Vladimír Blažek)  
Computer Modelling of Power Systems (Evžen Haluzík)  
Ecology in Power Engineering (Jiří Raček)  
Light and Lighting Systems (Petr Baxant)  
Low Temperature Plasma in Electrical Engineering (Oldřich Coufal)

Power Plants Control (Antonín Matoušek)  
Solar Energy Utilization (Jan Gregor)  
Specific Problems of Power Plants (Antonín Matoušek)  
State Estimation of Power Systems Security (Evžen Haluzík)  
Thermodynamics of The Electric Arc Plasma (Oldřich Coufal)

### Laboratories

**Power Plant Laboratory** (instruction in Power Plants 1 and 2, Automation of Power Plants, diploma theses and special research projects mainly on small resources, Jaroslava Orságová)

**Protective Device Laboratory** (instruction in Protection and Automatics in Networks, diploma theses, preparation of measurements in real networks and power sources, research in this area, Petr Toman)

**Laboratory of Electric Networks** (instruction in Electric Power Transmission and Distribution 1 and 2, Urban and Industrial Networks, Energetic Interferences, and research in this area, Jiří Drápela)

**Laboratory of Appliances-Electric Network Compatibility** (setting characteristics of the impact of appliances on the distribution network given different conditions of the network, Jiří Drápela)

**Laboratory of Non-Conventional Energy Conversion** (instruction in Non-Conventional Energy Conversion, fuel cells operation, Bachelor's projects and diploma theses, Antonín Matoušek)

**Lighting Technology Laboratory** (instruction in Electric Light and Heat, Lighting Systems, Operation of Lighting Systems, diploma theses, and technical light measurements for research and industrial applications, Petr Baxant)

**Solar Energy Laboratory** (research of complex exploitation of solar energy, development and testing of working models in real operation conditions, equipped with automatic system of data collection, Jan Gregor)

# Department of Electrotechnology

## **Doc. Ing. Josef Jirák, CSc.**

Head

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Prof. Ing. Rudolf Atrata, DrSc.  
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Prof. Ing. Pavel Procházka, CSc.

## **Associate Professors**

Doc. Ing. Josef Jirák, CSc.  
Doc. Ing. Karel Liedermann, CSc.  
Doc. Ing. Marie Sedlaříková, CSc.

## **Lecturers**

Ing. Petr Bača, Ph.D., Ing. Svatopluk Havlíček, CSc., Ing. Petr Křivák, Ph.D., Ing. Jiří Maxa, Ph.D., Ing. Helena Polsterová, CSc., Ing. Zdenka Rozsivalová, Ing. Jiří Špinka, Ing. Jiří Vaněk, Ph.D.

## **Postgraduate Students**

Ing. Patrik Bocek, Ing. Vladimír Brzokoupil, Ing. Pavel Černocho, Ing. Martin Dočkal, Ing. Radek Drnovský, Ing. Jan Dvořák, Ing. Martin Frk, Ing. Miroslav Haman, Ing. Petr Hrnčířík, Ing. Roman Kameník, Ing. Martin Kocian, Ing. Ondřej Krejza, Ing. Jan Linhart, Ing. Michal Macalík, Ing. Jan Mertl, Ing. Pavel Nečesal, Ing. Vilém Neděla, Ing. Tomáš Nováček, Ing. Jan Rychnovský, Ing. Mgr. Luděk Schneider, Ing. Jaroslav Skřivánek, Ing. Karel Smékal, Ing. Jiří Starý, Ing. Tomáš Stranyánek, Ing. Marek Tretera, Ing. Tomáš Vašíček, Ing. Petr Wandrol

## **Administrative and Technical Staff**

Jarmila Bartošková, Ing. Zdeněk Buřival, CSc., doc. RNDr. Milan Calábek, CSc., doc. RNDr. Miroslav Cenek, CSc., Ing. Petr Kahle, Ing. Martin Kocian, Rudolf Krásenský, Ing. Jan Mertl, Ing. Pavel Nečesal, Ing. Vítězslav Novák, Ph.D., Dagmar Prosová, Ing. Jiří Starý, doc. Ing. Jiří Vondrák, DrSc.

## Main Interests

In 2004 the department provided tuition in the subject Materials and technical documentation in the first year of the Bachelor's degree programme for both full-time and part-time students as well as instruction in subjects focusing on production processes, electrotechnical materials, printed circuit technology and surface mounting, diagnostics and reliability of electrotechnical materials and production, design systems in the Bachelor's and Master's degree programmes.

Research was focused on basic and applied research of renewable electrical power sources and their exploitation in alternative transport by electric and hybrid vehicles, detection of signal electrons and methods of environmental scanning microscopy, gel electrolytes and their application in lithium-ion batteries, electrocatalysts for fuel cells and thin-film electrodes for electrochromic systems, lead-free soldering and evaluation of the quality and reliability of soldered connections and diagnostics of electrotechnical materials.

The department cooperated with Technische Universität Wien, Universität Ulm - Zentrum für Sonnenenergie - und Wasserstoff-Forschung, École Polytechnique de Montréal, workplace Nanolytics in Feldkirchen, Institute of Instrumentation Technology, Institute of Inorganic Chemis-

## Major Achievements

The 5th International Conference Advanced Batteries and Accumulators (A. B. A. - 5) Brno (Marie Sedlaříková, Jiří Vondrák) was held in 2004.

In cooperation with the Institute of Inorganic Chemistry of Academy of Science the department co-organized the 6th International Meeting on Electrochromism Brno (Marie Sedlaříková, Jiří Vondrák, ).

The department also co-organized, with the Czech Electrotechnical Society, the International conference 25. Chemical sources of electric energy, Tuchlovice (Milan Calábek).

The department's staff participated in two GACR, three GAAV, two FRVS projects and in two research plans.

try and Institute of Physical Chemistry of Academy of Science of the Czech Republic, companies Biochemie Bohumín, CINK vodní elektrárny (hydroelectric plants) Karlovy Vary, ČAS-Service Znojmo, EPRONA a.s. Rokytnice n. Jizerou, ROTOKOV Křídlovky u Znojma. Within the framework of the programme KON-TAKT the department cooperated with the National Institute of Chemistry, Ljubljana.

It is assumed that in 2005 research in all mentioned areas will continue. Work will start on the newly obtained research plan 'Resources, Accumulation and Optimization of Electric Power Exploitation in Conditions of Permanently Sustainable Growth' scheduled for 2005 – 2009.

The 6th International Conference Advanced Batteries and Accumulators (A. B. A. - 6) will be held in 2005.

The department will host the meeting of the institutes and departments of electrotechnology of the Czech and Slovak technical universities.

Upgrading of instruction laboratories continues as well as increased utilization of the library for self-study, access to computer laboratories connected to the Internet for students outside instruction time, and subjects of the starting Bachelor's and Master's programmes are prepared.

Under the leadership of Prof. Jiří Kazelle the research plan 'Resources, Accumulation and Optimization of Electric Power Exploitation in Environmental Applications' was completed.

The department's staff worked out and submitted, together with representatives of the Departments of Power Electrical and Electronic Engineering, Power Electrical Engineering and Theoretical and Experimental Electrical Engineering proposal of a new research plan 'Resources, Accumulation and Optimization of Electric Power Exploitation in Conditions of Permanently Sustainable Growth' (investigator: Jiří Kazelle).

Marie Sedlaříková successfully accomplished habilitation proceedings and was granted the title Associate Professor. Associate professor Jiří Vondrák was appointed Professor.



An innovated laboratory for research, instruction and elaboration of Bachelor's and diploma theses

in the area of printed circuit technology and surface mounting was set up (Jiří Stary).

### Major Research Projects

#### **ALABC N4.2 Optimization of Negative Active Material and PSOC Cycle Life of Batteries for 42V Mild Hybrid Applications, N4.2**

Investigator: Milan Calábek

#### **Complex Study of the Internal Resistance of Lead Accumulator in Situ – AVČR B 2813305**

Investigator: Petr Křivák

#### **Scanning Electron Microscopy for Research of Moist Materials – S2065107**

Investigators: Rudolf Zátřata, Josef Jirák

#### **Study of Active Mass and Contact Layers in Lead Accumulator Electrodes in Situ – GAČR 102/02/0794**

Investigators: Milan Calábek

#### **Transport, Solvation and Sorption of Ions in Gel Polymer Electrolytes – GAČR 104/02/0731**

Investigator: Marie Sedlaříková

#### **Composite Electrode Materials Deposited on Ion Exchanging Membranes – AVČR KJB 4813302**

Investigator: Vítězslav Novák

#### **Resources, Accumulation and Optimization of Electric Power Exploitation in Environmental Applications – SRČR MSM 262200010**

Investigator: Jiří Kazelle

### Selected Publications

HRNČIŘÍK, P., MULLEROVÁ, I. Very Low Energy Scanning Electron Microscope. *GIT Imaging & Microscopy*, ISSN 1439-4243, 2004, Vol. 6, No. 4, pp. 47 - 49.

VANĚK, J., CHOBOLA, Z., HASSE, L. Effect of illumination on noise of silicon solar cell. *Elektronika*, ISSN 0033-2089, 2004, Vol. 2004, No. 5, pp. 16 - 17.

VONDRÁK, J., REITER, J., SEDLAŘÍKOVÁ, M. PMMA-based aprotic gel electrolytes. *Solid State Ionics*, 2004, Vol. 2004, No. 170, pp. 79 - 82.

### Bachelor's Programme

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

Design and Technology of Electric Devices (Vítězslav Novák)

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 (Petr Bača)

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

CAD 1 (Pavel Procházka)	Fundamentals of Reliability in Electrical Engineering (Helena Polsterová)
CAD 2 (Jiří Maxa)	Graphic Systems 2 (Pavel Procházka)
CADD5 basic 3D modelling (Jiří Maxa)	Manufacturing of Power Devices (František Veselka)
CADD5 Manufacturing (Jiří Maxa)	Materials in Electrical Engineering (Karel Liedermann)
Climatotechnology in Electrical Engineering (Karel Liedermann)	Printed Circuits and Surface Mount Technology (Jiří Starý)
Computer Aided Scheme Systems (Vítězslav Novák)	Production Processes (Jiří Kazelle)
Design of Production Systems and Logistic (Jiří Špinka)	Reliability of Power Devices and Systems (Helena Polsterová)
Design View (Jiří Maxa)	Special Materials (Karel Liedermann)
Diagnostics and Testing in Electrical Engineering (Josef Jirák)	
Ecology in Manufacturing (Miroslav Cenek)	

## Doctoral Programme

Accumulators and Protection of Environment (Miroslav Cenek)	Chemical Sources of Electric Energy in Electrotechnical Practice (Milan Calábek)
Diagnostics of Semiconductor Materials and Structures (Josef Jirák)	Methods of Measurement in Electrochemical Power Sources (Jiří Vondrák)
Electron Spectroscopies (Luděk Frank)	Optoelectronics - Materials and Technology (Rudolf Autrata)

## Laboratories

**Air-conditioned Laboratory of Dielectric Materials with Highly Specialized Environment** (research of dielectric properties of electroinsulating materials, measurements at stabilized temperatures and relative air moisture, Svatopluk Havlíček)

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

**Electron Microscopy Laboratory** (laboratory exercises in Diagnostics and Testing in Electrical Engineering, research of signal detection in environmental scanning electron microscopy, of the structure of accumulator mass and surfaces of electrotechnical materials, namely insulators, Josef Jirák)

**Laboratory of Electrotechnical Materials I** (laboratory exercises in Materials and Technical Documentation, 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, Zdenka Rozsivalová)

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

**Laboratory of Chemical Power Sources** (research of lead accumulators, Milan Calábek)

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

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

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

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

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

**Computer Systems Laboratory** (instruction in subjects concerned with reliability in electrical engineering, computer-aided projecting of electrotechnical manufacturing and logistics, computer-aided design of printed circuits, Helena Polsterová)

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

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



# Department of Physics

## **Doc. Ing. Lubomír Grmela, CSc.**

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## **Professors**

Prof. Dr. Ing. Josef Šíkula, DrSc.  
Prof. RNDr. Pavel Tománek, CSc.

## **Associate Professors**

Doc. Ing. Lubomír Grmela, CSc.  
Doc. RNDr. Pavel Hruška, CSc.  
Doc. RNDr. Milena Kheilová, CSc.  
Doc. Ing. Karel Liedermann, CSc.  
Doc. RNDr. Marian Štrunc, CSc.

## **Lecturers**

RNDr. Milada Bartlová, Ph.D., Ing. Jitka Brüstlová, CSc., RNDr. Pavel Dobis, CSc., RNDr. Eva Hradilová, Ing. Pavel Koktavý, CSc., RNDr. Naděžda Uhdeová, RNDr. Oldřich Veverka, RNDr. Vladimír Zdražil, Ph.D.

## **Postgraduate Students**

Ing. Mustafa M. Abdalla Ahmed, Ing. Zidan Dawo Basher, Ing. Martin Bláha, Ing. Salem Omar Saeid El-Fakhri, Ing. Jan Havránek, Ing. Štěpán Hefner, Ing. Vladimír Holcman, Ing. Jaroslav Kala, Ing. Petr Létal, Ing. Jiří Majzner, Mgr. Dana Otevřelová, Ing. Jaromír Pelčák, Ing. Petr Sedlák, Ing. Vlasta Sedláková, Ing. Rostislav Stráník, Ing. Jiří Zajaček

## **Administrative and Technical Staff**

Eva Biskupová, Lenka Horká, Ing. Jiří Majzner, Miroslav Sadovský, Ing. Petr Sadovský, Ing. Vlasta Sedláková, Ing. Vít Vrba

## Main Interests

In 2004 the department provided tuition in the basic courses of the Bachelor's programme Physics 1, Physics 2 and Physics for Information Technology as well as the course Physics III for the ending Master's programme as four subjects in the Doctoral degree programme.

The department was involved in basic and particularly applied research of the physical parameters of materials and semiconductors and dielectric materials. The main areas of interest were noise spectroscopy, measurement of nonlinearities and design of quality and reliability

indicators for assessment of the particular technological stages in mass production. Among further areas of interest were local spectroscopy, topography, photoluminescence of semiconductor surfaces and dielectric relaxation spectroscopy. The department cooperated with major European and Japanese laboratories of noise spectroscopy and nanooptics.

Emphasis was laid in 2004 on updating the tasks for Physical practice and on multimedia study materials for instruction in computer rooms and self-study.

## Major Achievements

In 2004 the department was involved in four GACR projects, two international KONTAKT projects and one COST, INGO and FRVS project. The GACR projects dealt with non-linear defectoscopy of solid matter, irreversible processes in dielectrics and processes affecting energy transport in arc discharge with liquid stabilization.

The international KONTAKT projects, where the chief investigators are Prof. J. Šikula and Prof. P. Tománek, are focused on research of noise in HEMT components for global communication and on study of local optical and electrical properties of semiconductors and nanostructures. Cooperation was established with MEISEI university in Tokyo and Osaka where we can use unique technological facilities for experiments. At the

present time Dr. Jan Pavelka is on a study stay at MEISEI university in Tokyo.

A majority of the academic staff of the department participated in the research plan MSM 2600022 – MIKROSYT where Lubomír Grmela is the co-investigator.

In June 2004 the department co-organized and international symposium of IMAPS (International Microelectronics and Casing Association) held in Prague. The chairman of the symposium 3rd EMPS 2004 was Prof. J. Šikula.

In November 2004 the department organized the conference New Trends in Physics 2004 (NTF 2004) with 91 contributions.

Lecture notes Physical practice, Uhdeová et al were issued.

## Major Research Projects

### **Detection of Fissures in Solids by Electromagnetic Emission – GACR 102/02/D073**

Investigator: Pavel Koktavý

### **Irreversible Processes in Electroinsulating Materials for High Temperatures – GACR 102/03/0621**

Investigator: Pavel Koktavý

### **Non-Linear Ultrasonic Defectoscopy of Solids – GACR 205/03/0071**

Investigator: Josef Šikula

### **The Study of Processes Influencing Radial Transport of Energy in a Liquid-Stabilized Electric Arc – GACR 202/02/1027**

Investigator: Milada Bartlová

## Selected Publications

COUFAL, O., BARTLOVÁ, M. Influence of concentration on the values of recombination and ionization rate coefficients of atoms S and F. *Czechoslovak Journal of Physics*, ISSN 0011-4626, 2004, Vol. 54, No. Suppl. C, pp. 665 - 670.

KOKTAVÝ, P., PAVELKA, J., ŠIKULA, J. Characterization of acoustic and electromagnetic emission sources. *Measurement Science and Technology*, ISSN 0957-0233, 2004, Vol. 15, No. 1, pp. 973 - 977.

SEDLÁKOVÁ, V., MELKES, F., DOBIS, P., ŠIKULA, J., TACANO, M., HASHIGUCHI, S. Non-linearity changes induced by current stress in thick film resistors. *Capacitor and Resistor Technology*, ISSN 0887-7491, 2004, Vol. 2004, No. 24, pp. 154 - 158.

ŠIKULA, J., HLÁVKA, J., SEDLÁKOVÁ, V., GRMELA, L., HOSCHL, P., ZEDNÍČEK, T., SITA, Z. Conductivity Mechanisms and Breakdown of NbO Capacitors. *Capacitor and Resistor Technology*, ISSN 0887-7491, 2004, Vol. 2004, No. 1, pp. 141 - 146.

ŠIKULA, J., SEDLÁKOVÁ, V., DOBIS, P. Noise and Non-Linearity as Reliability Indicators of Electronic Devices. *Informacije MIDEEM*, ISSN 0352-9045, 2004, Vol. 2003, No. 4, pp. 213 - 221.

TOMÁNEK, P., BENEŠOVÁ, M., DOBIS, P., BRÜSTLOVÁ, J., UHDEOVÁ, N. Local photoluminescence measurements of semiconductor surface defects. *Proceedings of SPIE*, ISSN 0277-786X, 2004, No. 5477, pp. 131 - 137.

TOMÁNEK, P., BENEŠOVÁ, M., OTEVŘELOVÁ, D., DOBIS, P. Scanning near-field optical microscopy in semiconductor research. *Physics of low-dimensional structures*, ISSN 0204-3467, 2004, Vol. 2004, No. 1/2, pp. 47 - 53.

UHDEOVÁ, N. Distance Learning at the Technical Universities in the Czech Republic: present state and future. *Ingenieurpädagogik*, ISSN 0724-8873, 2004, Vol. 50, No. 9, pp. 521 - 525.

## Bachelor's Programme

Physics 1 (Pavel Dobis)

Seminar of Physics (Eva Hradilová)

Physics 2 (Milena Kheilová)

## Master's Programme

Fundamentals of Optoelectronics (Pavel Tománek)

## Doctoral Programme

Dielectric Relaxation Spectroscopy (Karel Liedermann)

Selforganisation Processes in Nonequilibrium Nonlinear Systems (synergetics) (Marian Štrunc)

Modern Aspects of Optics (Pavel Tománek)

Stochastic Processes in Solids (Josef Šikula)

Physics of Semiconductor Interfaces and Structures (Pavel Hruška)

## Laboratories

**Czech Electronic Noise Research Laboratory** (research of low-frequency noise, noise spectroscopy, development of non-destructive diagnostic methods and indicators of the reliability of materials and microelectronic components, instruction in Physics of Semiconductors, Structures and Interfaces and Noise Spectroscopy, Josef Šikula)

**Laboratory of Dielectric Spectroscopy** (research of dielectric relaxation spectroscopy, monitoring molecular dynamics of dielectric materials, instruction in Non-Destructive Diagnostics of Materials, Semiconductors and Dielectrics, Karel Liedermann)

**Laboratory for Physics** (instruction in Physics 1, Physics 2 and Physics for Information Technology, Pavel Dobis)

**Laboratory of Nanometrology** (contactless investigation of material surfaces with transversal super-resolution by means of near-field scanning microscopy, instruction in Physical Fundamentals of Optoelectronics, Modern Aspects of Optics, Pavel Tománek)



# Department of Languages

## **PhDr. Milena Krhutová, Ph.D.**

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## **Lecturers**

Mgr. Marie Bartošová, Mgr. Ladislav Baumgartner, PaedDr. Alena Baumgartnerová, PhDr. Marcela Borecká, M. A. Kenneth Froehling, PhDr. Milena Krhutová, Ph.D., PhDr. Dagmar Malíková, Mgr. Jana Malíková, Mgr. Jana Matoušková, PhDr. Ludmila Neuwirthová, Ing. Helena Pálková, PAED IGIP, Mgr. Jaroslav Trávníček, Mgr. Danuše Zavřelová

## **Administrative and Technical Staff**

Lea Domanská, Hana Vondráčková

## Main Interests

In 2004 the department provided tuition not only for the Faculty of Electrical Engineering, but also for the Faculty of Information Technology and the Faculty of Business and Management. The offered courses focused on language of profession (management informatics) in both English and German. The numbers of courses were increased in order to meet the requirements of all three faculties.

Applied in instruction were the results of research into English as a language of profession. Within the framework of the integrated development project for support of internationalization 'Preparation of aids and study texts in English for selected subjects of the Bachelor's degree programme' new didactic devices, dictionaries sets of textbooks and professional literature were acquired. Accessible on the Intranet are study texts in English for selected subjects of the Bachelor's programme and software for language instruction.

Linguistic research of English as a language of profession in the field of science and technology continued as well as applied linguistics research focused on standardization of language skills of BUT graduates related to the standards of the European reference framework. Research results

## Major Achievements

The department's staff presented the following papers at international conferences and in international papers :

Krhutová, M.; Neuwirthová, L; Malíková, D; Malíková, J. Participation in the project 'Preparation of study aids and texts in English for selected subjects of the Bachelor's degree programme', investigator: Milena Krhutová

Neuwirthová, L. Participation in the international research project Leonardo da Vinci CZ/02-134009 – 'Interactive and Unified E-Based Education and Training in Electrical Engineering', investigator: Vítězslav Hájek

Malíková, D. Participation in international research project Leonardo da Vinci CZ/02/B/F/LA-1340437 – 'Writing Professional English', investigator: Zuzana Svobodová, FME VUT

were presented at international linguistic and engineering conferences and in scientific journals.

The department cooperated with the other language department in preparation of language tuition in Bachelor's programmes, and with the Language Centre of Masaryk University. The staff participated in the Leonardo da Vinci projects and in cooperation with the Department of English and American Studies of Wien Universitat, Austria.

The increasing scope of tuition will require enlargement of the department in 2005. Results of the development project will be accessible in a virtual study room for the students to improve their language skills outside lessons.

Results of linguistics and applied linguistics research are applied in the curricula. This work will continue, and research of English as a language of international communication (English as Lingua Franca) will be commenced in cooperation with the Department of English and American Studies, Universitat Wien. The Department of Languages together with the Department of Microelectronics will work on classification of professional electrotechnical terminology.

Borecká, M. Participation in research project 'Information and Control Systems', investigator: Jan M. Honzík, FIT VUT

Matoušková, J. Participation in FRVS project – 'Computer rooms of the Departments of Mathematics and Languages', investigator: Zdeněk Šmarda

Krhutová, M. 'Specific Stylistic Features of English of Electrical Engineering' paper presented at the international conference INEER 'Progress Through Partnership', Olomouc, ČR.

Krhutová, M.; Malíková, D. 'English as a Language of Professionals in Science and Technology'. Paper at the international conference on language education 'English is Not Enough', Olomouc, ČR.

Neuwirthová, L. 'Standardising Foreign Language Knowledge in Electrical Engineering Edu-

ation'. Paper at the international conference INEER "Progress Through Partnership", 2004, pp. 1683-1686.

Neuwirthová, L. 'Foreign Language Standards as a Framework for University Language Courses'. Paper at the 8th international conference CercleS 'University Language Centres': 'Broadening Horizons, Expanding Networks'. Komenský University, Bratislava, SROV.

Neuwirthová, L. 'Professional language in pre-graduate study' Masaryk University Brno: CPV PDF MU, 2004, pp.29-34.

Froehling, K. The "tourtiere" and Its Link to One's French Canadian Heritage. Participation at international conference 'Place and Memory in Canada: Global Perspectives', Cracow, Poland

Baumgartner, L. 'Fachsprachliche Standards Berufsorientierung des Fremdsprachenunterrichts' Paper at the international conference "Lingua Germanica", Plzeň, ČR.

Malíková, D. 'An Instruction Tool for Effective Technical/Scientific Writing in English', Paper at the international conference 'Progress Through Partnership', Olomouc, ČR.

### Selected Publications

KRHUTOVÁ, M. *Stylistic Features of English of Electrical Engineering* In iNEER International Conference on Engineering Education and Research "Progress Through Partnership". Czech Republic, Technical University of Ostrava, 2004, spp1 – 6.

NEUWIRTHOVÁ, L. *Standardising Foreign Language Knowledge in Electrical Engineering Education*. iNEER International Conference on Engineering Education and Research "Progress Through Partnership". Czech Republic: VŠB - Technical University of Ostrava, 2004, pp. 1683 - 1 686.

### Bachelor's Programme

Bookkeeping for Managers (Helena Pálková)  
Business English (Dagmar Malíková)  
Culture of Speech and the Generation of Texts (Helena Pálková)  
Double-Entry Bookkeeping (Helena Pálková)  
Engineering Pedagogy and Didactics (Helena Pálková)  
English for Bachelors - Intermediate (Jaroslav Trávníček)  
English Everyday Conversation (Kenneth Froehling)  
English for Bachelors - Pre-Intermediate (Alena Baumgartnerová)  
English for Bachelors (Jaroslav Trávníček)

German for Beginners (Ladislav Baumgartner)  
German for Intermediate Students I (Ladislav Baumgartner)  
German for Lower-Intermediate (Ladislav Baumgartner)  
Laboratory Didactic (Helena Pálková)  
Pedagogical Practice (Helena Pálková)  
Pedagogical Psychology (Helena Pálková)  
Professional English for Electrical Engineering and Computer Science (Ludmila Neuwirthová)  
Professional Success (Helena Pálková)  
Reading Skills (Marcela Borecká)

### Master's Programme

Bookkeeping for Managers (Helena Pálková)  
Business English (Dagmar Malíková)  
Double-Entry Bookkeeping (Helena Pálková)  
English Everyday Conversation (Kenneth Froehling)  
Ethics in Making the Business (Helena Pálková)  
German for Beginners (Ladislav Baumgartner)

German for Intermediate Students I (Ladislav Baumgartner)  
German for Lower-Intermediate (Ladislav Baumgartner)  
Headway Pre-Intermediate (Marie Bartošová)  
Headway Upper-Intermediate (Kenneth Froehling)

New Headway Intermediate (Jana Matoušková)  
Professional English for Electrical Engineering  
and Computer Science (Ludmila Neuwirthová)

Reading Skills (Marcela Borecká)  
Russian for Beginners (Alena Baumgartnerová)  
Spanish for Beginners (Marcela Borecká)

### **Doctoral Programme**

English for Post-Graduates (Dagmar Malíková)

# Department of Mathematics

## **Prof. RNDr. Jan Chvalina, DrSc.**

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## **Professors**

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

## **Associate Professors**

Doc. RNDr. Jaromír Baštinec, CSc.  
Doc. RNDr. Jaroslav Bayer, CSc.  
Doc. RNDr. Zdeněk Šmarda, CSc.  
Doc. RNDr. Josef Zapletal, CSc.

## **Lecturers**

RNDr. Lubomir Bajgar, Mgr. Helena Durnová, Ph.D., RNDr. Mgr. Břetislav Fajmon, Ph.D., RNDr. Petr Fuchs, Ph.D., Mgr. Jan Koláček, RNDr. Edita Kolářová, RNDr. Martin Kovár, Ph.D., RNDr. Vlasta Krupková, CSc., Mgr. Michal Novák, Ph.D., Mgr. Irena Růžicková, RNDr. Svatopluk Švarc, CSc., Mgr. Marie Tomšová

## **Postgraduate Students**

Ing. Jaroslav Klimek

## **Administrative and Technical Staff**

Prof. RNDr. Josef Diblík, DrSc., Marie Krejčířová, Prof. RNDr. František Neuman, DrSc.

## Main Interests

In 2004 the department was responsible for tuition in mathematical subjects in the Bachelor's and the ending Master's programme, including a number of courses for the Faculty of Information Technology.

Research was focused on mathematical models of processes described by differential and difference equations with strong non-linearities, delay and Wiener processes, mainly feedback time delay and random perturbations. In discrete approach, acting of algebraic structures have been studied on state spaces of discrete systems and hyperstructures of transformation and differential operators with regard to application in sensitivity analysis of systems. Mathematical structures generated in modelling of processes in integrated circuits described by functional equations with focus on solution, stability and optimal control were among further areas studied. Algorithms were designed for automatic generation of some parts of discretization network. Selection of parts emphasized practical applications in analysis of

## Major Achievements

Assoc. Prof. Baštinec and Prof. Chvalina co-organized the international conference XXII. International Colloquium on Acquisition Process Management, Vyškov.

Prof. Neuman a Assoc. Prof. Baštinec organized the Seventh Crimean International Workshop on the Method of Lyapunov Functions and their Applications, Crimea, Alushta, Ukraine.

Prof. Diblík and Prof. Chvalina co-organized the 3rd International Mathematical Workshop, Faculty of Civil Engineering, BUT Brno

Two computer rooms were set up (each containing 28 computers) for solving application problems using mathematical software.

The department's academic staff published several significant contributions in prestigious journals:

DIBLÍK, J. Anti-Lyapunov method for systems of discrete equations, *Nonlinear Analysis, Theory, Methods & Applications*, 57 (2004), 1043-1057.

passive electronic components. Resistors fields and adaptation and optimization of the methodology of numerical calculations of plane current, electrostatic and stationary magnetic fields using the finite elements method with focus on microelectronics were investigated.

The results were presented at the seminar 'Discussions on mathematical structures' organized by the department.

Close cooperation was maintained with Roger Williams University, Rhode Island, USA, Matematisches Institut Universität Stuttgart and technical universities in Klagenfurt, Dresden, Kiev, Udine and Žilina.

The department was visited by Prof. Bruce Burdick (Roger Williams University, USA), Prof. Gerhard Grimeisen (Matematisches Institut Universität Stuttgart), Prof. Khusainov a Prof. Gritsay (Technical University Kiev), Prof. Christine Nowak (Technical University Klagenfurt).

DIBLÍK, J. Asymptotic behaviour of solutions of discrete equations, *Functional Differential Equations*, 11 920040, 37-48.

DIBLÍK, J., BAŠTINEC, J. Subdominant positive solutions of the discrete equations  $\Delta u(k+n) = -p(k)u(k)$ , *Abstract and Applied Analysis*, 2004:6 (2004), 461-470.

CHVALINA, J., CHVALINOVÁ, L. Transposition hypergroups formed by transformation operators on rings of differentiable functions, *Italian Journ. Pure and Applied Mathematics*, 15 (2004), 93-106.

CHVALINA, J., MOUČKA, J. Hypergroups determined by orderings with regular edomorphism monoids, *Italian Journ. Pure and Applied Mathematics*, 16 (2004), 227-242.

KOVÁR, M. On weak reflections in some superclasses of compact spaces II, *Topology Appl.* 137 (2004), 195-205.

## Major Research Projects

### Differential Equations and Dynamic Equation on "Time Scales" – GACR 201/04/0580

Investigator: Josef Diblík

### Set Theoretical and Categorical Methods in Topological and Algebra – GACR 201/03/0933

Investigator: Miroslav Hušek

## Selected Publications

BAŠTINEC, J., DIBLÍK, J. One case of appearance of positive solutions of delayed discrete equations. *Applications of Mathematics*, ISSN 0862-7940, 2004, Vol. 48, No. 6, pp. 429 - 436.

BAŠTINEC, J., DIBLÍK, J. Subdominant positive solutions of the discrete equation  $\Delta u(k+n) = -p(k)u(k)$ . *Abstract and Applied Analysis*, ISSN 1085-3375, 2004, Vol. 2004, No. 6, pp. 461 - 470.

DIBLÍK, J. Anti-Lyapunov method for systems of discrete equations. *Nonlinear Analysis, Theory, Methods and Applications*, ISSN 0362-546X, 2004, Vol. 2004, No. 57, pp. 1043 - 1057.

DIBLÍK, J. Asymptotic behaviour of solutions of discrete equations. *Functional Differential Equations*, ISSN 0793-1786, 2004, Vol. 11, No. 1, pp. 37 - 48.

DIBLÍK, J., RŮŽIČKOVÁ, M. Existence of positive solutions of an initial problem for a nonlinear system of differential equations. *Rocky Mountain Journal of Mathematics*, ISSN 0035-7596, 2004, Vol. 2004, No. 34, pp. 923 - 944.

DIBLÍK, J., RŮŽIČKOVÁ, M. Exponential solutions of equations  $y'(t) = b(t)(y(t-d) - y(t-T))$ . *Journal of Mathematical Analysis and Application*, ISSN 0022-247X, 2004, Vol. 294, No. 1, pp. 273 - 287.

CHVALINA, J., CHVALINOVÁ, L. Transposition hypergroups formed by transformation operators on rings of differentiable functions. *Italian Journal of Pure and Applied Mathematics*, ISSN 1126-8042, 2004, Vol. 2004, No. 15, pp. 93 - 106.

CHVALINA, J., MOUČKA, J. Hypergroups determined by orderings with regular endomorphism monoids. *Italian Journal of Pure and Applied Mathematics*, ISSN 1126-8042, 2004, Vol. 2004, No. 16, pp. 227 - 242.

KOVÁR, M. On Weak Reflections in Some Superclasses of Compact Spaces II. *Topology and its Applications*, ISSN 0166-8641, 2004, Vol. 1, No. 137, pp. 195 - 205.

NEUMAN, F. A General Construction of Linear Differential Equations with Solutions of Prescribed Properties. *Applied Mathematics Letters*, 2004, Vol. 17, No. 1, pp. 71 - 76.

NEUMAN, F. Smooth and discrete systems - algebraic, analytic, and geometrical representations. *Advances in Difference Equations*; ISSN: 1687-1820, e-ISSN: 1687-1812, 2004, Vol. 2004, No. 2, pp. 111 - 120.

## Bachelor's Programme

Mathematical Seminar (Petr Fuchs)

Mathematics 1, 2 (Jan Chvalina)

Mathematics 3 (Břetislav Fajmon)

Selected Parts from Mathematics (Zdeněk Šmarda)

## Master's Programme

Differential Equations in Electrical Engineering (Josef Diblík)

Mathematical Statistics and Econometry (Josef Zapletal)

Probability and Statistics (Josef Zapletal)

## Doctoral Programme

Algebra, Combinatorics, Graphs (Václav Havel)  
Complex Variable in Electrical Engineering (Josef Diblík)  
Differential Equations in Electrical Engineering (Jaromír Baštinec)  
Discrete Processes in Electrical Engineering (Josef Diblík)  
Global Transformations of Functional Equations (František Neuman)

Impulse Function, Applications in Electrical Engineering (Zdeněk Šmarda)  
Logic (Václav Havel)  
Operational Analysis (Josef Zapletal)  
Statistical Methods of Data Processing (Josef Zapletal)  
Variational Calculus, Applications in Electrical Engineering (Zdeněk Šmarda)



# Department of Microelectronics

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

Head

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## **Professors**

Prof. Ing. Dalibor Bielek, 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, Ing. Edita Hejátková, RNDr. Michal Horák, CSc., Ing. Jaromír Hubálek, Ph.D., Ing. Radek Kuchta, Ing. Radovan Novotný, Ph.D., Ing. Jan Prášek, Ing. Roman Prokop, Ing. Milan Recman, CSc., Ing. Josef Šandera, Ph.D.

## **Postgraduate Students**

Ing. Martin Adámek, Ing. Zdeněk Bartoň, Ing. Daniel Bečvář, Ing. Jaromír Bílek, Ing. Tomáš Břich, Ing. Jindřich Bulva, Ing. Lukáš Daněk, Ing. Jan Drobek, Ing. Issa El Dbib, Ing. Tomáš Fořt, Ing. Lukáš Fucík, Ing. Tomáš Gubek, Ing. Jiří Háze, Ing. Radek Helán, Ing. Luboš Jakubka, Ing. Jaroslav Kadlec, Ing. Ahmad Khateb, Ing. Zdeněk Král, RNDr. Jan Krejčí, Ing. Radek Kuchta, Ing. Karel Malysz, Ing. Anar Mammadov, Ing. Vít Matoušek, Ing. Filip Mika, Ing. Břetislav Mikel, Ing. Feras Moualla, Ing. Kamil Nováček, Ing. Marek Novotný, Ing. Vít Ondruch, Ing. Robert Pasz, Ing. Radomír Plachejda, Ing. Jan Prášek, Ing. Tomáš Procházka, Ing. Roman Prokop, Ing. Ondřej Sajdl, Ing. Michal Skočdopole, Ing. Jiří Stehlík, Ing. Josef Šandera, Ph.D., Ing. Pavel Šteffan, Ing. Petr Tomiczek, Ing. Jaroslav Týnek, Ing. Cyril Vaško, Ing. Michal Vitovský, Ing. Lukáš Vojkůvka, Ing. Miroslav Zachariáš, Lubomír Znoj

## **Administrative and Technical Staff**

Ing. Daniel Bečvář, Ing. Jindřich Bulva, Jarmila Fučíková, Ing. Lukáš Fucík, Ing. Zuzana Grosmanová, Ing. Jiří Háze, Ing. Petr Hub, Ing. Jaromír Hubálek, Ph.D., Petra Jedličková, PhDr. Jarmila Jurášová, Ing. Jaroslav Kadlec, Ing. Břetislav Mikel, Ing. Thibault Mougel, Ing. Michal Skočdopole, Ing. Pavel Šteffan, Jan Žaloudek

## Main Interests

In 2004 the department provided instruction in basic subjects, mainly electronic components and circuits and subjects specialized in the design of integrated circuits and microelectronic technology in both the new and the ending system of the Bachelor's and Master's study programmes. Laboratories of microelectronic technologies and vacuum techniques have moved into new premises and the Laboratory of Design of Electronic Instrumentation of Systems focused on experimental research and students' projects.

Research was focused on basic and applied research of integrated circuits and sensors. The main areas of interest were the design of switching current circuits and evaluation of signals from chemosensors and biosensors, mainly gases and pesticides.

The department closely cooperated in pedagogical work (student stays) with Bournemouth Uni-

versity in Great Britain and with KHBO Oostende in Belgium and has had research cooperation with BVT Technologies Brno, Autoflug Hamburg, the ISEP University Paris (with Prof. B. Svietzeny), and research laboratory IMEC-KHBO in Belgium.

In 2005 the department will be engaged in the methods of the design of integrated current mode circuits and completion of the EU grant project on the sensor systems of aircraft fuel tanks. It is expected that the prototype of a portable device for analysis of heterogeneous substances in fruit and vegetables will be completed and the first results achieved in the EU project on remote monitoring of temperature in transport cooling boxes.

Increased attention will be paid to student stays abroad.

## Major Achievements

In 2004 the members of the department's staff participated in two projects of the 5th framework programme of the EU, in six GACR projects and 11 FRVS projects and in three projects of cooperation with industry of the Ministry of Trade and Industry.

In September 2004 the department organized the international conference Electronic Devices and Systems EDS2004 where 122 contributions on microelectronics and technology were presented.

Prof. J. Brzobohatý and Prof. J. Pospíšil developed a new concept of modelling non-linear dynamic systems. It was proven that connection of research with the modelling of non-linear dynamic systems with functional blocks and with the further development and optimization of the state models of these systems represents a completely

new unconventional approach to the theme of interdisciplinary character. The publication in the prestigious international journal 'International Journal of Chaos and Bifurcation in Applied Sciences and Engineering', often quoted in other international journals, is a proof of that.

Assoc. Prof. Ivan Szendiuch achieved remarkable results in modelling heat transfer in casing of integrated circuits and presented them at the IMAPS conference in Copenhagen and in Phoenix. Prof. Dalibor Bielek developed the theory of active frequency filters working in the current mode with the newly introduced (2003) CDTA (Current Differencing Transconductance Amplifier) active element, presented the principle and basic applications at international WSEAS conferences in Crete and Tenerife.

## Major Research Projects

**ANTOPE New Methods of Instrumentation Toxicity Analysis for Integrated Toxicity Measurements in Foodstuff Industry and Verification on a Prototype of Pesticide Toxicity Analyzer – MPO FD-K2/53**

Investigator: Radimír Vrba

**ECOFRIDGE Ecological Refrigeration - EUREKA CRAFT 1999-72067**

Investigator: Radimír Vrba

**Identification of the Parameters of Models of Semiconductor Structures – GACR 102/03/0720**

Investigator: Milan Recman

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

Investigator: Jaromír Hubálek

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

Investigator: Radimír Vrba

**Smart Microsensors and Microsystems for Measurement, Control and Environment – GACR 102/03/0619**

Investigator: Radimír Vrba

**Micro- and Nanostructures in Microelectronic Technology – GACR 102/04/P162**

Investigator: Jaromír Hubálek

**The Methodology of New Technology Design of Analogue Integrated Circuits – GACR 102/03/0721**

Investigator: Vladislav Musil

**New Principles and Working Blocks for Design of Integrated Circuits – GACR 102/02/1312**

Investigator: Jaromír Brzobohatý

**SMARTFUEL – EUREKA G4RD-CT-02-769**

Investigator: Jaromír Brzobohatý

**New Generation Pressure Sensor – PROGRES FF-P/112**

Investigator: Radimír Vrba

**Special Sensors for Research of Ionized Gases – GACR 102/02/1311/A**

Investigator: Vladislav Musil

**Development of Microelectronic Mounting Technology for 3D Circuits and Systems – GACR 102/04/0590**

Investigator: Ivan Szendiuch

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

Investigator: Radimír Vrba

**Research of Microelectronic Systems and Technologies – SRCR MSM 262200022**

Investigator: Radimír Vrba

### **Selected Publications**

BIOLEK, D., BIOLKOVÁ, V. Secondary Root Polishing: Increasing the Accuracy of Semisymbolic Analysis of Electronic Circuits. *WSEAS Transactions on Mathematics*, ISSN 1109-2769, 2004, Vol. 3, No. 3, pp. 493 - 497.

BIOLEK, D., BIOLKOVÁ, V. Simulating Arbitrary Transfer Function by CDTA-Based Current Divider. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 3, No.9, pp. 1815 - 1 819.

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BITTENCOURT, C., LLOBET, E., IVANOV, P., CORREIG, X., VILANOVA, X., BREZMES, J., HUBÁLEK, J., MALYSZ, K., PIREAUX, J., CALDERER, J. Influence of the doping method on the sensitivity of Pt-doped screen-printed SnO<sub>2</sub> sensors. *Sensors and Actuators B: Chemical*, ISSN 0925-4005, 2004, Vol. B97, No 1, pp. 67 - 73.

FUJCIK, L., VRBA, R., KREJČÍ, J. The Biosensor Signal Analysis in Portable Microfluidic Device. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 2004, No. 9, pp. 1965 - 1 967.

- HÁZE, J., VRBA, R. Error Correction and Compensation in Capacitive Sensor Systems. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 2004, No. 1, pp. 1939 - 1 941.
- HÁZE, J., VRBA, R., SKOČDOPOLE, M., FUJCIK, L. Low Power SC Pipelined ADC Using Op-Amp Sharing Approach. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 2004, No. 9, pp. 1959 - 1 961.
- HUBÁLEK, J., MALYSZ, K., PRÁŠEK, J., VILANOVA, X., IVANOV, P., LLOBET, E., BREZMES, J., CORREIG, X., SVĚRÁK, Z. Pt-loaded Al<sub>2</sub>O<sub>3</sub> catalytic filters for screen-printed WO<sub>3</sub> sensors highly selective to benzene. *Sensors and Actuators B: Chemical*, ISSN 0925-4005, 2004, Vol. 101, No. 3, pp. 277 - 283.
- IVANOV, P., LLOBET, E., VILANOVA, X., BREZMES, J., HUBÁLEK, J., CORREIG, X. Development of high sensitivity ethanol gas sensors based on Pt-doped SnO<sub>2</sub> surfaces. *Sensors and Actuators B: Chemical*, ISSN 0925-4005, 2004, Vol. 99, No.1, pp. 201 - 206.
- IVANOV, P., LLOBET, E., VILANOVA, X., BREZMES, J., HUBÁLEK, J., MALYSZ, K., CORREIG, X. A route toward more selective and less humidity sensitive screen-printed SnO<sub>2</sub> and WO<sub>3</sub> gas sensitive layers. *Sensors and Actuators B: Chemical*, ISSN 0925-4005, 2004, Vol. 100, No. 1-2, pp. 221 - 227.
- KADLEC, J., VRBA, R., SAJDL, O. New method of pressure sensing in explosive industrial environment. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 2004, No. 9, pp. 1936 - 1 938.
- KOLKA, Z., BIOLKOVÁ, V., BIOLEK, D. Exploiting Matrix Sparsity for Symbolic Analysis. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 3, No. 10, pp. 2278 - 2 281.
- KREJČÍ, J., PRÁŠEK, J., FUJCIK, L., KHATIB, S., HEJÁTKOVÁ, E., JAKUBKA, L. Screen-printed sensors with graphite electrodes - comparison of properties and physical method of sensitivity enhancement. *Microelectronics International*, ISSN 1356-5362, 2004, Vol. 21 No. 3, pp. 20 - 24.
- KUCHTA, R., VRBA, R., FUJCIK, L. Neural network for waste-water recognition. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 2004, No. 9, pp. 1968 - 1 970.
- POSPÍŠIL, J., KOLKA, Z., HANUS, S., MICHÁLEK, V., POSPÍŠIL, V., BRZOBOHATÝ, J. Fully-Generalized State Model of Optimized Third-Order Dynamical Systems of Class C. *WSEAS Transactions on Systems*, ISSN 1109-2777, 2004, Vol. 3, No. 5, pp. 2021 - 2 024.
- PROKOP, R., VRBA, R., SKOČDOPOLE, M. Design of the optimum current mode second order active filters using Current Conveyors. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 2004, No. 9, pp. 1974 - 1 976.
- SAJDL, O., VRBA, R. Static and Dynamic ADC Integral Nonlinearity Estimation. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 2004, No. 9, pp. 1933 - 1 935.
- SKOČDOPOLE, M., VRBA, R., HÁZE, J., FUJCIK, L. RSD Algorithm Implementation to Semiflash ADC. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 2004, No.9, pp. 1971 - 1 973.
- ŠANDERA, J., SZENDIUCH, I. FR4-Ceramic "Z" Axis Solder Interconnection. *Journal of Electrical Engineering*, ISSN 1335-3632, 2004, Vol. 55, No. 9-10, pp. 256 - 260.
- ŠTEFFAN, P., VRBA, R., HÁZE, J. New Integrated Measurement System for Electrochemistry Microsensors. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 2004, No. 9, pp. 1962 - 1 964.
- ŠVĚDA, M., VRBA, R. Embedded System Specifications Reuse by a Case Based Reasoning Systems. *WSEAS Transactions on Computers*, ISSN 1109-2750, 2004, Vol. 2, No. 1, pp. 10 - 14.
- VRBA, R., ŠVĚDA, M., SAJDL, O. Smart Pressure Transducer Resistive to Aggressive Media. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 2004, No. 9, pp. 1942 - 1 944.
- VRBA, R., VEČEŘA, I. An algorithmic A/D switched-current converter for smart signal digitization with self-test features. *MEASUREMENT, Journal of the International Measurement Confederation (IMEKO)*, ISSN 0263-2241, 2004, Vol. 35, No. 2, pp. 153 - 160.
- ZEZULKA, F., VRBA, R., BRADÁČ, Z. Wireless Networked Single Sensors. *WSEAS Transactions on Electronics*, 2004, Vol. 2, No. 1, pp. 359 - 361.

## Bachelor's Programme

Analogue Electronic Circuits (Dalibor Biolek)  
Czech Language (Jarmila Jurášová)  
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)

## Master's Programme

Analogue and Digital Circuits (Radimír Vrba)  
Analogue Circuits (Jaromír Brzobohatý)  
Computers in Practical Management (Jaromír Hubálek)  
Design of Analogue CMOS Circuits (Vladislav Musil)  
Design of Digital CMOS Circuits (Vladislav Musil)  
Digital Circuits (Radimír Vrba)  
Management Minimum (Pavel Legát)  
Manufacturing of Electronics Devices (Ivan Szendiuch)

## Doctoral Programme

Electronics Systems Technology (Ivan Szendiuch)  
Interconversion of Analogue and Digital Signals (Radimír Vrba)  
Microelectronics and Management (Ivan Szendiuch)  
New Circuit Principles for IC Design (Jaromír Brzobohatý)

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 Biolek)  
Optoelectronics and Optical Communications (František Urban)  
VLSI Digital IC Design and VHDL (Daniel Bečvář)

Microprocessors Technology (Jaroslav Boušek)  
Modelling and Simulation (Vladimír Kolařík)  
Mutual Conversion of Analogue and Digital Signals (Radimír Vrba)  
Optoelectronics, Optical Communications and Nets (František Urban)  
PC Technology and Communication (Vladimír Kolařík)  
Quality Control (Jaromír Hubálek)  
Vacuum Technology (Jaroslav Boušek)

Nuclear Magnetic Resonance for Material Diagnostic (Karel Bartušek)  
Optoelectronic Transmission Systems and Networks (František Urban)  
Simulation of Digital Integrated Circuits (Vladislav Musil)  
Switched Circuits and Their Applications (Dalibor Biolek)

## Laboratories

**Laboratory of Biosensors** (research laboratory, Jaromír Hubálek)

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

**Laboratory of Microelectronic Technology** (thick films, soldering surface mounting, casing, instruction in Microelectronic Technology, student projects, Ivan Szendiuch)

**Electronic Instruments and Systems Design Laboratory** (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)

**Optoelectronics and Laser Laboratory** (instruction in Optoelectronics, implementation of the technical part of student projects, František Urban)

**Vacuum Technology Laboratory** (instruction in Vacuum Technology and Cryotechnology, Jaroslav Boušek and Josef Šandera)

**Computer Laboratory I and II** (numerical exercises for different subjects, students self-study, work with the Internet, Petr Hub)

# Department of Radioelectronics

## **Prof. Ing. Jiří Svačina, CSc.**

Head

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## **Professors**

Prof. Ing. Tomáš Dostál, DrSc.  
Prof. Ing. Jiří Pospíšil, DrSc.  
Prof. Dr. Ing. Zbyněk Raida  
Prof. Ing. Václav Říčný, CSc.  
Prof. Ing. Jiří Svačina, CSc.  
Prof. Ing. Vladimír Šebesta, CSc.

## **Associate Professors**

Doc. Ing. Stanislav Hanus, CSc.  
Doc. Ing. Miroslav Kasal, CSc.  
Doc. Dr. Ing. Zdeněk Kolka  
Doc. Ing. Jaromír Kolouch, CSc.  
Doc. Ing. Zdeněk Nováček, CSc.  
Doc. Ing. Milan Sigmund, CSc.  
Doc. Ing. Otakar Wilfert, CSc.

## **Lecturers**

Ing. Viera Biolková, Ing. Ivana Jakubová, Ing. Marta Krátká, Ing. Tomáš Kratochvíl, Ing. Roman Maršálek, Ph.D., Ing. Václav Michálek, CSc., Ing. Aleš Prokeš, Ph.D., Ing. Jiří Šebesta

## **Postgraduate Students**

Ing. Vladimír Axman, Ing. David Bělohrad, Ing. Milan Boštík, Ing. Karel Čermák, Ing. Jiří Dřínovský, Ing. Pavel Dýmal, Ing. Lukáš Džbánek, Ing. Jakub Džubera, Ing. Zbyněk Fedra, Ing. Ondřej Franek, Ing. Tomáš Frýza, Ing. Dalimil Gala, Ing. Ondřej Hála, Ing. Martin Hampl, Ing. Ivo Hertl, Ing. David Hlaváč, Ing. Martin Horák, Ing. Pavel Hovořák, Ing. Rostislav Hučka, Ing. Pavel Chytil, Ing. Tomáš Kašparec, Ing. Tomáš Kratochvíl, Ing. Martin Kravka, Ing. Petr Kučera, Andy Alexander Kuiper, Ing. Petr Kutín, Ing. Radek Kvíčala, Ing. Jaroslav Láčik, Vishwas Lakkundi, Ing. Zbyněk Lukeš, Ing. Pavel Matějka, Ing. Richard Menšík, Ing. Zdeněk Mikéska, Ing. Milan Motl, Ing. Vlastimil Navrátil, Ing. Viktor Otevřel, Ing. Jiří Petržela, Ing. Ondřej Pirochta, Ing. Petr Poměnka, Ing. Václav Pospíšil, Ing. Jan Prokopec, Ing. Bohdan Růžička, Ing. Zdeněk Růžička, Ing. František Řezníček, Ing. Petr Stančík, Ing. Tomáš Sutový, Ing. Václav Šádek, Ing. Jan Šebesta, Ing. Jiří Šebesta, Ing. Josef Šíp, Ing. Petr Šmíd, Ing. Jiří Špaček, Ing. Dalibor Štverka, Ing. Martin Švirák, Ing. Roman Tkadlec, Ing. Tomáš Urbanec, Ing. Michal Vavrda, Ing. Ivo Viščor, Ing. Martin Vlk, Ing. Josef Vochyán, Ing. František Vostál, Ing. Michal Zamazal, Ing. Luděk Závodný

## **Administrative and Technical Staff**

Květuška Bílá, František Horký, Anna Kalná, Radka Kielarová, Jaroslav Novák, Ing. Jan Prokopec, Bohuslava Raidová, Petra Šípová, Aleš Vanžura

## Main Interests

Tuition was provided in the Bachelor's degree programme (25 subjects in 5 areas), Master's degree programme (32 subjects in 4 areas) and Doctoral degree programme (17 subjects).

The department participated in a number of grant projects supported by various institutions and in cooperation with national and international institutions and companies. In 2004 the members of the

staff were involved in 50 research, development and professional pedagogical projects. The department was involved in the research plan 'Electronic communication systems and technologies' (investigator Prof. J. Svačina) and participated in another research plan 'Microelectronic systems and technologies' (investigator Prof. R. Vrba).

## Major Achievements

The frequency synthesizer PLL was implemented and detectors with follow-up digital signal processing for the transponder receiver of the Phase 3E AMSAT satellite were developed (to be launched in 2006). The investigator Assoc. Prof. M. Kasal was awarded a Special award of the Rector of the Brno University Technology.

The new EDGE technology for fast data transfer in the GSM network was verified and tested in cooperation of T-Mobile CZ and the department laboratory of mobile communication (the results were applied in introduction of the EDGE technology in T-Mobile CZ network at the end of 2004).

The department organized the 14th International Travelling Summer School on Microwaves and Lightwaves (in cooperation with IEEE, EuroTraining, TheNet, H-Test a DCom; with participation of

21 teachers a 47 students from 10 universities from seven European countries.

The department's staff obtained a remarkably high number of grant projects: 9 GACR projects (among them 3 doctoral projects), 31 FRVS projects and 10 research and development projects for other organizations (GAAV CR, T-Mobile CZ, National Security Agency, AMSAT DL, US Naval Academy, AMI Semiconductor).

Assoc. Prof. M. Kasal received the Siemens Award 2004 for research in satellite communication. Prof. Z. Raida received the Siemens AWARD 2004 for the prestigious scientific publication 'Analysis of microwave structures in time domain'. Prof. J. Svačina was awarded the Gold Medal of the Brno University of Technology for his contribution to the development of the research area Electronics and Communications.

## Major Research Projects

### **Analytic Modelling of Special Microwave Planar structures – GACR 102/04/0553**

Investigator: Jiří Svačina

### **Matrix Methods of Approximation Symbolic Analysis – AVCR KJB 2813301**

Investigator: Zdeněk Kolka

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

Investigator: Vladimír Šebesta

### **Modelling and Analysis of Transmission and Digital Signal Distortion in DTV and DVB – GA AV CR KJB2813302**

Investigator: Tomáš Kratochvíl

### **Special Phenomenon Modelling in Non-Linear Dynamic Structures – GACR 102/04/0469**

Investigator: Jiří Pospíšil

### **Mobile Network Modelling and Optimization – GACR 102/04/2080**

Investigator: Stanislav Hanus

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

Investigator: Jiří Pospíšil



**Non-conventional Methods of Modelling and Optimization of Microwave Structures – GACR 102/04/1079**

Investigator: Zbyněk Raida

**Novel Electronic Circuits with Modern Multiple- gate Operating Blocks – GACR 102/04/0442**

Investigator: Tomáš Dostál

**Novel Approach and Coordination of Doctoral Education in Radioelectronics and Related Disciplines – GACR 102/03/H086**

Investigator: Zbyněk Raida

**Research of Electronic Communication Systems and Technologies – SRCR MSM 262200011**

Investigator: Jiří Svačina

**Research of Digital Radio Communication Systems – GACR 102/04/0557**

Investigator: Vladimír Šebesta

**Selected Publications**

BIOLEK, D., BIOLKOVÁ, V. Secondary Root Polishing: Increasing the Accuracy of Semisymbolic Analysis of Electronic Circuits. *WSEAS Transactions on Mathematics*, ISSN 1109-2769, 2004, Vol. 3, No. 3, pp.93 - 497.

BIOLEK, D., BIOLKOVÁ, V. Simulating Arbitrary Transfer Function by CDTA-Based Current Divider. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 3, No. 9, pp. 1815 - 1 819.

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DOSTÁL, T. Modifikácii matric rešenija električeskoj cepi pri učjote komponentov, nereguljarnych dlja bazisa uzlovych naprjažeij. *Elektronika i svjaz*, ISSN 1811-4512, 2004, Vol. 9, No. 21, pp. 46 - 50.

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DOSTÁL, T., ČAJKA, J., VRBA, K. Design Procedure of Oscillators and Biquads Based on Current Conveyors. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 3, No. 5, pp. 1122 - 1 125.

DOSTÁL, T., ČAJKA, J., VRBA, K. General view on current conveyors. *International Journal of Circuit Theory and Applications*, ISSN 0098-9886, 2004, Vol. 2004, No. 3, pp 133 - 138.

DOSTÁL, T., POSPÍŠIL, J., HANUS, S., MICHÁLEK, V. *Computational Methods In Circuits and Systems Applications*. Chapter: Current mode state models of third-order dynamical systems. 1 issue. Greece: WSEAS Press, 2004. pp 243 - 246 . ISBN 960-8052-882

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MOTL, M., RAIDA, Z., LÁČÍK, J. Fast Frequency Sweep Technique in Envelope Finite Element Method with Absorbing Boundary Condition. *WSEAS Transactions on Computers*, 2004, Vol. 2004, No. 6, pp. 1903 - 1 906.

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TKADLEC, R., RAIDA, Z. A Novel Design of the Sample Holder for Broadband Complex Permittivity Measurements. *WSEAS Transactions on Computers*, ISSN 1109-2750, 2004, Vol. 2004, No. 6, pp. 1825 - 1 828.

## Bachelor's Programme

Analogue Electronic Circuits (Tomáš Dostál)	Communication Systems (Aleš Prokeš)
Audiofrequency Electronics (Vlastislav Novotný)	Computers and Programming 2 (Zbyněk Raida)
CAD of Communication Systems (Zbyněk Raida)	Electrical Filters (Tomáš Dostál)
CAD of Electronic Circuits (Zdeněk Kolka)	

Electronic Instruments Feeding (Vlastislav Novotný)  
Electromagnetic Compatibility (Jiří Svačina)  
Electronic Practice (Marta Krátká)  
EM Waves, Antennas and Lines (Zdeněk Nováček)  
Fundamentals of TV Technology (Václav Říčný)  
HF and Microwave Techniques (Stanislav Hanus)  
HF Techniques and Antennas (Miroslav Kasal)

### Master's Programme

Analog Circuits and Converters (Tomáš Dostál)  
Antennas and Radio Waves Propagation (Zdeněk Nováček)  
Audiofrequency Electronics (Vlastislav Novotný)  
CAD in HF and Microwave Techniques (Zbyněk Raida)  
CAD of Electronic Circuits (Zdeněk Kolka)  
Communication Theory (Vladimír Šebesta)  
Community Antenna Television (CATV) (Václav Říčný)  
Electromagnetic Compatibility (Jiří Svačina)  
Electronic Circuits and Filters Design (Tomáš Dostál)  
Electronic Circuits Theory (Jiří Pospíšil)  
Electronic Instruments Feeding (Vlastislav Novotný)  
Electronics (Jaromír Kolouch)  
EM Waves and Lines (Zdeněk Nováček)  
HF and Microwave Techniques (Stanislav Hanus)  
Microcomputers for Instrumental Applications (Václav Michálek)  
Microprocessor Techniques (Václav Michálek)

### Doctoral Programme

Electromagnetic Waves in Communications (Zdeněk Nováček)  
Methods for Modeling and Analysis of Electronic Circuits (Zdeněk Kolka)  
Modelling of Chaos in Electronic Circuits (Jiří Pospíšil)  
Modern Analogue Filters (Tomáš Dostál)  
Modern Methods In Optical Communication (Otakar Wilfert)

Microprocessor Techniques (Václav Michálek)  
Optoelectronics (Otakar Wilfert)  
Pulse and Digital Techniques (Jaromír Kolouch)  
Radio and Mobile Communication (Stanislav Hanus)  
Radio Receivers and Transmitters (Aleš Prokeš)  
Signals and Systems (Vladimír Šebesta)  
Special Electronic Devices and Their Applications (Jiří Svačina)

Object Oriented Programming in Pascal (Zbyněk Raida)  
Optoelectronics (Otakar Wilfert)  
Photonics and Optical Communications (Otakar Wilfert)  
Programmable Logic Devices (Jaromír Kolouch)  
Pulse and Digital Techniques (Jaromír Kolouch)  
Quantum and Laser Electronics (Otakar Wilfert)  
Radars and Navigation (Jiří Šebesta)  
Radio Links Design (Zdeněk Nováček)  
Radio Receivers and Transmitters (Aleš Prokeš)  
Radio Relay and Satellite Communication (Miroslav Kasal)  
Special Electronic Devices and their Applications (Jiří Svačina)  
Speech Signal Analysis and Synthesis (Milan Sigmund)  
Television Technique (Stanislav Hanus)  
Videotechnology (Václav Říčný)  
Wireless and Mobile Communications (Stanislav Hanus)

Neural Networks and Fuzzy Systems (Vladimír Mikula)  
New methods of Audio Signal Processing (Vlastislav Novotný)  
Numerical Methods in Electrical Engineering (Zbyněk Raida)  
Optimization in Electrical Engineering (Zbyněk Raida)

Photonics and Optical Communications (Otakar Wilfert)  
Selected Topics of Digital Wireless Communication (Aleš Prokeš)  
Selected Topics of Wireless and Mobile Communication systems (Stanislav Hanus)  
Selected Problems of TV Technique (Václav Říčný)  
Selected Topics of Signal Analysis (Vladimír Šebesta)

Selected Topics of Digital Techniques (Jaromír Kolouch)  
Signal Processing in Instrumental Applications (Miroslav Kasal)  
Special Measurement in EMC (Jiří Svačina)  
Special Types of Functional Blocks and their some Applications (Jiří Pospíšil)  
Speech Signal Processing for Speaker Recognition (Milan Sigmund)

## Laboratories

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

**Laboratory of Aerials and Electromagnetic Field** (research and instruction in electromagnetic fields, aerials and radio connections design, Zdeněk Nováček)

**Laboratory of Digital and Microprocessor Technology** (instruction in digital and microprocessor technology, Viera Biolková, Václav Michálek)

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

**Laboratory of Mobile Communication and HF Technology** (research and instruction in mobile communication and HF technology, Stanislav Hanus)

**Laboratory of Low-Frequency Applications** (instruction in low-frequency electronics and power supply of electronic devices, Jiří Šebesta)

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

**Laboratory of Signals and Data Transmission** (research and instruction in signals, systems and data transmission, Aleš Prokeš)

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

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

**Personal Computer Laboratory** (three computer rooms for instruction in circuits, signals and systems, and in 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, development of devices for digital video technology, Václav Říčný)

**Research Laboratory of Experimental Satellite Communication** (research and development of components and subsystems for satellite communication and navigation, telemetric and command station of the P3 satellite of the international organization AMSAT, Miroslav Kasal)

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

**Research Laboratory for Digital Processing of Signals** (research of methods and techniques of digital processing of signals, speech signal processing and digital radio technology, Vladimír Šebesta)

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

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

# Department of Telecommunications

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

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## **Professors**

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

## **Associate Professors**

Doc. Ing. Miloslav Filka, CSc.  
Doc. Ing. Vladimír Kapoun, CSc.  
Doc. Ing. Karel Němec, CSc.  
Doc. Ing. Ivan Rampl, CSc.  
Doc. Ing. Vladislav Škorpil, CSc.

## **Lecturers**

Ing. Miroslav Balík, Ph.D., Prof. Ing. Josef Čajka, DrSc., Ing. Radim Číž, Ing. Ivo Herman, CSc., Ing. Ladislav Káňa, Ing. Dan Komosný, Ph.D., Mgr. Otakar Kříž, Ing. Ivo Lattenberg, Ph.D., Ing. Jiří Mišurec, CSc., Ing. Karol Molnár, Ph.D., Ing. Zoltán Nagy, Ph.D., Ing. Vít Novotný, Ph.D., Ing. Jiří Schimmel, Ing. Petr Sysel, Ing. Pavel Šilhavý, Ph.D., Ing. Václav Zeman, Ph.D.

## **Postgraduate Students**

Ing. Mansour M. Abaid, Petr Berka, Ing. Kamil Bodeček, Ing. Milan Březina, Ing. Lubomír Cvrk, Ing. Jan Čermák, Ing. Radim Číž, Ing. Petr Daněček, Ing. Václav Eksler, Ing. Jiří Franek, Ing. Miroslav Gregořica, Ing. Martin Habr, Ing. Pavel Hanák, Ing. Pavel Hofírek, Ing. Aleš Holec, Ing. Marek Huczala, Ing. Petr Hujka, Ing. Pavel Kania, Ing. Michal Kohoutek, Ing. Vítězslav Kot, Ing. Ivan Koula, Ing. Vítězslav Krčmář, Ing. Jiří Krejčí, Ing. Václav Křepelka, Ing. David Kubánek, Ing. Tomáš Langer, Ing. Tomáš Lukl, Ing. Jiří Macola, Ing. Vladimír Malenovský, Ing. Martin Mareš, RNDr. Vladimír Mazálek, Ing. Tomáš Miklánek, Ing. Pavel Moučka, M.Sc. Jamal Ali Khalefa Mtaawa, Ing. Galal Abdo Awad Murshed, Ing. Ondřej Pavelka, Ing. Martin Plšek, Ing. Karel Polák, Mgr. Pavel Rajmic, Ph.D., Ing. Kamil Říha, Ing. Omer M. Salih, Ing. Khaled M. Shakhtur, Ing. Jiří Schimmel, Ing. Jaromír Skřípský, Ing. Jaroslav Snášel, Ing. Michal Soumar, Ing. Jan Stavárek, Ing. Vojtěch Stejskal, Ing. Martin Sýkora, Ing. Petr Sysel, Ing. Radek Šponar, Ing. Richard Štefíček, Ing. Miroslav Štěpán, Ing. Abdelgawad Taher, Ing. Jorge Truffin, Ing. Stanislav Uchytíl, Ing. Milan Vajdík, Ing. Martin Vítek, Ing. Martin Vondra, Ing. Jaroslav Vrána, Ing. Vít Vrba, Ing. Radek Zezula

## **Administrative and Technical Staff**

Ing. Lubomír Cvrk, Magda Lounková, Jitka Lukešová, Jitka Macháčková, Jaroslav Meixner, Pavel Novotný, Zdeněk Procházka, Mgr. Pavel Rajmic, Ph.D., Ing. Michal Soumar, Ing. Robert Vích, DrSc.

## Main Interests

The department is involved in instruction and research in the Bachelor's study programme Teleinformatics. The concept of the study programme reflects the convergence of communication and information technologies. The provided instruction seeks balance between mobile and stationary communications, computer systems and network, design of network applications in various programming languages. Instruction also covers design of analog and digital circuits, microprocessors and signal processors, and mainly their application. The students can also specialize in multimedia i.e. digital processing of speech, music and images. At the expense of nearly 3.1 million CZK the department set up a laboratory of multimedia services where those interested can learn how to set up and organize videoconferences, and other ways of communication.

## Major Achievements

In 2004 laboratory for testing modern network technologies was established. The central component of the laboratory is the pointer Cisco 2610XM and the switches Catalyst 3750G-24T-E and Catalyst C2950T-24 from Cisco Systems. The whole network is protected by the PIX 515 firewall with security rules set up to secure complex safety of computers and other laboratory equipment.

Another important part of the laboratory network are two access points of the company Aironet 1231G from Cisco Systems. The access points are equipped with external omnidirectional aerials. Also available are seven combined wireless network interfaces Aironet CB21AG supporting technologies 802.11a, 802.11b and 802.1g. The software protocol analyzer Observer is installed in five laboratory workstations for extended monitoring and analysis of the stationary and wireless local network operation.

The department has been successful in receiving funds from education and research projects. In 2004 the department's research and development teams were involved in basic and applied research projects amounting to over 18.5 million CZK. A research team has been engaged in up-to-date multimedia services through mobile and wireless networks. The department's staff members are involved in a research and development programme of the Ministry of Trade and Industry. Within this research close cooperation was started with the companies GiTy a.s., VÚSH a.s., DISK Multimédia s.r.o., WESTCOM s.r.o., ENJOY s.r.o. a STROM telecom s.r.o. A practical outcome of this research is for example user-friendly videoconferencing, modular architecture of information and videoconferencing systems, contactless measurement of filtering networks or the development of a new generation communication system.

In cooperation with Motorola, Ltd a laboratory of mobile network technologies was set up. The major components of the laboratory are the base station and base station controller. This equipment represents the access part of mobile networks. These products are commonly used by mobile network operators. The base station contains two radio modules, on 900 MHz and 1800 MHz to enable the operator to monitor the handovers in a mobile network. The testing mobile network also contains a transcoder for speech signal processing.

The staff members co-organized the international conference 'Telecommunications and Signal Processing TSP'04'. The department provides technical support for publishing the Czech electronic journal [www.Elektrorevue.cz](http://www.Elektrorevue.cz) and the international electronic journal [www.Electronicsletters.com](http://www.Electronicsletters.com).

## Major Research Projects

**Analysis of xDSL Transmission Parameters Using Real Access Networks – GACR 102/03/0762**

Investigator: Karel Němec

**Application of New Voltage and Current Conveyors in Filtering and Non-Filtering Structures – GACR 102/02/P067**

Investigator: Vít Novotný

**Quality Assurance in Mass Radio Network Services – GACR 102/04/P047**

Investigator: Dan Komosný

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

Investigator: Zdeněk Smékal

**New Methods of Service Quality Assurance in New Generation Networks – GACR 102/03/0560**

Investigator: Vladimír Kapoun

**Limits for Broadband Signal Transmission on the Twisted Pairs and Other System Co-existence – GACR 102/03/0434**

Investigator: Vladislav Škorpil

**Synthetic Elements with Higher Order Immitance Using Non-conventional Active Circuit Elements – GACR 102/02/P130**

Investigator: Ivo Lattenberg

**Development and Application of New Active Elements UCC, UVC, MOTA – GACR 102/03/1465**

Investigator: Ing. Kamil Vrba

**Research of New Image Processing Methods Used for Accurate Gauging of Dimensions in Building Industry and Their Verification on Type of 2D Tester – MPO FD-K2/01**

Investigator: Kamil Vrba

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

Investigator: Jiří Schimmel

**Highlighting Speech Signal Masked in Noise – GACR 102/04/1097**

Investigator: Zdeněk Smékal

## Selected Publications

BALÍK, M. Optimized Structure for Multichannel Digital Reverberation. *WSEAS Transactions On Acoustics And Music*, ISSN 1109-9577, 2004, Vol. 2004, No. 1, pp. 62 - 68.

DOSTÁL, T., ČAJKA, J., VRBA, K. Design Procedure of Oscillators and Biquads Based on Current Conveyors. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 3, No. 5, pp. 1122 - 1 125.

DOSTÁL, T., ČAJKA, J., VRBA, K. General view on current conveyors. *International Journal of Circuit Theory and Applications*, ISSN 0098-9886, 2004, Vol. 2004, No. 3, pp. 133 - 138.

NOVOTNÝ, V., VRBA, K. Applications with Voltage Conveyors. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 2004, No. 1, pp. 25 - 28.

NOVOTNÝ, V., VRBA, K. LC Ladder Filter Emulation by Structures with Current Conveyors. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 2004, No. 12, pp. 2104 - 2 107.

ŠKORPIL, V., ABUZAHO, A. Tonal and Non-Tonal Components for the MPEG-1 Model. *WSEAS Transactions on Communications*, ISSN 1109-2742, 2004, Vol. 3, No. 1, pp. 128 - 133.

ŠKORPIL, V., ŠŤASTNÝ, J. Comparative Methods for Pattern Recognition. *WSEAS Transactions on Circuits*, ISSN 1109-2734, 2004, Vol. 3, No. 9, pp. 1846 - 1 851.

ŠKORPIL, V., ŠŤASTNÝ, J. Face Recognition by Face Bunch Graph Method. *WSEAS Transactions on Communications*, ISSN 1109-2742, 2004, Vol. 3, No. 1, pp. 134 - 138.

TAHER, A. New Refinement Schemes for Voice Conversion. *Lecture Notes in Computer Science*, ISSN 0302-9743, 2004, No. , pp. 1 - 6.

## Bachelor's Programme

Accesses and Transports Networks (Vladislav Škorpil)

Analog Technology (Kamil Vrba)

Audioengineering (Ladislav Káňa)

Communication Technology (Ivo Herman)

Data Communication (Karel Němec)

Design of Electronic Devices (Kamil Vrba)

Digital Filters (Zdeněk Smékal)

Digital Signal Processing (Jiří Mišurec)

Hardware Computer Networks (Karol Molnár)

High-speed Communications Systems (Vladislav Škorpil)

Multimedia Services (Zoltán Nagy)

Network Architecture (Vít Novotný)

Network Operating systems (Dan Komosný)

Practical Exercises in Information Networks (Karol Molnár)

Signals and Systems Analysis (Zdeněk Smékal)

Studio-engineering (Ladislav Káňa)

Terminal Equipment (Vít Novotný)

Transmission Media (Miloslav Filka)

## Master's Programme

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

Access and Transport Networks (Vladimír Kapoun)

Analog Circuits (Kamil Vrba)

Audioengineering (Ladislav Káňa)

Communications Networks and Engineering (Ivo Herman)

Cryptography (Václav Zeman)

Data Communication (Karel Němec)

Design and Technology of Electronics Devices (Kamil Vrba)

Digital Audio Signal Processing (Miroslav Balík)

Digital Exchanges (Vladimír Kapoun)

Digital Filters (Zdeněk Smékal)

Digital Signal Processors (Zdeněk Smékal)

Digital Transmission Systems (Vladislav Škorpil)

High-speed Communications Systems (Vladislav Škorpil)

Integrated Networks (Vít Novotný)

ISDN Services (Vladislav Škorpil)

Management and Marketing (Ivan Rampl)

Microprocessors Technique in Telecommunications (Miroslav Balík)

Sensor Systems (Ivan Rampl)

Studio and music electronics (Ladislav Káňa)

Telecommunication Devices Maintenance (Vladislav Škorpil)

Telecommunication Systems (Karel Němec)

Telecommunications Optical Networks (Miloslav Filka)

Telematic and Multimedia Services (Zoltán Nagy)

Terminal Equipments (Vít Novotný)

Transmission Lines (Miloslav Filka)



## Doctoral Programme

Active Elements Using the Current Mode (Ivan Koudar)

Advanced Teleinformatics Systems (Vladislav Škorpil)

Digital Signal Processors (Zdeněk Smékal)

Integration of Telecommunication Networks and Services (Vladimír Kapoun)

Modern Network Technologies (Karol Molnár)

Sensor Information Systems (Ivan Rampl)

Speech Analysis and Synthesis (Robert Vích)

Telecommunications Media for Information Transmission (Miloslav Filka)

## Laboratories

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

**Laboratory of Wireless Computer Networks and XoIP** (operation in wireless computer networks based on IEEE 802.11, on access part of the second generation mobile networks using full base station and Motorola base station controller, and on voice and video transmission on IP networks including implementation of QoS, Karol Molnár, Vít Novotný)

**Laboratory of Digital Music Studio** (instruction and research of the synthesis, analysis, processing and reproduction of music signals including multichannel sound systems Surround Sound, Zdeněk Smékal, Jiří Schimmel)

**Laboratory of Electroacoustics, Studio and Music Electronics** (electroacoustic converter measurement, acoustic educational programmes, examining of human hearing, testing of electroacoustic devices, anechoic room, Ladislav Káňa)

**Laboratory of Coherent Imaging** (research of coherent, 2D and 3D imaging and subsequent digital image analysis, Kamil Vrba, Zoltán Nagy)

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

**Laboratory of Multimedia Services** (research in design and providing of multimedia communication services including digital processing of multimedia data, Zoltán Nagy)

**Laboratory of Optical Transmission** (instruction and research of optical transmission, mechanical work with fibres, direct and reflectometric technique, special measurement, Miloslav Filka)

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

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

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

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

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

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

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

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

**Computer Laboratory** (instruction in fundamentals of communication technologies and networks, design and simulation of discrete systems mainly of telephone exchanges and protocols, Ivo Herman)

**Motorola Research Laboratory of Signal Processing** (research and development of applications with digital signal processors with Harvard architecture and VLIW architecture, instruction in Signal Processors, Digital Filters and Acoustic Signal Digital Processing, Zdeněk Smékal, Petr Sysel)

# Department of Theoretical and Experimental Electrical Engineering

## **Ing. Pavel Fiala, Ph.D.**

Head

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## **Professors**

Prof. Ing. Libor Dědek, CSc.

## **Associate Professors**

Doc. Ing. Lubomír Brančík, CSc.  
Doc. Ing. Jarmila Dědková, CSc.  
Doc. Ing. Pavel Kaláb, CSc.  
Doc. Ing. Milan Murina, CSc.  
Doc. Ing. Jiří Rez, CSc.  
Doc. Ing. Jiří Sedláček, CSc

## **Lecturers**

Doc. Ing. Karel Bartušek, DrSc., Ing. Pavel Fiala, Ph.D., Ing. Eva Gescheidtová, CSc., Ing. Miloslav Steinbauer, Ing. Miroslav Veselý

## **Postgraduate Students**

Mgr. Zbyněk Češka, Ing. Petr Drexler, Ing. Vítězslav Kafka, Ing. Radek Kubásek, Ing. Pavel Londák, Ing. Vratislav Michal, Ing. Zdeněk Pončík, Ing. Tomáš Smutný, Ing. Miloslav Steinbauer, Ing. Zdeněk Zapletal, Ing. Martin Zlomek

## **Administrative and Technical Staff**

Eva Cupáková, Ing. Eva Kadlecová, Veronika Raabová, Ing. Alice Špérová, Ing. Martin Zlomek

## Main Interests

Research was centred on numerical modelling in impedance tomography (IT) methods. New methods and algorithms for IT were devised, with participation of students of all study programmes. Results were presented at international events, contacts were established or continued with universities in Austria and USA.

Cooperation continued with the Institute of Instrumentation Technology of Academy of Sciences in evaluation of MR images with support of numerical modelling. The department is involved in evaluation in NMR images in highly disturbed or distorted NMR signals. Long-term cooperation with ABB EJV s.r.o. Brno continued in the development of the measuring transformer TDO-6. A series of three lectures for ABB staff took place, and a joint grant project of the Ministry of Trade and Industry is being prepared.

The department developed cooperation with ESB in technological processes by way of revitalization of power machines and devices. Research and development of pulse sources on the MHD principle and the Faraday induction principle was carried on, basic experiments were performed and prototypes created. The department's staff cooperated with VOP 026 Šternberk, VTUPV in research of a microwave source – vircator at the premises of TESLA Vršovice.

## Major Achievements

Conclusions from the experimental research of measurement techniques for gradient magnetic fields and from research of filtering techniques on the basis of wavelet transformation and banks of filters as well as results of the theoretical research of impedance tomography techniques were presented.

A prototype of a calorimetric sensor for reading immediate values of electromagnetic pulse output was implemented in cooperation with PROTOTYPA a.s. Brno, as well as a prototype of pulse generator based on the MHD principle and a prototype of an innovated pulse generator PGV-1.

Designed and implemented was a dipole measuring voltage transformer TDO-6 24kV, introduced to manufacture by ABB EJV s.r.o. Brno.

The achieved results and experience with measurement and metrology of ultrashort single electromagnetic pulses were presented at an EMC seminar in VTUPV Vyškov. Outcomes of long-term research and application of numerical methods: finite elements methods were presented at a seminar of the Czech Electrotechnical Society in Prague.

Cooperation was maintained with the Institute of Plasma Physics of Academy of Sciences in the development of the vircator. The department cooperated with TEROS Loštice in research of filters, and a Master's degree student worked on his diploma thesis in the I.S.E.P. Institute in Paris. Cooperation was established with the Institute of Landscape Ecology of Academy of Science in the design of an electro-optical workplace in research of landscape biotope. Research has been conducted of the measuring methods of air-ion concentrations and a measuring system was constructed. Basic and applied research into measurement of single electromagnetic pulses has been conducted as support for the above projects. The prototype of a calorimetric sensor for pulse output measurement was implemented as well as experimental preparations for pulse measurement by electro-optical methods.

A new research laboratory of magnetic measurements and light technology, a research laboratory of optoelectronic systems, a laboratory for modelling and optimization in electromechanical systems of the FEEC, a research laboratory for numerical modelling, a research laboratory of pulse sources and microwave devices, a laboratory of electro-optics and an instruction laboratory of electrical engineering were set up.

Contacts were established with the National Cheng Kung University, South Korea, Department of Electrical Engineering, South Korea, INHA University, Department of Physics, Motorola LABS USA, Institute of Environmental Electromagnetics, Japan, Max-Born-Institute, Berlin, Uppsala Universitet, Sweden, Bauman Moscow State Technical University, Moscow, National radiological protection board, GB.

## Major Research Projects

### Electric Impedance Tomography in Loss Environment – GACR 102/03/1108

Investigator: Libor Dědek

### Gradient Magnetic Fields Generation and Measuring for in Vivo MR Spectroscopy – AVCR IAA 2065201

Investigator: Karel Bartušek

### Simulation and Optimization of Integrated Electronic Systems Focused on Signal Integrity – GACR 102/03/0241

Investigator: Lubomír Brančík

## Selected Publications

DĚDEK, L., DĚDKOVÁ, J. Application of Electrical Resistance Tomography to Nondestructive Testing of Carbon Fiber Honeycombs. *WSEAS Transactions on Systems*, ISSN 1109-2777, 2004, Vol. 10, No. 3, pp. 3010 - 3 012.

DĚDEK, L., DĚDKOVÁ, J. Identification of Conductivity of Electrodes using EIT Total Variation primal-dual method. *WSEAS Transactions on Systems*, ISSN 1109-2777, 2004, Vol. 10, No. 3, pp. 3013 - 3 015. (paper in journal) A103

FIALA, P., GESCHEIDTOVÁ, E., STEINBAUER, M. Measurement of ultra-short solitary electromagnetic pulses. *Advances in Electrical and Electronic Engineering*, ISSN 1336-1376, 2004, Vol. 1, No. 1, pp. 173 - 176.

## Bachelor's Programme

Electrical Engineering 1 (Lubomír Brančík)

Electrical Engineering 2 (Jiří Sedláček)

Measurement in Electroengineering (Karel Bartušek)

Safety in Electrical Engineering (Miloslav Steinbauer)

Seminar of Electrical Engineering (Jarmila Dědková)

The C++ Programming Language (Pavel Fiala)

## Master's Programme

Electrical installations (Pavel Kaláb)

## Doctoral Programme

Computer Methods of Filter Design and Optimization (Jiří Sedláček)

Field Computation in Power Engineering (Libor Dědek)

Measurement Methods in NMR (Karel Bartušek)

## Laboratories

**Laboratory for Measurement in Electrical Engineering A** (instruction in Measurement in Electrical Engineering, Eva Gescheidtová)

**Laboratory for Measurement in Electrical Engineering B** (instruction in Measurement in Electrical Engineering, Eva Gescheidtová)

**Laboratory for Electrical Engineering** (instruction in Electrical Engineering 1, Electrical Engineering 2, Milan Murina)

**Computer Laboratory** (exercises in Computers and Programming 2, Miloslav Steinbauer)

**Computer Laboratory for Electrical Engineering** (exercises in Electrical Engineering 1, Electrical Engineering 2, Miloslav Steinbauer)

**Research Laboratory of Electric Circuits** (research laboratory for doctoral students, Jiří Sedláček)

**Research Laboratory of Electro-optics** (research of electro-optic measurement methods, Eva Kadlecová)

**Research Laboratory for Modelling and Optimization of Fields in Electromechanical Systems** (unique technical problems, Pavel Fiala)

**Research Laboratory of Numeric Modelling 1** (research of complex numeric assignments)

**Research Laboratory of Numeric Modelling 2** (research of electric circuits modelling and models with centred parameters, Miloslav Steinbauer)

**Research Laboratory of Optoelectronic Systems** (research of optoelectronic methods of measurement and numeric modelling, Eva Kadlecová)

**Research Laboratory for Magnetic Measurements** (using electromagnetic methods in non-destructive testing of products, Jiří Rez)

**Research Laboratory of Pulse Sources and Microwave Devices** (basic research of impulse sources, low-noise measurements, shielded laboratory, anachronistic laboratory, Pavel Fiala)

**Research Laboratory of Light Technology** (measuring of light source parameters, Eva Kadlecová)

# Department of Power Electrical and Electronic Engineering

## **Doc. Ing. Čestmír Ondrůšek, CSc.**

Head

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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 Koláčny, 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.

## **Lecturers**

Ing. Josef Bradík, Ph.D., Ing. Jaromír Vaněk, CSc., Ing. Jaromír Vrba, CSc.

## **Postgraduate Students**

Ing. Andrea Bergerová, Ing. František Blažek, Ing. Tomáš Cibulka, Ing. Ivan Cívín, Ing. Dalibor Červinka, Ing. Petr Dohnal, Ing. Jiří Duroň, Ing. Salem S. Elfard, Ing. Petr Frank, Ing. Pavel Gajdůšek, Ing. Jan Hájek, Ing. Petr Hemerka, Jiří Hnízdil, Ing. Aleš Honzák, Ing. Martin Jarmara, Ing. Emil Kalina, Ing. Tomáš Kerlin, Ing. Jiří Klíma, Ing. Marek Klimeš, Ing. Roman Kostka, Ing. Zdeněk Langr, Ing. Tomáš Láníček, Ing. Miloš Machat, Ing. Martin Maňa, Ing. Tomáš Matucha, Ing. Petr Melichar, Ing. Salou Moussa, Ing. Jan Novotný, Ing. Pavel Nykodým, Ing. Radim Peřina, Ing. Jaroslav Pozdník, Ing. Lubomír Příklad, Mohamed Abdulalam Shaban Ali, Ing. Luboš Sikora, Ing. Radek Stupka, Ing. Alice Špérová, Ing. Zdeněk Štáva, Ing. Filip Štěpančík, Ing. Pavel Štorek, Ing. Radek Trávníček, Ing. Zdeněk Tulis, Ing. Pavel Tureček, Ing. Ferdinand Urban, Ing. Jiří Valenta, Ing. Ondřej Vítek, Ing. Zdeněk Wolf, Ing. Miroslav Zemánek, Ing. Jakub Žajdlík

## **Administrative and Technical Staff**

Ing. Josef Bartl, CSc., Ing. Dalibor Červinka, Josef Daněk, Ing. Petr Dohnal, Ing. Zdeněk Feiler, Ph.D., Ing. Petr Huták, Ph.D., Ing. Bohumil Klíma, Ph.D., Zdeněk Koráb, Ing. Jaroslav Pozdník, Alena Šmídková, Ing. Pavel Vorel, Ph.D.

## Main Interests

The department provided tuition of a general subject in the first year of the new Bachelor's degree programme and in specialist subjects in the area of Power Electrical and Electronic Engineering in the ending and in the new Bachelor's programme and the ending Master's programme. Instruction is provided in subjects in the area of electric machines, device, drives, power and control electronics.

Research is focused on basic research into theoretical modelling of radiation energy transport in thermic plasma.

Applied research is centred on low-voltage electric machines in automotive industry, design optimization and identification of the parameters of electric machines using artificial intelligence, the development of special machines as starter-generators, levitation systems, electronic electric energy converters with extreme parameters,

utilization of ultracapacitors in cooperation of electronic converters, accumulators and electric machines mainly in electric traction. The department has had cooperation with a number of universities, e.g. Technical University of Gliwice, RWTH Aachen and industrial companies, e.g. Siemens Elektromotory Drásov, Magnetron Kroměříž, OEZ Letohrad.

In 2005 basic research will continue in the area of calculating energy transmission by radiation in air plasma. Research and development of a micro-generator for aircraft industry will be conducted within the framework of the 6th framework programme as well as design optimization of synchronous machines by means of artificial intelligence methods, controlled magnetic bearings, special electronic converters and utilization of ultracapacitors in electric traction.

## Major Achievements

Under the leadership of B. Klíma and P. Huták, a team implemented a control system of hydrostatic drives for the LARIX Hydro cableway for wood mining in hardly accessible and environmentally sensitive terrain. The project was conducted in cooperation with LP Křtiny, Czech republic and Beltra Resources, Ireland with support of the international project EUREKA E2989.

The department has been involved in the EU pilot project (INETELE) of the Leonardo da Vinci programme together with international partners. The outcomes were presented at the international exhibition TRANSFAIR in Bratislava. In the com-

petition of projects the INETELE exposition came first.

The project was also presented at the exhibition KONTAKT-KONTRAKT organized by OHK Brno on 25 November 2004 at the Brno fair grounds.

Under the leadership of Assoc. Prof. J. Lapčík the department participated in construction of active-control magnetic bearings.

In cooperation with the Energy Institute a heart pump with magnetically controlled bearing was designed (J. Lapčík).

A microgenerator was designed by a team led by Assoc. Prof. Čestmír Ondrůšek.

## Major Research Projects

**Higher Power Alternator for Motor Vehicles Focused on Agricultural and Special Machinery – MPO FD-K3/102**

Investigator: Vítězslav Hájek

**Environment-Friendly Mining Technologies for Mountain Forest Reproduction in Spain and Ireland – EUREKA E2989**

Investigator: Bohumil Klíma

**Electrical Pumping Device for NC Working Machines – MPO FF-P/094**

Investigator: Vítězslav Hájek

**Empiric Models for Multiparametric Evaluation of Quality Parameters – GACR 102/03/P124**

Investigator: Josef Bradík



**Innovation of DC Motors with Gear Used in Electric Systems of Vehicles – MPO FD-K3/044**

Investigator: Vítězslav Hájek

**Interactive and Unified e-Based Education and Training in Electrical Engineering – CZ/02-134009**

Investigator: Vítězslav Hájek

**Converter Control in Electric Drives for Ecological Transport Systems – GACR 102/03/D222**

Investigator: Bohumil Klíma

**Impact of External Fields on the Properties of Electric Arc – GACR 102/04/2090**

Investigator: Zdeněk Vávra

**Development of High-Voltage Disconnect Switches – MPO FI-IM/158**

Investigator: Zdeněk Vávra

**Enhancement of Selected Parameters of Electrical Low-Voltage Machines – GACR 102/03/0813**

Investigator: Vítězslav Hájek

### Selected Publications

DOHNAL, P., URBAN, F., VALENTA, J. AUTOMATED DC SUBSTATION SHORT-CURRENT EVALUATION. *Advances in Electrical and Electronic Engineering*, ISSN 1336-1376, 2004, Vol. 2004, No. 2, spp278 - 280.

KUCHYŇKOVÁ, H. Compatibility of Data Transfer between CAD Applications. *Radioengineering*, ISSN 1210-2512, 2004, Vol. 12, No. 4, pp. 58 - 62.

PATOČKA, M. Driving circuits for power transistors MOSFET and IGBT. *ElectronicsLetters.com* - <http://www.electronicletters.com>, ISSN 1213-161X, 2004, Vol. 2004, No. 1/7, pp. 20 - 27.

VOREL, P. Drivers for power transistors MOSFET a IGBT. *ElectronicsLetters.com* - <http://www.electronicletters.com>, ISSN 1213-161X, 2004, Vol. 2004, No. 1/5, pp. 1 - 9.

### Bachelor's Programme

Automobile Electric and Electronic Systems  
(Vítězslav Hájek)

Computational Visualization and Animation (Hana Kuchyňková)

Computer Aided Design (Hana Kuchyňková)

Computer Science in High Power Engineering  
(Vladimír Aubrecht)

Control Electronics (Miroslav Patočka)

Control Theory (Jiří Skalický)

Data Transfer and Analysis (Vladimír Aubrecht)

Design of Electrical Drives (Jiří Skalický)

Electrical Drives (Josef Koláčný)

Electrical Machines (Čestmír Ondrůšek)

Electrotechnical Inspection and Supervision  
(František Veselka)

Microprocessor Technology for Drives (Miroslav Patočka)

Power Electronics (Jaromír Vrba)

### Master's Programme

AC Controlled Drives (Jiří Skalický)

Automobile Electric and Electronic Systems  
(Vítězslav Hájek)

Computer Aided Design (Hana Kuchyňková)

Computers in High Power Engineering (Hana Kuchyňková)

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

Control Theory (Jiří Skalický)

Design of Electrical Drives (Jiří Skalický)

Design of Electrical Machines and Apparatus  
(Zdeněk Vávra)

Electric Drives (Josef Koláčný)

Electric Machines for Motor Vehicles (Vítězslav Hájek)

Electric Stations (Zdeněk Vávra)

Electrical Apparatus (Zdeněk Vávra)

Electrical Drives I (Josef Koláčný)  
 Electrical Drives II (Jiří Skalický)  
 Electrical Machines 1, 2 (Čestmír Ondrůšek)  
 Electrical Microdrives (Josef Koláčný)  
 Electromechanical Systems (Čestmír Ondrůšek)  
 Electrotechnical Inspection and Supervision  
 (František Veselka)  
 Fundamentals of Logistic and Management  
 (Bohumil Klíma)  
 High Voltage Phenomena (Vladimír Aubrecht)  
 International Cooperation of Quality Assurance  
 (Karel Hruška)  
 Laboratory Courses of Electrical Drives (Josef  
 Koláčný)  
 Measurement In Heavy Current Engineering  
 (Vítězslav Hájek)  
 Micromachines (Vítězslav Hájek)

Microprocessor Technology (Bohumil Klíma)  
 Power and Control Electronics (Jaromír Vrba)  
 Power Electronics I (Jaromír Vrba)  
 Power Electronics II, III (Miroslav Patočka)  
 Principles of Power Electronics (Miroslav  
 Patočka)  
 Protection Electric Devices (Jaromír Vaněk)  
 Protection In Heavy Current Engineering (Jaromír  
 Vaněk)  
 Quality Assurance and Metrology (Karel Hruška)  
 Regulate and Quality Control (Karel Hruška)  
 Technical Requirements On Production  
 Evaluation (Karel Hruška)  
 Technological Processing (Vladimír Kutnohorský)  
 Theory Of Inventive Problem Solving - TIPS  
 (Bohuslav Bušov)

### Doctoral Programme

Advanced Control of Electrical Drives (Jiří  
 Skalický)  
 Automatic Measurement of Electric Machines  
 (Vítězslav Hájek)  
 Electric Machines for Motor Vehicles (Vítězslav  
 Hájek)  
 Electric Microdrives (Josef Koláčný)  
 Electromechanics (Čestmír Ondrůšek)

Optical Plasma Diagnostics (Ladislav Peška)  
 Power Electromechanical Systems (Miroslav  
 Patočka)  
 Power Electronics (Miroslav Patočka)  
 Theory of Inventive Problem Solving (Bohuslav  
 Bušov)  
 Topical Conditions of Testing and Certification in  
 CR and EU (Karel Hruška)

### Laboratories

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

**Laboratory of Electric Arc** (optical diagnostics of switching arc in high-voltage switches, Zdeněk Vávra)

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

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

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

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

**Laboratory of Small Electric 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 using digital signal processors, Bohumil Klíma)

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

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

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

**Laboratory of Quality Assurance and Testing** (non-destructive diagnostics and monitoring, expressing uncertainty of measurement in NDT, research of empirical models for multiparametric evaluation of quality parameters, Josef Bradík)

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