

# Annual Report 2017

**Faculty of Electrical Engineering and Communication**  
**Brno University of Technology**

**Contents**

Introduction..... 3  
Faculty of Electrical Engineering and Communication..... 6  
Accredited Study Programmes and Specialisations ..... 10  
Study Programmes..... 13  
Science, Research and Doctoral Study..... 18  
External Relations and International Cooperation ..... 24  
Academic Senate ..... 31  
Campus Development..... 33  
Other ..... 34  
Department of Control and Instrumentation..... 37  
Department of Biomedical Engineering ..... 43  
Department of Power Electrical Engineering ..... 49  
Department of Electrical and Electronic Technology ..... 55  
Department of Physics ..... 61  
Department of Languages ..... 67  
Department of Mathematics..... 71  
Department of Microelectronics ..... 75  
Department of Radioelectronics ..... 83  
Department of Telecommunications ..... 89  
Department of Theoretical and Experimental Electrical Engineering..... 99  
Department of Power Electrical and Electronic Engineering ..... 103

# 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 specialisations. The languages of instruction were Czech and German. However, in consequence of political and national disputes, Czech gradually ceased to be used as a language of instruction until in 1899 the Czech Technical High School was established in Brno. After World War I and the founding of Czechoslovakia this school merged with the German Technical School (originally bilingual) to form the High Technical School in Brno (later bearing the name of Dr. Edvard Beneš, the second President of Czechoslovakia). In the period between World War I and World War II the school was among the best technical high schools in Europe. During World War II the school was, as all other Czech high schools were, closed and the premises were used by German military institutions, and most equipment was destroyed. Immediately after the end of World War II the activities of the school were resumed. In 1951 at the beginning of Cold War, the Technical High School was closed and some departments were incorporated in the newly established Military Academy. Tuition for civilians continued at the former Faculty of Civil Engineering only.

Electrotechnical disciplines were first taught at the university in 1905. Since the Faculty of Power Engineering was founded in 1959, and subsequently transformed into Electrotechnical Faculty, nearly 27,000 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) and was the third largest among the then existing seven faculties of Brno University of Technology 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 in 2001 in connection with the founding of a new faculty in 2002 - Faculty of Information Technology (FIT) and transformation of the Faculty of Electrical Engineering and Computer Science (FEECS) into the Faculty of Electrical Engineering and Communication (FEEC). The present Faculty of Electrical Engineering and Communication was established on 1 January 2002. The first deans were Professor Hruška (FIT) and Professor Vrba (FEEC). A significant milestone in the faculty history was the year 2013 when construction of new faculty premises was completed. After more than fifty years of its existence, the whole faculty, all departments and workplaces, moved to one location in the BUT campus Pod Palackého vrchem.

## The Faculty in 2017

The Rector was Professor Petr Štěpánek and his Vice-Rector for Creative Activities was Professor Lubomír Grmela from the Department of Physics, Faculty of Electrical Engineering and Communication.

The Dean of FEEC in 2017 was Professor Jarmila Dědková, and the four vice-deans were Professor Vladimír Aubrecht (research and doctoral study programme, acting dean), Associate Professor Jiří Háze (external relations and international affairs), Associate Professor Petr Fiedler (Bachelor study programme), Professor Stanislav Hanus (Master study programme), and Miloslav Morda was faculty bursar.

At the end of 2017 there were 220.75 academic loads at the faculty (professors, associate professors, senior lecturers, lecturers and other pedagogical and research staff) and 3,195 students in all forms of government supported programmes. Moreover, inter-faculty instruction was provided to 229 students of the Faculty of Information Technology, 31 students of the Faculty of Mechanical Engineering, 144 students of the Faculty of Management and 4 students from Institute of Forensic Engineering. On the other hand, the faculty purchased instruction for 22 students from the Faculty of Management and for 6 students from the Faculty of Information Technology. Then the number of students educated at the faculty totalled 3, 575. In 2017 education was provided in study programmes Electrical Engineering, Electronics, Communication and Control Technology (EECR, accredited in 2001) and Biomedical Technology and Bioinformatics (BTBIO-A, reaccruited in 2013), Biomedical Engineering and Bioinformatics (BTBIO-F, accredited in 2010), English in Electrical Engineering and Information Technology (AJEI-H, accredited in 2012) and Audio Engineering (AUDIO, accredited in 2012) in the Bologna system. The study programmes at FEEC are now fully compatible with European education systems, and student mobility has been facilitated. Among the FEEC graduates in 2017 there were 373 students who completed the Bachelor degree programme, 375 follow-up Master programme graduates and 38 doctoral students completed the Ph.D. programme. There were 1,039 admissions to Bachelor programmes, 503 admissions to follow-up Master programmes, and 47 students started their Ph.D. studies. Instruction in English was provided to 2 international students paying their fees. Four academics habilitated and received the title docent.

## Events and Activities

- operation of the interactive playroom 'Elektrikárium'
- courses for secondary school students interested in study at FEEC organised by Department of Mathematics to help them prepare for entrance examination
- 'Open Days' (January, November, December 2017), visits by students to secondary schools, secondary school advisors visiting FEEC, 'Night of Scientists'
- faculty presentation at the European trade fair of higher and lifelong education 'GAUDEAMUS 2017, 31 October-3 November 2017', trade fairs in Bratislava, Nitra and Prague
- meeting of the leaderships of Czech and Slovak faculties of electrical engineering and associated faculties 16-18 May 2017 in Plzeň
- '23 STUDENT EEICT Conference and Competition 2017' with 39 Bachelor, 55 Master, 76 Ph.D. papers and 3 papers by secondary school students, sponsored by Honeywell, ABB, ON Semiconductor etc.
- the top creative competition for secondary school students 'Merkur perFEKT Challenge' with more than 200 participants from all parts of the Czech Republic
- participation in the programme Erasmus+ and other European programmes
- continuation of the project 'Energy in Conditions of Sustainable Development (EN-PUR)' of the regional centre CVVOZE (Centre for Renewable Electric Energy Sources) funded from NPU I, investigator Vladimír Aubrecht
- continuation of the project 'Interdisciplinary Research of Wireless Technologies' (INWITE) of the regional centre SIX (Centre for Sensor, Information and Communication Systems) funded from NPU I, investigator Martin Slanina
- operation of the mini nursery 'Edisonka' in the sustainability period supported by the faculty
- activities of Academic Senate member Ivana Jakubová in her capacity as a member of the Higher Education Council
- activities of Academic Senate, namely Chairman Miloslav Steinbauer, focused on organisational issues and economic interests of FEEC
- activities of Advisor for Equal Opportunities Vlasta Sedláková focused on consultancy for female students and study opportunities for handicapped students
- work on applications for accreditation of Bachelor programmes Audio Engineering, Control and Measurement Technology, Electronics and Communication Technology, Microelectronics and Technology, Power Electrical and Electronic Engineering, Telecommunication and Information Systems, Information Safety and follow-up programmes Audio Engineering, Biomedical Engineering and Bioinformatics
- 50th faculty ball organised in cooperation with Faculty of Information Technology

## Achievements

Economic situation of the faculty in 2017 was satisfactory. It can be said that income for education slightly increased, however, higher write-offs had to be covered from allocated funds. Research and development institutional support substantially increased. The trend in salaries and material supply was favourable. The funds received for project solution have slightly decreased though outstanding pedagogical and research achievements of academic staff are apparent as well as minimisation of faculty expenditure. The balance of 2017 that can be used to finance faculty activities only to a limited extent was transferred to wages and salaries to be paid as an extra pay at the end of the year. Faculty funds are generated and used to support faculty development and provide funding for research projects when necessary, namely in the period before projects are launched and financial support received.

Economic stability of the faculty was mainly due to involvement in research projects of the Czech Science Foundation, Czech Technology Agency, Ministry of Trade and Industry, and efforts of those who under the leadership of chief investigators participated in NPU EN-PUR and INWITE projects. For three subsequent years income from economic activity has been rising, owing to the results of the centre CVVOZE. Also in 2017 the faculty achieved a positive economic result that will be used to finance faculty activities in the following period.

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

*Jarmila Dědková*

Dean



The Dean, vice-deans and faculty bursar

# Faculty of Electrical Engineering and Communication

## Dean

Prof. Ing. Jarmila Dědková, CSc.



## Vice-Deans

Prof. RNDr. Vladimír Aubrecht, CSc.

Acting Dean, Vice-Dean for Creative Activities and Doctoral Degree Programme



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



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



Doc. Ing. Jiří Háze, Ph.D.  
Vice-Dean for External Relations and International Cooperation



### **Chairman of Academic Senate**

Doc. Ing. Miloslav Steinbauer, Ph.D.



### **Faculty Bursar**

Ing. Miloslav Morda



### **Student Advisor to the Dean**

Ing. Daniel Janík

### **Advisor for Equal Opportunities**

Doc. Ing. Vlasta Sedláková, Ph.D.

### **Trade Unions Representative**

Prof. Ing. Vítězslav Hájek, CSc.



## Departments

Department of Control and Instrumentation  
Department of Biomedical Engineering  
Department of Electrical Power Engineering  
Department of Electrical and Electronic  
Technology  
Department of Physics  
Department of Languages

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

## Scientific Board

### Internal members

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

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

### External members

Doc. Ing. Otto Dostál, CSc.  
Doc. Ing. Ladislav Dušek, CSc.  
Ing. Leoš Dvořák  
Ing. Jiří Holoubek  
Doc. Dr. Ing. Pavel Horský  
Prof. Ing. Miroslav Husák, CSc.

Prof. Dr. Ing. Josef Lazar  
Doc. Ing. Jiří Masopust, CSc.  
Ing. Petra Peterková, Ph.D.  
Ing. Jiří Potěšil  
Prof. Ing. Aleš Richter, CSc.  
Ing. Roman Schiffer

## Contacts

Address: FEKT VUT, Technická 3058/10, 616 00 Brno  
Tel.: exchange 54114 1111, extension 54114 xxxx  
E-mail: [info@feec.vutbr.cz](mailto:info@feec.vutbr.cz)  
Internet: <http://www.feec.vutbr.cz>  
Facebook: <http://www.facebook.com/FEKTVUT>  
Youtube: <http://www.youtube.com/user/perFEKTniFakulta>

# Accredited Study Programmes and Specialisations

## Accredited Study Programmes

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

Study areas: Control and Measurement Technology  
Electronics and Communications  
Microelectronics and Technology  
Power Electrical and Electronic Engineering  
Teleinformatics

### **Bachelor Degree Programme Biomedical Technology and Bioinformatics**

Study area: Biomedical Technology and Bioinformatics

### **Bachelor Degree Programme English in Electrical Engineering and Information Technology**

Study area: English in Electrical Engineering and Information Technology

### **Bachelor Degree Programme Audio Engineering**

Study area: Audio Engineering

### **Bachelor Degree Programme Information Safety**

Study area: Information Safety

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

Study areas: Biomedical and Ecological Engineering  
Power Electrical Engineering  
Electronics and Communications  
Electrotechnical Manufacturing and Management  
Cybernetics, Control and Measurement  
Microelectronics  
Power Electrical Engineering and Power Electronics  
Telecommunications and Information Technology

### **Follow-up Master Degree Programme Biomedical Engineering and Bioinformatics**

Study area: Biomedical Engineering and Bioinformatics

### **Follow-up Master Degree Programme Audio Engineering**

Study area: Audio Engineering

### **Follow-up Master Degree Programme Information Safety**

Study area: Information Safety

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

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

### **Doctoral Degree Programme Biomedical Technology and Bioinformatics**

Study areas: Biomedical Technology and Bioinformatics

## Accredited Study Areas for Habilitation and Appointment to Professorship

Biomedical Engineering  
Electronics and Communications  
Electrical and Electronic Technology  
Power Electrical Engineering  
Technical Cybernetics  
Teleinformatics  
Theoretical Electrical Engineering



Secondary school students taking part in the competition 'Merkur perFEKT Challenge'



'BUT Junior' event organised by Brno University of Technology for elementary school pupils

# Study Programmes

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

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

In 2017, 1,117 full-time students enrolled in the Bachelor programme EECR-B. The programme was completed by 249 full-time students, 43 of them in the study area Control and Measurement Technology (B-AMT), 38 in Electronics and Communications (B-EST), 48 in Microelectronics and Technology (B-MET), 54 in Power Electrical and Electronic Engineering (B-SEE) and 66 in Teleinformatics (B-TLI).

In the part-time Bachelor programme EECR-BK there were 127 students. The programme was completed by 24 students, 2 of them in Control and Measurement Technology (BK-AMT), 6 in Electronics and Communications (BK-EST), 5 in Power Electrical and Electronic Engineering (BK-SEE) and 7 in Teleinformatics (BK-TLI).

Applications for full-time and part-time Bachelor study were accepted. There was a written entrance test in either mathematics and physics, or mathematics and the basics of informatics. Students who met one of the following requirements were exempt from examination:

- passed their school-leaving examination in mathematics or physics with grade 1 or 2 in at least one of these subjects
- completed a preparatory course in mathematics or physics with grade 1 or 2
- achieved a secondary-school average better than 2.0 (arithmetical average of grades in final reports for 1st, 2nd and 3rd year and the first half of 4th year)
- passed National Comparative Examinations and Test of General Study Prerequisites with a minimum of 60% in all assessed parts
- passed National Comparative Examinations and in mathematics achieved a minimum of 60% in each part of the test

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

In 2017 there were 958 applicants, 842 for full-time study and 116 for part-time study. Finally, 613 students were admitted, 539 in full-time study and 116 in part-time study. As the number of admitted students did not reach full capacity, a second term was announced. There were 72 applications for full-time study and 16 applications for part-time study. The total number of students enrolled was 558, 485 full-time students and 73 part-time students. It can be said that part-time study remains in the focus of interest. Numbers of applicants in Table 1 indicate declining interest in technical programmes. Table 1 shows numbers of students interested in individual specialisations over the period 2013/14 - 2017/18.

Preparatory courses are offered by FEEC Department of Mathematics and Department of Physics to assist applicants preparing for entrance examinations and help them adapt to university studies. Information on study programmes and qualifications such as Certificate of Electrotechnical Qualification, Certificate of Pedagogical Practice, Microsoft Certificate, Cisco Certificate are regularly presented in the media, on 'Open Days', visits by teachers and students to secondary schools, and at the 'GAUDEAMUS' fair. All activities are focused on promotion of FEEC and increasing the interest in studies at FEEC.

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

<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>total</i>
<b>2013/14</b>	number	121	111	73	153	200	658
	%	18,4	16,9	11,1	23,3	30,4	
<b>2014/15</b>	number	125	70	90	119	186	590
	%	21,2	11,9	15,3	20,2	31,6	
<b>2015/16</b>	number	148	80	97	129	167	621
	%	23,8	12,9	15,6	20,8	26,9	
<b>2016/17</b>	number	148	61	79	139	141	568
	%	26,1	10,8	13,9	24,5	24,9	
<b>2017/18</b>	number	175	62	64	122	62	485
	%	21,2	11,5	15,2	20,5	31,5	

### Bachelor Degree Programme Biomedical Technology and Bioinformatics

In academic year 2007/08 the Bachelor programme 'Biomedical Technology and Bioinformatics' (BTBIO-A) was launched. The full-time form of study covers one study area Biomedical Technology and Bioinformatics(A-BTB). Instruction in this interdisciplinary programme is also provided by the Faculty of Medicine, Masaryk University in Brno.

The study area Biomedical Technology and Bioinformatics is mainly focused on practical training, but it also prepares graduates for further studies in the follow-up Master programmes at universities providing education in biomedical engineering, medical informatics and mathematical biology (Brno University of Technology, Czech Technical University in Prague, Charles University, Masaryk University). Students gain theoretical knowledge in mathematics, physics and chemistry, basic knowledge in biology, human anatomy and physiology, needed to understand the basic biological processes taking place in human organism and to communicate with doctors and medical staff. They get acquainted with operation principles and use of medical technology and informatics, and gain ability to work with them. Moreover, they are offered information on medical legislative and learn how to apply it in practice. Emphasis is laid on general and professional language skills. The Bachelor programme includes a four-week professional training in hospitals, health centres, institutions and companies focused on running clinics, treatment, research and trade in biomedical technology and bioinformatics in the Czech Republic and abroad. The training is arranged by the students themselves and takes place outside scheduled instruction (mainly during the summer holidays) before completion of the Bachelor programme.

The top limit approved by Academic Senate for admission to full-time study in the programme BTBIO-A in academic year 2017/2018 was 150. Written entrance examination consisted of tests in mathematics and biology. Applicants with secondary-school grade average of 1.25 were exempt from entrance examination. The maximum number of points to be achieved in each subject was 50 and the pass was 12 points for each subject. All applicants exempt from entrance examination and those who passed the examination with excellent results were admitted. In 2017 there were 158 paid applications, 113 admissions and 85 enrolled. In 2017 there were 210 full-time students in the BTBIO-A programme.

### Bachelor Degree Programme English in Electrical Engineering and Information Technology

The Bachelor programme 'English in Electrical Engineering and Information Technology' (AJEI-H) with the study area English in Electrical Engineering and Information Technology (H-AEI) was launched in academic year 2012/13. English in Electrical Engineering and Information Technology as a specific professional variety had not been taught before at universities in the Czech Republic though English is the lingua franca of engineering specialisations. The programme also includes cultural studies and fundamentals of electrical engineering and economics. The graduates will be equipped for work in industrial companies, government administration, research institutions, management, and translating of technical texts. They will acquire basic knowledge of electrical engineering and professional language competences on level C1 of the 'Common European Reference Framework'.

The subjects selected for entrance examination are mathematics and English. The entrance examination contained an English language test (multiple choice) at the intermediate level B1 of the 'Common European Reference Framework'. Exempt from the examination in English were students who submitted a certificate or report confirming the required level of knowledge B2 of the 'Common European Reference Framework' (Upper-Intermediate).

Students who met one of the following requirements were exempt from examination in mathematics:

- passed their school-leaving examination in mathematics with grade 1 or 2
- completed a preparatory course in mathematics with grade 1 or 2
- achieved a secondary-school average better than 1.70 (arithmetical average of grades in final reports for 1st, 2nd and 3rd year and the first half of 4th year)
- passed National Comparative Examinations and reached 60.0% in each part of the test in mathematics

The maximum number of points to be achieved in entrance examination for each subject was 50 and the pass was 12 for each subject. All applicants who passed the entrance examination or who were exempt from it were admitted. There were 115 applicants for academic year 2017/2018, 79 of them were admitted and 67 enrolled.

### **Bachelor Degree Programme Audio Engineering**

Since academic year 2013/14 a new full-time Bachelor programme 'Audio Engineering' (AUDIO-J) with one study area Audio Engineering (J-AUD) has been offered. The programme provides interdisciplinary Bachelor education in audio engineering and is focused on training of audio engineers with technical and artistic approach to the latest audio technology, audio signal processing, musical production and studio practice. The programme was prepared and implemented in cooperation with Janáček Academy of Music and Performing Arts, Faculty of Music.

Applicants for admission to the study programme AUDIO-J are required to take an aptitude test and entrance examination in mathematics and physics or mathematics and basics of informatics. The aptitude test is taken prior to entrance examination. Applicants cannot be exempt from entrance examination. There were 105 applicants, 64 admissions and 57 enrolled.

### **Bachelor Degree Programme Information Safety**

A full-time Bachelor programme 'Information Safety' (IBEP-T) was launched in academic year 2015/16 and followed in 2016/2017 by a part-time programme (IBEP-TZ), both of them offering one study area Information Safety (T-IBP, TZ-IBP). This interdisciplinary programme provides training for a Bachelor degree in information and communication safety (ICT). It is focused on technical education of experts in safety of information and communication technologies (ICT), and legal and economic aspects connected with safety issues. The programme was designed and is implemented in cooperation with Faculty of Law, Masaryk University.

Entrance examination contains an optional combination of mathematics and physics or mathematics and fundamentals of informatics. Exempt from entrance examination are applicants who achieved a secondary-school average 1.25 (an arithmetical average of grades in final reports for 1st, 2nd and 3rd year and the first half of the fourth year).

There were 185 applicants, 101 admitted and 83 enrolled.

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

The follow-up Master programme 'Electrical, Electronic, Communication and Control Technology' in full-time form of study was first offered in academic year 2005/06 and in part-time form of study in academic year 2007/08.

In academic year 2017 there were 662 students in the EECR-M programme, 291 in the first year of study and 371 in the second year, there were 164 students in the part-time programme EECR-ML, 90 of them in the first year of study and 74 in the second year.

The full-time programme was completed by 283 students, 14 of them in Biomedical and Ecological Engineering (M-BEI), 39 in Power Electrical Engineering (M-EEN), 38 in Electronics and Communications (M-EST), 21 in Electrotechnical Manufacturing and Management (M-EVM), 56 in Cybernetics, Control and Measurement (M-KAM), 32 in Microelectronics (M-MEL), 20 in Power Electrical and Electronic Engineering (M-SVE) and 63 in Telecommunications and Informatics (M-TIT). Part-time study was completed by 46 students, 1 in Biomedical and Ecological Engineering (ML-BEI), 1 in Power Electrical Engineering (ML-EEN), 2 in Electronics and Communications (ML-EST), 9 in Electrotechnical Manufacturing and Management (ML EVM), 6 in Cybernetics, Control and Measurement (ML-KAM), 3 in Microelectronics (ML-MEL), 7 in Power Electrical and Electronic Engineering (ML-SVE) and 20 in Telecommunications and Informatics (ML-TIT).

The total number of paid applications for the EECR programme was 545, 414 for full-time study (EECR-M) and 131 for part-time study (EECR-ML). For academic year 2017/18 the maximum numbers of admissions approved by Academic Senate were 700 (full-time study) and 200 (part-time study). Written entrance examination contained 10 tasks, two for each of the five subjects approved by the Study Programmes Council - Electrotechnical Engineering 1, Electrotechnical Engineering 2, Electronic Components, Signals, Structures, Systems and

Measurement in Electrical Engineering. The number of points to be achieved for each problem was 10, total of 100 points. The time limit was 75 minutes. As the number of applicants was lower than the number approved for admission, the Dean decided, in accordance with Admission Procedure Rules, about exemption from entrance examination and admission of all applicants. On announced entrance examination date 22 June 2017 nearly all applicants enrolled. The second examination term 10 July 2017 and Committee meeting scheduled for 17 August 2017 were cancelled. There were 441 applicants, 339 for full-time study and 102 for part-time study. All admitted were registered for the study areas they had selected. Numbers of applicants and admissions by study areas are in Table 2. The total number of enrolled is 411, 317 in full-time study and 94 in part-time study.

### **Follow-up Master Degree Programme Biomedical Engineering and Bioinformatics**

Since academic year 2010/11 education has been provided in the follow-up Master programme 'Biomedical Engineering and Bioinformatics' BTBIO-F. In 2017 there were 55 students in this full-time programme, 28 of them in the first year of study and 27 in the second year. In 2017 the programme BTBIO-F was completed by 44 students.

The total number of applicants (with paid application) for BTBIO-F was 44. The number of admissions approved by Academic Senate for full-time study in 2017/18 was 200. The written examination contained 10 problems selected from two topic areas published on faculty websites. The topic areas were approved by the Study Programmes Council. Every correct result yielded 10 points, max. 100 for the whole examination. The time limit was 75 minutes. As the number of applicants was lower than the number approved for admission, the Dean decided, in accordance with Admission Procedure Rules, about exemption from entrance examination. On announced entrance examination date 22 June 2017 nearly all applicants enrolled. The second entrance examination term 10 July 2017 and Committee meeting scheduled for 17 August 2017 were cancelled. There were 33 admissions and 33 enrolled.

### **Follow-up Master Degree Programme Audio Engineering**

The full-time follow-up Master programme 'Audio Engineering' AUDIO-P was launched in academic year 2016/17 and in 2017 there were 53 students, 29 in the first year of study and 24 in the second year of study. Thirty-six applicants sent in a paid application for study in the programme AUDIO-P. The number of admissions approved by Academic Senate for academic year 2017/18 was 40. Entrance examination contained an aptitude listening test, written examination and interview focused on evaluation of applicant's own musical recording.

The aptitude test lasted 25 minutes and included a hearing ability test centred on space perception, sound colour intonation and rhythm analysis and a genre and style test to assess the ability to distinguish aesthetic musical parameters. The maximum number of points was 50.

The written examination lasted 50 minutes and contained 5 tasks selected from 5 areas of topics involving acoustics, electroacoustics, analog low-frequency techniques, digital processing of sound signals and sound technology. The topics were published on faculty websites. The maximum number of points to be attained for written examination was 50. The topic areas were issued by the Study Programmes Council. They were equally difficult and kept secure until the examination started.

In the interview the applicant's recording of the required length and format was analysed. The applicant presented CD files with sound tracks of his/her own recording of an ensemble playing several instruments chosen by the applicant. The CD also contained a file with the resulting stereophonic recording (master) and a PDF document describing the used technique, location of microphones, recording, mixing and the process of creating the master recording. For this recording and its defence the applicant could earn 50 points.

The second entrance examination term was scheduled for 10 July 2017 and Committee meeting for 17 August 2017. There were 29 admissions and 29 enrolled.

### **Lifelong Education and Self-Paid Study**

The faculty participates in the system of lifelong education (Amendment to Act 111/98 Coll. on tertiary education). Apart from a range of specialised courses for professionals, the faculty offers paid study of subjects in the Bachelor and the follow-up Master programme EECR. Having completed the courses, the graduates will be admitted in a study programme without being required to pass entrance examination, and earned credits will be recognised. In 2017 there were 5 students in the lifelong education programme.



Table 2: Applicants and admissions to study areas of follow-up programmes EECR-M and EECR-ML in 2017: Biomedical and Ecological Engineering (M-BEI, ML-BEI), Power Electrical Engineering (M-EEN, ML-EEN), Electronics and Communications (M-EST, ML-EST), Electrotechnical Manufacturing and Management (M-EVM, ML-EVM), Cybernetics, Control and Measurements (M-KAM, ML-KAM), Microelectronics (M-MEL, ML-MEL), Power Electrical Engineering and Power Electronics (M-SVE, ML-SVE), Telecommunications and Information Technology (M-TIT, ML-TIT)

<i>Study area</i>	<i>Applicants</i>	<i>Admissions</i>	<i>Study area</i>	<i>Applicants</i>	<i>Admissions</i>
M-BEI	57	35	ML-BEI	12	11
M-EEN	40	33	ML-EEN	20	13
M-EST	51	43	ML-EST	16	13
M-EVM	55	45	ML-EVM	20	16
M-KAM	58	48	ML-KAM	8	8
M-MEL	33	31	ML-MEL	13	10
M-SVE	41	38	ML-SVE	0	0
M-TIT	79	66	ML-TIT	42	31

Table 3: Numbers of Bachelor and Master students over 2013 - 2017

<b>Programme</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
EEKR-B	1812	1716	1611	1401	1244
BTBIO-A	263	230	218	204	210
AJEI-H	88	162	179	171	163
AUDIO-J	52	100	139	134	124
IBEP-T	0	0	52	123	178
<b><i>Bc total</i></b>	<b>2215</b>	<b>2208</b>	<b>2199</b>	<b>2033</b>	<b>1919</b>
EEKR-M	974	964	1002	916	826
BTBIO-F	118	137	108	76	55
AUDIO-P	0	0	0	25	53
<b><i>Mgr total</i></b>	<b>1092</b>	<b>1101</b>	<b>1110</b>	<b>1017</b>	<b>934</b>
<b>Total</b>	<b>3307</b>	<b>3309</b>	<b>3309</b>	<b>3050</b>	<b>2853</b>

## Instruction Support

There has been a consistent effort at the FEEC to improve and use more extensively the information system for management of study affairs and to make relevant information accessible to students. In 2017 regular assessment of the quality of teaching by students took place at the end of the winter and the summer semester using the BUT information system.

In support of instruction in full-time and part-time Bachelor and follow-up Master programmes innovated electronic texts (ET) and multimedia aids (MP) were created in 2017 and published via the BUT information system.

# Research, Development and Doctoral Study

## Creative Activities, Research and Development

Academics and students are involved in basic and applied research in most specialisations of electrical engineering.

Research and development at FEEC is supported by the Ministry of Education, Youth and Sports, Czech Republic, and national programmes. In the period 2010 - 2013 the faculty received a major investment support from European structural funds through Operational Programme 'Research and Development for Innovations' for completion of two regional research centres CVVOZE and SIX..

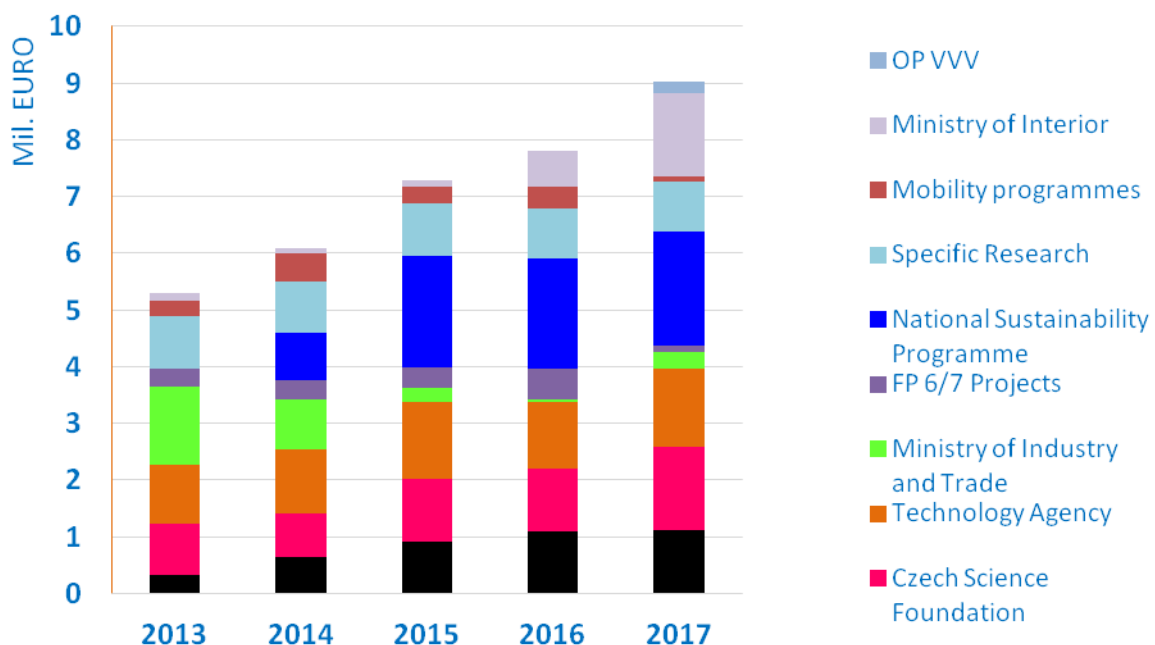
Another sources of financial support in 2017 were projects of the Czech Science Foundation, Technology Agency of the Czech Republic, and two projects of 'National Sustainability Programme I'.

On international level, our researchers are involved in a number of projects, mainly in the framework of 'Horizon 2020', and are preparing a number of other projects.

FEEC is also involved in applied research for industrial partners. Apart from cooperation projects, research on contract basis is increasing. Income from contracts in 2017 amounted to roughly 28 million CZK, with significant contribution of the regional research centres CVVOZE and SIX. Research is carried out on the basis of commercial contracts, and also as part of diploma theses and dissertations (specific research). All companies interested in cooperation with FEEC can contact us.

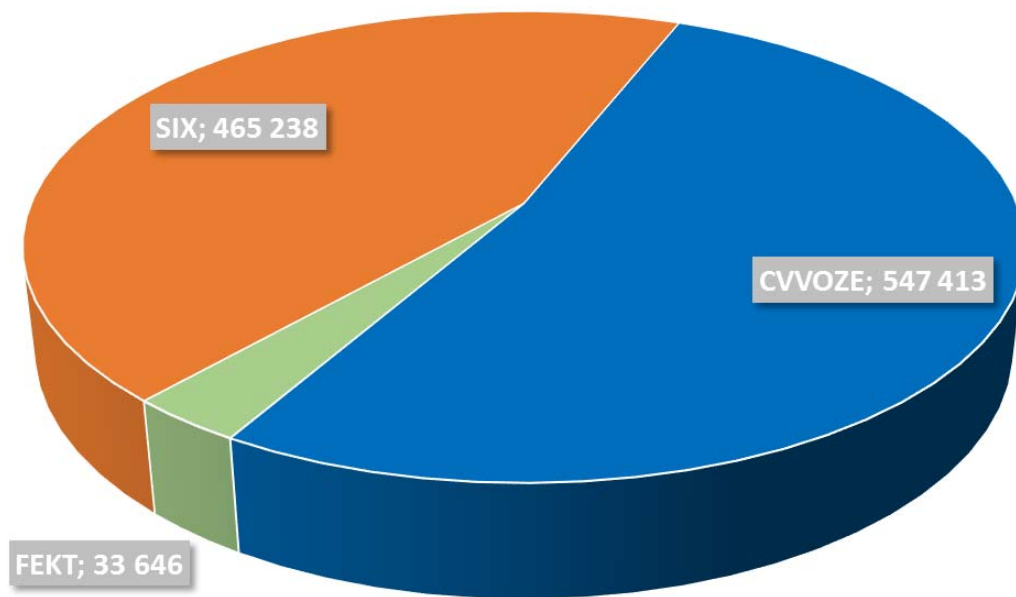
Original scientific and professional outcomes were published in three international monographs and 174 papers in impact scientific journals. The faculty was granted 5 national and 1 international patent or utility sample.

## Financial support for R&D activities from selected resources (non-investment)



Graph 1: Research and development funds in 2013 to 2017

## Outcomes from commercial contracts in 2017 (EUR)



Graph 2: Income from contract research in 2017

## Regional Research Centres

Two regional research centres continued their research and development activities.

### Centre of Research and Utilisation of Renewable Energy Sources (CVVOZE)

Prof. RNDr. Vladimír Aubrecht, CSc.

Director



Centrum výzkumu a využití  
obnovitelných zdrojů  
energie



The centre coordinates research, development and innovation capacities for research on renewable energy sources. The research team focuses on chemical and photovoltaic energy sources, electromechanics, electrotechnology, electrical drives, power electrical engineering, mobile robots and industrial electronics. In 2017 CVVOZE focused on research in five research areas:

- optimisation of electrochemical energy conversion
- chemical and photovoltaic energy sources
- generation, transmission, distribution and utilisation of electrical energy
- control and sensor technologies
- switch-off process in switching devices



The unique short circuit laboratory at CVVOZE

An important source of research funding in 2017 was the project of National Sustainability Programme 'Energy in Conditions of Sustainable Development (EN-PUR)'.

The centre's activities are focused on basic research, and on applications and acceleration of transfer of novel technologies into industrial use. All CVVOZE laboratories form a unique infrastructure that will undoubtedly attract important industrial partners whose areas of interest are closely connected with research carried out in the centre.

A major part of the centre is an extensive infrastructure established in compliance with Act 130/2002 Coll. called CVVOZEPowerLab. The leading workplaces are High Current Laboratory and High Voltage Laboratory located in Professor List Technology Park. The High Voltage Laboratory includes a complex of three laboratories with various types of high voltage sources. These strategic laboratories are used for research and development of various power and high voltage electrical devices and systems. Equipment can be used to simulate extreme short-circuit grid conditions, lightning strike on lines etc. The unique laboratory equipment draws attention of many industrial companies. We have been offered contracts from industrial leaders such as SIEMENS, ABB, EATON, and also from smaller Czech firms (DRIBO) and foreign companies (SEZ Krompachy - Slovakia, Techna Ltd. – Great Britain, Schaltbau - Austria). Research contracts for these laboratories in 2017 amounted to more than 8 million CZK.

For more information on CVVOZE visit [www.cvvoze.cz](http://www.cvvoze.cz).

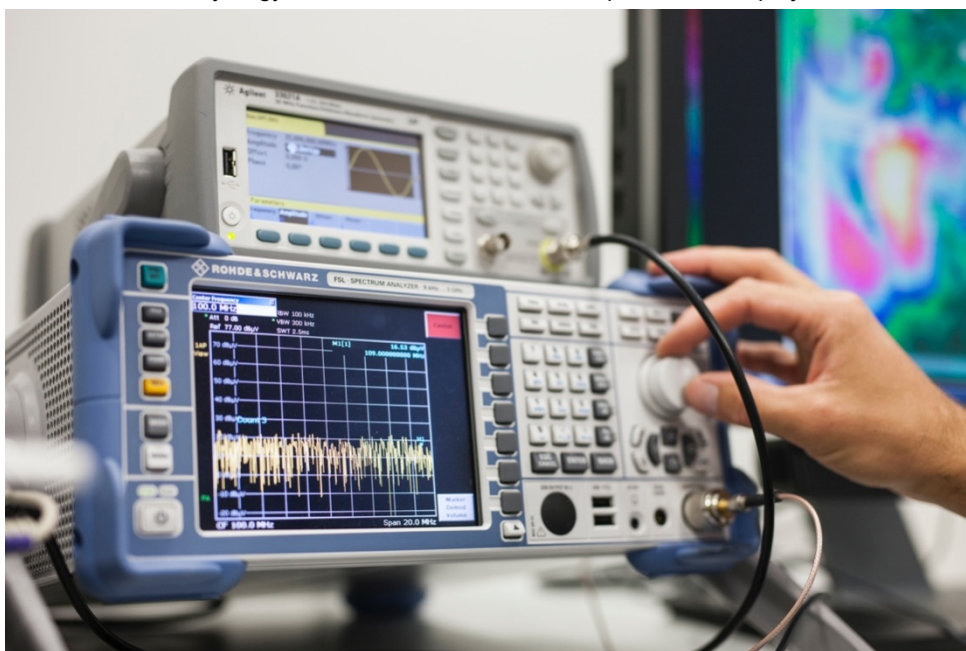
### Centre of Sensor, Information and Communication Systems (SIX)

Doc. Ing. Martin Slanina, Ph.D.

Director



Centre SIX was established in 2010 as a joint initiative of FEEC departments involved in research and development of sensor systems, information and communication technologies. The aim was to interconnect research interests and utilise achieved synergy in work on extensive and complex research projects.



Spectrum and signal analysers for evaluation of physical communication signals

The involved departments offered their laboratories that were upgraded and extended in the period 2011 - 2013 owing to support from the operational programme 'Research and Development for Innovations'. In 2014 the centre started full operation without direct financial support from public sources. The centre grew, not only in terms of numbers of involved researchers and their loads, but also results, grants and commercial contracts. And the growth continued in 2015, 2016 and 2017.

Since 2015 the centre has been supported by the National Sustainability Programme 'Interdisciplinary Research of Wireless Technologies' (INWITE), designed to increase the volume and quality of basic research and thus increase the centre's chances to make a good use of acquired knowledge in projects of applied and commercial research. The project is conducted by a team of five groups jointly led by professors from Vienna Technical University and Centre SIX. The groups involved in project INWITE focus on six specialisations (sensors, signals, radio frequency systems, mobile communication systems, antennas and high frequency circuits, advanced cyber security). In recent years the share of applied research has been growing, which proves that the centre has succeeded in interconnecting academic and industrial sectors. The growing interest of industrial companies in professional cooperation resulted in increasing number of applied research projects and contract research projects. While in 2016 contract research yielded 8 million CZK, in 2017 it was more than 12 million CZK.

For more information visit [www.six-centre.cz](http://www.six-centre.cz).

#### **Professor List Technology Park (VTP PL)**

Professor List Technology Park was designed to support technology companies and research institutions involved in renewable energy sources, power engineering and power electrical engineering, microelectronics, control and measurements. One part of the Park contains laboratories for research on ultra high voltages and switching devices and the second part contains administrative buildings rented to industrial companies. The Park covers an area of 1,900 sq.m. The chief target is the development of novel technologies, products and services connected with research conducted at FEEC. In 2015 Professor List Technology Park ranked 3rd in the competition 'Entrepreneurial Project 2014', category 'Infrastructure for Support of Enterprise and Innovations' (PROSPERITA).

More at [www.vtppl.cz](http://www.vtppl.cz).

### **Habilitations and Appointments**

In 2017 four academics habilitated.

#### **Doc. Ing. Roman Šotner, Ph.D.**

Electronics and Communications

#### **Doc. Ing. Martin Štumpf, Ph.D.**

Theoretical Electrical Engineering

#### **Doc. Ing. Petr Číka, Ph.D.**

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

Teleinformatics

## Ph.D. Programme

In academic year 2016/17 there are 369 students in the Ph.D. programme, 2 of them enrolled in the study programme in English. Numbers of Ph.D. students over the last five years are shown in Table 4.

Table 5 shows numbers of Ph.D. graduates by departments over the last five years. The list of graduates in 2017 can be found on FEEC websites, links *Study*, *Doctoral study programmes*, *Doctoral programme graduates*.

Table 4: Numbers of Ph.D. graduates from 2013 to 2017

<i>year</i>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
<b>1.</b>	79	70	84	81	47
<b>2.</b>	62	62	62	56	54
<b>3.</b>	70	50	62	48	46
<b>4.</b>	77	57	47	55	42
<b>5.</b>	49	55	45	37	41
<b>6.</b>	46	38	45	38	29
<b>7.</b>	51	43	56	52	34
<b>total</b>	<b>434</b>	<b>375</b>	<b>401</b>	<b>369</b>	<b>321</b>

Table 5: Numbers of Ph.D. graduates by departments from 2013 to 2017

	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>total</b>
<b>UAMT</b>	2	1	7	1	8	22
<b>UBMI</b>	4	2	2	2	5	16
<b>JEEN</b>	1	5	0	1	4	11
<b>UETE</b>	1	4	8	2	1	16
<b>UMAT</b>	1	4	1	0	0	8
<b>UFYZ</b>	2	3	6	1	2	18
<b>UMEL</b>	4	8	8	3	2	28
<b>UREL</b>	8	10	3	6	4	38
<b>UTEE</b>	1	4	1	3	2	12
<b>UTKO</b>	4	11	7	6	9	44
<b>UVEE</b>	5	1	2	4	1	16
<b>total</b>	<b>33</b>	<b>53</b>	<b>45</b>	<b>29</b>	<b>38</b>	<b>229</b>

## Student Creative Activities

The '23 STUDENT EEICT 2017 Conference' was held on 27 April 2017. The abbreviation stands for the English words Electrical Engineering, Information and Communication Technology indicating the priority areas of research and education. There were 174 papers, 39 Bachelor, 55 Master and 76 Ph.D. papers. Three posters were presented by talented secondary school students. The event was sponsored by Honeywell, ABB and ON Semiconductor.

The papers were defended in 22 expert committees including representatives of sponsoring companies, academics and representatives of the club 'Students for Students'. Top or outstanding papers were awarded at the closing ceremony. For more information visit FEEC websites, links *Research*, *Conference*, *Student EEICT*.

# External Relations and International Cooperation

## International Cooperation

International activities have been focused on increasing the prestige of FEEC by presenting results of research projects at international conferences and participating in international research and education projects, placements of FEEC students at partner universities abroad, and offering instruction in English to international students.

Among our priorities is student and teacher mobility involving universities cooperating within the framework of European Commission programmes. FEEC is one of the most active faculties at Brno University of Technology. We have had good cooperation with the BUT Department of International Relations responsible for organisational and economic support of programme Erasmus+. As a result there were 63 student placements of 229 months last year, 22 lecture stays of 22 weeks and one one-week training of academic staff (see Table 6). There were 99 students coming for placements of 380 months. Mobility figures for incoming and outgoing students in individual programmes in 2017 are in Table 7. The list of universities cooperating with FEEC within the programme Erasmus+ is in Table 9.

In 2017 funding was received for long-term international placements of students of all study programmes from the mobility development programme of Ministry of Education 'International Mobility Support for of BUT Students' in the amount of 395 thous. CZK. Owing to this support 15 students could go for placements of 19 months.

Mobility figures for outgoing and incoming students in all programmes are in Table 8. It is apparent that the number of placements in 2017 was substantially lower as compared with the previous year, only 253 months. The number of incoming students was nearly the same.

The faculty supports cooperation of academics and departments with international institutions based on inter-faculty and Erasmus+ agreements, and encourages seeking of new contacts. Last year 71 thous. CZK was provided in support of such activities. Targeted international relations were financed by departments through operational programmes. The funds were used to cover travel expenses of internationally recognised academics coming to short lecture stays at FEEC.

The faculty invites renowned international researchers to give lectures or take part in research projects. They help to upgrade the professional and general level of education and create an atmosphere of international environment in implementation of research projects.

The faculty obtained 80 thous. CZK from the Ministry of Education development programme 'Support of International Cooperation of BUT Brno' for cooperation of academics and Ph.D. students with international institutions and framework agreements.

An amount of 285 thous. CZK was obtained from the development programme of Ministry of Education 'Support of International Mobility of Academics'. These funds were used to cover expenses on stays of 4 international experts coming to give lectures and lead seminars for academics and Ph.D. students.

Table 6: Student and teacher placements at international universities in Erasmus+ programme from 2013 to 2017

<i>Erasmus +</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>	<i>2016</i>	<i>2017</i>
Students	49	46	81	49	63
Months	201	191	324	214	229
Lecture stays	19	23	22	15	22
Lecture weeks	22	25	22	15	22
Trainings	2	4	3	2	1
Training weeks	2	4	3	2	1



Table 7: Student placements at FEEC and abroad by programmes in 2017

<b>Activity</b>	<b>Arrivals</b>		<b>Departures</b>	
	<b>Students</b>	<b>Months</b>	<b>Students</b>	<b>Months</b>
Erasmus +	93	363	63	229
Inter-faculty agreements	2	8	-	-
Development programme of Ministry of Education	-	-	15	19
Other mobility	4	9	1	5

Table 8: Student placements at FEEC and abroad in all mobility programmes from 2013 to 2017

		<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
<b>Arrivals</b>	Students	109	83	99	100	99
	Months	462,5	378,5	380	383,5	380
<b>Departures</b>	Students	60	62	102	57	79
	Months	223	227,5	361,5	236	253

Table 9: Universities having agreements with FEEC in the frame of the programme Erasmus for 2017/18

<b>University</b>	<b>Country</b>
University of Applied Sciences Upper Austria School of Engineering and Environmental Sciences	Austria
Technische Universität Wien- Vienna University of Technology Faculty of Electrical Engineering and Information Technology	Austria
Kunstuniversität Graz (KUG) - University of Music and Performing Arts Graz	Austria
UMIT - Universität für Gesundheitswissenschaften, Medizinische Informatik und Technik	Austria
Technische Universität Graz	Austria
University of Applied Sciences Technikum Wien	Austria
University for Continuing Education Krems	Austria
UC Limburg (= UC Leuven-Limburg, Limburg Campuses)	Belgium
KU Leuven Faculty of Engineering Technology	Belgium
Technical University of Gabrovo	Bulgaria
Technical University of Sofia	Bulgaria
Technical University of Sofia, branch Plovdiv	Bulgaria
Angel Kanchev University of Ruse	Bulgaria
Hochschule RheinMain - RheinMain University of Applied Sciences	Germany

Technische Universität Dresden	Germany
Hochschule Augsburg - University of Applied Sciences	Germany
Universität Ulm	Germany
Friedrich-Alexander- Universität Erlangen-Nürnberg	Germany
Hochschule für Technik, Wirtschaft und Kultur Leipzig (Leipzig University of Applied Sciences)	Germany
Hochschule Furtwangen University	Germany
Aalborg Universitet	Denmark
University of Southern Denmark	Denmark
Tallinn University of Technology School of Information Technologies	Estonia
TTK University of Applied Sciences, Talin	Estonia
Universidad politécnica de Madrid – ETS Ingeniería y Sistemas de Tellecomunicación	Spain
Universitat Rovira i Virgili School of Engineering	Spain
Universitat de Vic Escola Politecnica Superior	Spain
Universidad de Cantabria	Spain
Universitat Politècnica De Valencia Escuela Politécnica Superior de Alcoy (EPSA)	Spain
Universitat Politècnica de Valencia Escuela Técnica Superior de Ingenieros de Telecomunicación	Spain
Universidad de Granada - Escuela Técnica Superior de Ingenierías Informática y de Telecomunicación (ETSIIT - UGR)	Spain
Universidad de Zaragoza	Spain
Escola Superior Politecnica (Fundació TecnoCampus Mataró – Maresme)	Spain
Universidad del País Vasco/Euskal Herriko Unibertsitatea	Spain
Universidad de Malaga School of Industrial Engineering	Spain
Universitat de Valencia	Spain
Universidad De Las Palmas De Gran Canaria	Spain
Institut Supérieur d'Electronique de Paris (ISEP)	France
INSA Rennes Dpt Communication Systems and Network Dpt Electronics and Computer Engineering	France
ESIEE Paris	France
Institut Polytechnique de Grenoble	France
ESIGELEC Rouen School of Engineering	France
ESIEE Amiens	France
Université Joseph Fourier Polytech School of Engineering	France

Universite Du Maine	France
Eastern Macedonia and Thrace Institute of Technology	Greece
TEI of Crete Branch Chania	Greece
Technological Educational Institute (TEI) of Thessaly	Greece
University Of Patras	Greece
Universita degli Studi di L'Aquila Dipartimento di Ingegneria Industriale e dell'Informazion e di Economia	Italy
Seconda Università degli Studi di Napoli	Italy
University of Palermo	Italy
Università degli Studi Mediterranea di Reggio Calabria	Italy
Vilnius Gediminas Technical University	Lithuania
Kaunas University of Technology	Lithuania
Goce Delcev University	Macedonia
University of Malta	Malta
Ostfold University College	Norway
Norwegian University of Science and Technology Faculty of Natural Sciences and Technology	Norway
University of Stavanger Department of Music and Dance	Norway
Gdansk university of Technology Faculty of Electronics, Telecommunications and Informatic / Faculty of Electrical and Control Engineering	Poland
Politechnika Wroclawska - Wroclav University Of Technology	Poland
AGH University of Science and Technology Faculty of Computer Science, Electronics and Telecommunications	Poland
Politechnika Poznańska	Poland
Nencki Institute of Experimental Biology PAS	Poland
University of Porto Faculty of Engineering	Portugal
Instituto Politécnico de Lisboa (IPL) Instituto Superior de Engenharia de Lisboa (ISEL)	Portugal
Universidade Católica Portuguesa - Escola Superior de Biotecnologia	Portugal
Polytechnic Institute of Coimbra	Portugal
Universidade de Coimbra	Portugal
Técnico Lisboa Department of Electrical Engineering and Computer Science	Portugal
Technical University of Cluj-Napoca	Romania
Malmö University Faculty of Technology and Society	Swedwen

Aalto University School of Electrical Engineering	Finland
Tampere University of Technology	Finland
University of Eastern Finland	Finland
Univerza v Novi Gorici/University of Nova Gorica	Slovenia
University Of Maribor	Slovenia
Žilinská univerzita v Žilíně Fakulta humanitních věd	Slovakia
Technická univerzita v Košiciach - Fakulta elektrotechniky a informatiky - Faculty of Mining, Ecology, Process Control and Geotechnologies	Slovakia
Yildirim Beyazit University	Turkey
Yildiz Technical University - Dept. of Electronics and Communication Engineering - Dept. of Mathematics (Faculty of Sciences and Arts)	Turkey
T.C. Dogus University	Turkey
Bogazici University Department of Electrical & Electronics Engineering	Turkey
Istanbul Teknik Universitesi	Turkey
Suleyman Demirel University	Turkey
Işık University Faculty of Engineering	Turkey
University College London School of Engineering Sciences	Great Britain

## External Relations

External relations are focused on promoting faculty activities and providing updated and specific information on study opportunities offered by the faculty, study programmes and study areas. The newly structured websites, presentations and videopresentations as well as faculty profile on the social network Facebook and Youtube are targeted at our future students, secondary school and technical secondary school students. In this respect, an important role was played by the so called 'Roadshow' – FEEC students popularising technical science at secondary schools.

Very popular is the recently launched competition of four-person secondary-school teams 'Merkur perFEKT Challenge'. The competition offered 9 topics, selected by the teams at registration. For capacity reasons only the first 54 applications could be accepted. This number was reached one month after the call. Secondary schools from all over Moravia and part of Bohemia registered 200 students, including several girls. The competition was conducted in an atmosphere of fair-play, and generally the performance and knowledge of students in areas such as electrical engineering, robotics, programming, etc. must be appreciated. On January 2018 the winners in individual categories competed in the superfinals, where the winner was the Mithnite team representing the Technical Secondary School from Zlín. This year they are owners of the challenge cup for the overall winner.

Increased attention was paid to the media, presentation of FEEC achievements in basic and applied research, development and cooperation with the industrial sector.

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

The Faculty commemorated the 50th anniversary of the tragic event on Kubínská Hůla in 1968 when an avalanche killed 6 students of the Electrotechnical Faculty.

Contacts have been maintained with industrial companies in the Brno region and other parts of the Czech Republic. These contacts are mainly based on cooperation with FEEC departments in specific research, expert's reports and consultancy. The major cooperating companies are ABB s.r.o., Siemens A. G., Honeywell s.r.o., T-Mobile Czech Republic, a.s., ON Semiconductor Czech Republic, AT&T Czech, EATON Czech Republic, Rockwell/Allen

Bradley, Škoda Volkswagen Mladá Boleslav, Motorola Solutions, National Semiconductor, ČEZ, a.s., Linet, s.r.o., BD Sensors, s.r.o., Buchlovice etc.

Cooperation continued within the two regional centres CVVOZE and SIX and research centre of excellence 'CEITEC - Central European Institute of Technology', where the faculty is significantly involved.

Another recent and remarkable contribution to cooperation with industrial partners is the Partner Programme constituting a platform for presentation of industrial companies, increased cooperation with research teams and these projects.

Close cooperation of many years has been maintained with the Institute of Instrument Technology of Czech Academy of Sciences in Brno in research projects of joint interest. Members of the Institute's staff are part-time teachers at FEEC, in Master and Ph.D. programmes. Academy of Sciences can offer Ph.D. study based on a contract with the faculty. Academic staff, mainly departments of mathematics and physics, have cultivated long-term cooperation with secondary schools in the Brno region in preparing their students for studies at FEEC.



Popularisation of science and technology - 'Night of Scientists'



Research achievements are regularly presented at the trade fair 'Amper' - system Ateros was awarded the prize 'Golden Amper 2017'

# Academic Senate

On 30 October 2017, elections to Academic Senate were held. Before the elections, the Senate was composed of the following members (LK – legislative committee, PK – pedagogical committee, EK – economic committee, KK - quality and represented department):

## Chair

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

## Academic Staff Chamber

Ing. Ivana Jakubová, EK, LK, KK (UREL), chair  
Doc. Ing. Bohuslav Bušov, CSc., EK, PK (UVEE)  
Ing. Petr Číka, Ph.D., EK, PK (UTKO)  
RNDr. Petr Fuchs, Ph.D., EK (UMAT)  
Doc. Ing. Vladislav Škorpil, CSc. (UTKO)  
Ing. Martin Jílek, EK (UJAZ)  
Doc. Ing. Petr Mastný, Ph.D., EK, PK, KK (UEEN)  
Prof. Ing. Vladislav Musil, CSc., EK, LK (UMEL)  
Ing. Helena Polsterová, CSc., EK (UETE)  
Doc. Ing. Vlasta Sedláková, Ph.D., EK, PK, KK (UFYZ)  
Doc. Ing. Miloslav Steinbauer, Ph.D., EK, LK, PK, KK (UTEE)  
Ing. Martin Vitek, Ph.D. EK, LK (UBMI)

## Student Chamber

Ing. Daniel Janík, EK, LK, PK, chair  
Svätopluk Blažej, LK  
Miroslav Molinek, EK, KK  
Mgr. Ing. Karel Sedlář, EK  
Alexandra Šujanská, LK, PK (until May 2017)  
Bc. Vojtěch Kučírek, EK, LK, (since May 2017)  
Bc. Petr Šerý, LK, KK  
Bc. Martin Šelíng, PK, KK

## Academic Senate Constituted on 7th November 2017

### Chair

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

### Academic Staff Chamber

Ing. Ivana Jakubová, EK, LK, KK (UREL), chair  
Doc. Ing. Petr Číka, Ph.D., EK, PK (UTKO)  
RNDr. Petr Fuchs, Ph.D., EK (UMAT)  
Ing. Martin Jílek, EK (UJAZ)  
Ing. Stanislav Klusáček, Ph.D., EK, PK (UAMT)  
Doc. Ing. Petr Mastný, Ph.D., EK, PK, KK (UEEN)  
Prof. Ing. Vladislav Musil, CSc., EK, LK (UMEL)  
Ing. Helena Polsterová, CSc., EK (UETE)

Doc. Ing. Vlasta Sedláková, Ph.D., EK, LK, KK (UFYZ)  
Doc. Ing. Miloslav Steinbauer, Ph.D., EK, PK, KK (UTEE)  
Ing. Martin Vítek, Ph.D. EK, LK (UBMI)  
Doc. Ing. Pavel Vorel, Ph.D. (UVEE)

## **Student Chamber**

Ing. Daniel Janík, EK, LK, PK, KK, chair  
Jiří Dvořáček, LK, KK  
Kateřina Chroustovská, EK, PK  
Bc. Vojtěch Kučírek, EK, LK  
Bc. David Michalík, PK, KK  
Bc. Martin Šelíng, PK, KK  
Hana Vrtělková, PK, KK

Academic Senate held 11 regular meetings and discussed legislative, economic and issues. Average attendance was 82%. Discussions were always constructive, proposals were sent to members prior to the meeting for study and comments.

Election committee prepared timetable and instructions for elections to Academic Senate FEEC and Academic Senate BUT. Elections took place in compliance with election regulations and a report was issued by the committee. Regular elections to Academic Senate FEEC were held on 30 October-1 November 2017 in compliance with the newly approved Election Regulations of Academic Senate FEEC. The turnout in academic constituency was 76,98 % and in student constituency 12,13 %. Constituent meeting of new Academic Senate was held on 7 November 2017.

On December 5, Academic Senate elected new Dean for the period 2018-2022 - Prof. RNDr. Vladimír Aubrecht, CSc who was the only candidate.

Academic Senate dealt with amendments to internal faculty guidelines following the amendment to Act 111Coll. Academic Senate approved internal regulations (Statute of FEEC, Disciplinary Regulations for Students of FEEC, Election Regulation of Academic Senate, Academic Senate Rules of Procedure, Scientific Council Rules of Procedure) and internal standards – Organisational Rules of FEEC, Rules of Procedure of Doctoral Study Council. Following the amendment to internal regulations the senate discussed and approved Dean's guidelines.

The proposal on the 'Implementation Plan of Strategic Intent of FEEC for 2017' was discussed and approved as well as 'Annual Report 2016' and 'Economic Annual Report 2016'. As some changes in the accreditation process were implemented, applications for accreditation of new study programmes were discussed and approved.

Economic issues discussed and approved included the proposal for the distribution of financial means in 2017 and proposal on the distribution of the Balanced Fund. Budget rules were drafted at several joint meetings of economic committee and faculty management.

Ing Ivana Jakubová was delegated in the Assembly of the Council of Universities for her third period in office.



# Campus Development

After moving the whole faculty to the campus Pod Palackého vrchem, all necessary adaptations were completed. It was agreed with the Faculty of Mechanical Engineering to jointly use the park place behind Technická 8 on completing the driveway behind Technická 10, and the parking area was divided into sections to be used by FEEC and FSI staff respectively.

Final adaptations of terrain to the south and east of Technická 8 were completed as well as the pavement along Technická 8, and invasive plants were removed.

Protection barriers against pigeons were installed on roofs and open staircases at Technická 10 and 12.

At the end of 2017 the faculty started installation of horizontal blinds in lecture rooms.

A study room was opened at Technická 12 for self-study and work on joint student projects.

## Computer Networks and Information Systems

Priority was given to:

- upgrading of servers and adaptation of facilities as a constant responsibility of OSIS
- completion of centralisation of network administration services and continuous supply of HV equipment in all premises at Technická
- network backup
- innovation and administration of faculty websites in two languages
- full use of modern communication channels favoured by young generation, namely faculty profile on social network Facebook and Youtube channel

## Information Systems and Services

Besides the economic system SAP, the faculty uses the BUT information system. Negotiations and analyses of individual modules of the BUT system and adaptation of the information system in operation are in progress. The process will continue in 2018.



'Student EEICT Conference' and job opportunities fair 'perFEKT JobFair' are organised annually

# Other

## Equal Opportunities

The consultancy centre for support of equal education opportunities continued its activities in 2017. The centre provided professional and personal consultancy for FEEC students, and organised promotion and information events for the public aimed at removing the barriers female students face when choosing careers in technical fields.

In 2017 the centre focused its attention on improving conditions for students with specific needs in terms of financial and operational support. The centre concentrates on integration of handicapped students in full-time and part-time study programmes, promotion of study opportunities, and individual approach to students with specific needs.

The Centre cooperated with Department of Physics, club 'Students for Students' and members of faculty departments.

Contact: Doc. Ing. Vlasta Sedláková, Ph.D.,

## Institute of Experimental Technology

Institute of Experimental Technology (IET) was established in 2008 and draws on longterm experience of the Department of Theoretical and Experimental Electrical Engineering in involving students in research pursued by the department's staff and centres its activities on maintaining and innovating the educational activities at the faculty where the key moment is involvement of student research teams in real application projects. The teams include secondary school students, university students and research workers from IET. Projects are published at '*Microcontrollers are in*'.

Contact: Prof. Ing. Pavel Fiala, Ph.D.,

## Interactive Playroom 'Elektrikárium'

An interactive playroom 'Elektrikárium' was opened in December 2015. As in large scientific centres worldwide, its goal is to publicize science and technology and to draw a wide spectrum of visitors. The playroom can be found at the premises of FEEC. The exhibits illustrate various phenomena connected to the electricity and electronics..

There are 15 exhibits for the visitors' hands-on experience and entertainment, which demonstrate the principles of electricity, electrical engineering, physics etc.

The visitors can compete in production of electricity, examine robots or laser harp. The composition of exhibits is being changed regularly to motivate the visitors to re-entry.

In 2017 new exhibits were installed in the playroom in building T12. We are pleased that it arose interest of elementary and secondary schools as well the public. 'Elektrikárium' or 'PerFEKT electro games' have been opened to visitors for 5 years on and is free of charge.

It is open to the public Tuesday to Thursday afternoon and the whole of Saturday. For more information visit [www.feec.vutbr.cz/elektrikarium](http://www.feec.vutbr.cz/elektrikarium)

## Study Room - 'Studentárium'

A significant event in 2017 was the completion and opening of 'Studentárium' - a multifunctional room for students to spend their free time, work on joint projects, revise. Available in the room is AV technology and board. The students can also use a kitchen, where they can heat meals, make coffee or tea. The room was opened at the beginning of the winter semester and since the very start it has become popular. The room is open from 6.00 to 22.00.



Popularisation of technical sciences – interactive playroom ‘Elektrikárium’

## Student Activities

Active at FEEC are two student organisations – the voluntary club ‘Students for Students’ (SPS) and the Student Chamber of Academic Senate FEEC (SK AS FEKT), the student part of an officially elected faculty body. Both organisations cooperate closely. The Student Chamber acts as an intermediary between faculty leadership and students, organises instruction quality assessment to increase the quality of instruction and helps to tackle students’ problems. Activities of the club ‘Students for Students’ are focused on leisure time. Its role is to enrich the students’ life. The membership is voluntary, all those interested in student activities at FEEC and BUT can apply. The club concentrates on two areas:

### Magazine e-FEKT

The student magazine is issued bi-monthly. It offers information on current events at FEEC. Moreover, technical, entertaining and many other articles can be found there.

### Assistance

The club helps first-year students to adapt to life in an unfamiliar environment of the faculty, halls of residence and the town of Brno. The students receive the ‘Freshman’s Manual’ which was first issued five years ago and offers all necessary information they will need at the beginning and during their studies. It helps the students to find their way in the labyrinth of school corridors and get around the town. Students are invited to the event ‘PerFEKT start’ organised at a weekend before the start of the semester to meet each other, explore the premises and get some tips for places to go to in their free time. For students who wish to meet during the winter semester, there are sports, cultural and entertainment events every week within the programme ‘PerFEKT assistance’.

### Cultural events

Social, cultural and educational events are organised. The biggest event last year was the 9th open-air festival - ‘*Music from FEEC*’ (Hudba z FEKTu) staged in the faculty car park on 20th September 2017, 12.00. The festival offered a rich programme, student amateur bands performed and competed, over 5,500 spectators came to see PSH and ‘Mydy Rabycad’.

Sport-loving students were invited to take part in the fun race ‘Run to 53’. The task was to run the distance from school to the 53 bus stop in the shortest possible time. The event took place along the pavement at Technická 12. There were several student categories and, as every year, VIP management relays. The main prizes were vouchers for public transport three-month tickets.

During the year, several 'Tabletop days' were organised for the students to play board games and compete in tournaments. During the summer semester a series of sound system design seminars was organised for the students of Audio Engineering, but not only for them.



Club 'Students for Students' organises many events, e.g. 'Tabletop Days'

# Department of Control and Instrumentation

## Doc. Ing. Václav Jirsík, CSc.

Head

Technická 3082/12  
616 00 Brno  
Tel.: 54114 6411  
Fax: 54114 6451  
Email: [uamt@feec.vutbr.cz](mailto:uamt@feec.vutbr.cz)



## Professors

Prof. Ing. Pavel Jura, CSc.  
Prof. Ing. Petr Pivoňka, CSc.  
Prof. Ing. František Šolc, CSc.  
Prof. Ing. Pavel Václavek, Ph.D.  
Prof. Ing. Petr Vavřín, DrSc.  
Prof. Ing. František Zezulka, CSc.  
Prof. Ing. Luděk Žalud, Ph.D.

## Associate Professors

Doc. Ing. Petr Beneš, Ph.D.  
Doc. Ing. Petr Blaha, Ph.D.  
Doc. Ing. Zdeněk Bradáč, Ph.D.  
Doc. Ing. Petr Fiedler, Ph.D.,  
Doc. Ing. Václav Jirsík, CSc.

## Lecturers

Ing. František Burian, Ph.D., Mgr. Terezie Filipenská, Ph.D., Ing. Marie Havlíková, Ph.D., Ing. Zdeněk Havránek, Ph.D., Ing. Radovan Holek, CSc., Ing. Peter Honec, Ph.D., Ing. Karel Horák, Ph.D., Ing. Ilona Janáková, Ph.D., Ing. Tomáš Jílek, Ph.D., Ing. Miroslav Jirgl, Ph.D., Ing. Václav Kaczmarczyk, Ph.D., Ing. Stanislav Klusáček, Ph.D., Ing. Lukáš Kopečný, Ph.D., Ing. Tomáš Macho, Ph.D., Ing. Petr Málek, CSc., Ing. Jan Pásek, CSc., Ing. Petr Petyovský, Ph.D., Ing. Lukáš Pohl, Ph.D., Ing. Miloslav Richter, Ph.D., Ing. Soňa Šedivá, Ph.D., Ing. Radek Štohl, Ph.D., Ing. Libor Veselý, Ph.D.

## Ph.D. Students

Internal: Ing. Jakub Arm, Ing. Ondřej Bartík, Ing. Ondřej Baštán, Ing. Tomáš Beneš, Ing. Ondřej Boštík, Ing. Martin Čala, Ing. Davídek Daniel, Ing. Jan Glos, Ing. Lukáš Honc, Ing. Adam Chromý, Ing. Aleš Jelínek, Ing. Miroslav Jirgl, Ing. Jiří Kármík, Ing. Vilém Kármík, Ing. Jan Klečka, Ing. Matuš Kozovský, Ing. Jakub Krejčí, Ing. Jan Kunz, Ing. Tomáš Lázna, Ing. Adam Ligockí, Ing. Štefan Mišík, Ing. Petr Nováček, Ing. Lucie Obšilová, Ing. Lukáš Otava, Ing. Milan Papež, Ing. Michal Skalský, Ing. Jakub Streit, Ing. Michal Šindelář

External: Ing. Luděk Buchta, Ing. Vladimír Burlak, Ing. Michaela Fendrychová, Ing. Tomáš Florián, Ing. Lešek Franek, Ing. Petr Gábrlík, Ing. Miroslav Graf, Ing. Daniel Haupt, Ing. Tomáš Hynčica, Ing. Ondřej Hynčica, Ing. Jan Klusáček, Ing. Vlastimil Kříž, Ing. Aleš Lebeda, Ing. Jaroslav Lepka, Ing. Stanislav Mašláň, Ing. Zbyněk Mynář, Ing. Petr Petyovský, Ing. Stanislav Pikula, Ing. Peter Rášo, Ing. Karel Stibor, Ing. Michal Šír, Ing. Ladislav Šťastný, Mgr. Martin Tůma, Ing. Miroslav Uher, Ing. Michal Vašina, Ing. Ivo Veselý

## Administrative and Technical Staff

Ing. Luděk Anděra, Ing. Jakub Arm, Ing. Ondřej Boščík, Ing. Martin Čala, Ing. Daniel Davídek, Ing. Adam Chromý, Ph.D., Ing. Aleš Jelínek, Ing. Jan Klečka, Ing. Jakub Krejčí, Ing. Jan Kunz, Ing. Petr Nováček, Lenka Petrová, Ing. Stanislav Pikula, Ing. Michal Šindelář, Ing. Miroslav Uher, Ing. Soběslav Valach, Ing. Ivo Veselý, Jan Vodička

## Main Interests

The department provides instruction in the Bachelor degree programme 'Control and Measurement' and the follow-up Master degree programme 'Cybernetics, Control and Measurement'. Instruction and research are conducted by five specialised groups.

The main interest of the group involved in automatic control was robust and predictive electrical drives control. Research of nonlinear estimators for sensor-free drives control continued. The outcomes have been applied within the competence centre projects, namely TA ČR CAK3 – 'Centre of Applied Cybernetics' and CIDAM – 'Centre of Intelligent Drives and Advanced Machine Control'. In cooperation with the 'Centre of Excellence CEITEC', the group was involved in international projects H2020 '3Ccar Integrated Components for Complexity Control in Affordable Electrified Cars' and OSEM-EV 'Optimised and Systematic Energy Management in Electric Vehicles'. In 2017 the group started, in cooperation with CEITEC, research on systems for autonomous vehicles in frame of the project 'H2020 AutoDrive', which is the cornerstone of 'European Light-house initiative Mobility E', and the technology project 'H2020 I-MECH' for Industry 4.0. Intensive research was carried out in the field of theoretical probability filtration of dynamical systems, automatic setting algorithms of filter parameters with possible suppression of system model vagueness. The group continued its cooperation with NXP Semiconductors Czech Republic and Infineon Technologies in the development of robust and predictive algorithms for alternating electric drives.

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

The group involved in industrial automation deals with real-time embedded systems, wireless communication systems and industrial Ethernet with focus on operational safety and protection against external and internal errors, faults and attacks. Furthermore, the group is involved in research of decentralised and distributed control and communication systems. Research is also centred on control systems for buildings and complex units. Instruction is focused on subjects dealing with control and automation of industrial technology (embedded systems, programmable automatics, SCADA systems, Industry 4.0 technology, functional safety). The group closely cooperates with Beta Control, ModemTec, Siemens, Rockwell Automation, Škoda Auto etc.

The group of artificial intelligence and robotics is involved in research of service mobile robotics. Research is mainly concerned with telepresence control of mobile robots in difficult terrain, self-localisation in outer environment, in urban areas and interiors of buildings, design of highly reliable land-based and airborne robotic systems for work under extreme conditions, and automatic map-making. Now we entered the fourth year of research on employment of elements of advanced optical scanning and virtual/extended reality in biomedical engineering, especially for cardio- and neuro-rehabilitation. Instruction encompasses introduction into stationary and mobile robotics and sections dealing with above mentioned research issues. A new subject Practical Robotics and Computer Vision was introduced in 2016, where the students can assemble their own robot and can earn credits for racing.

The long-term prime interest in computer vision is applied research and development of industrial and transport visual systems. The group cooperates with a number of commercial companies and university departments. Academics are involved in research project solution and research contracts, and provide instruction in signal and image processing and analysis, localisation, recognition and reconstruction of 3D bodies. Part of the group deals with specialised hardware design on the basis of FPGA/DSP platforms for processing of extensive data files in real time. The staff is involved in more than ten subjects in Bachelor and Master programmes, and TAČR, MPO, MŠMT, UAMT and CEITEC research projects.

Research teams are engaged in the project of European 'Centre of Excellence' OP VaVpI CEITEC – 'Central European Technology Institute', group 'Cybernetics for Materials Science' involved in cutting-edge research on control, sensors, robotics and embedded systems.

The department's two laboratories are part of the 'Centre for Research and Utilisation of Renewable Energy' (CVVOZE). They focus on developing a smart grid model with different renewable sources to test grid stabilisation algorithms, operation of certified rooms for vibration and climate testing, and training and testing laboratories for safety control systems.



Computer vision laboratory

## Major Achievements

The group focused on automatic control joined international projects H2020 3Ccar and OSEM-EV, AutoDrive and I-MECH and cooperates with the 'Centre of Excellence CEITEC' and leading international partners. The group publishes in leading journals (e.g. IEEE Transaction on Industrial Electronics) and attends conferences on theory (e.g. 'IEEE Conference on Decision and Control') and applications (e.g. IECON – 'Annual Conference of IEEE Industrial Electronics Society').

The group of measurement technology involved in projects VaVPI invested in upgrading of the laboratories for measurement of noise, vibrations and temperature. The Climate and Vibration Test Laboratory was re-accredited, and a new Calibration Laboratory for Vibration Sensors has been accredited. The structure of instruction was completely re-organised, with introduction of new compulsory subjects.

The group of industrial automation dealt with several significant projects, mainly 'Research and Development of a Filter Ventillation Unit for Protection from Chemical Substance', Dust and Biological Infection in Personal Protection Means' and REVYT.

The group of artificial intelligence and robotics focused on the system for visual telepresence with high resolution and option to combine data from TOF proximity scanners, CCD sensors and thermovision cameras. The reconnaissance robotic system Morpheus-2 with a unique system of drives inside wheel discs was presented. And a system for precise self-localisation and navigation in outer environment was designed.

The group of computer vision continued research in TAČR CK TE01020197 project 'Centre of Applied Cybernetics', as investigator of the package 'Camera systems and methods of image analysis for monitoring in transportation and industry'. Research activities of CAK are centred on sophisticated computer vision problems in traffic applications, driving assistance systems and industrial camera inspection systems. Another important research objective is the development of our own systems for processing large volumes of data on the basis of FPGA/DSP platforms e.g. the high rate 4K camera with 10G Ethernet optical interface. The group is involved in several research and development projects, in transformation of courses related to computer vision and instruction from single signal processing to meta algorithms for machine learning. The students acquire complex and at the same time detailed knowledge.

## Major Research Projects

### Centre of Intelligent Drives and Advanced Machine Control – Technology Agency of the Czech Republic – CK

Investigator: Zdeněk Peroutka, investigator at UAMT Pavel Václavek

### Illumination Systems with Defined Characteristics for Industrial Camera Systems and Power Illumination Systems – MPO Aplikace

Investigator: Karel Horák

### Centre of Competence, Technology Agency of the Czech Republic – Advanced Sensors and Sensor Data Processing Techniques – Project TA ČR TE02000202

Investigator: Antonín Platil, Czech Technical University, investigator at UAMT Petr Beneš

### Centre of Applied Cybernetics III. – Technology Agency of the Czech Republic – CK TE01020197

Investigator: Vladimír Kučera, Czech Technical University, investigator at UAMT Pavel Václavek

### Novel Products for Filling Stations Based on Development of Alternative Technologies (CNG, LNG, electromobility) – OP PIK CZ.01.1.02/0.0/0.0/16\_084/0010312

Investigator: Zdeněk Bradáč

### Manufacturing Processes Control, Measurement and Monitoring – Technology Agency of Czech Republic – Epsilon TH02010830

Investigator: Petr Beneš

### Advanced Technology of Modular Control and Diagnostic systems in Aircraft Engines - MPO TRIO FV20043

Investigator: Petr Beneš

## Selected Publications

CHROMÝ, A.; KLÍMA, O. A 3D Scan Model and Thermal Image Data Fusion Algorithms for 3D Thermography in Medicine. *multi science- Journal of Healthcare Engineering*, 2017, vol. 2017, no. 2017, p. 1-9. ISSN: 2040-2295.

CHROMÝ, A.; KLÍMA, O. A 3D Scan Model and Thermal Image Data Fusion Algorithms for 3D Thermography in Medicine. *multi science- Journal of Healthcare Engineering*, 2017, vol. 2017, no. 1, p. 1-9. ISSN: 2040-2295.

MIŠÍK, Š.; BRADÁČ, Z.; CELA, A. Reducing Usage of the Computational Resources by Event Driven Approach to Model Predictive Control. *Journal of Electrical Engineering*, 2017, vol. 68, no. 4, p. 290-298. ISSN: 1335-3632.

BORIL, J., JIRGL, M., JALOVECKY, R. Using Simulation Technologies in Aviation for Pilot Behaviour Modelling and Flight Training Assessment. *Advances in Military Technology*, 2017, vol. 12, no. 1, p. 147-161. ISSN: 1802-2308.

MARCOŇ, P.; SZABÓ, Z.; VESELÝ, I.; ZEZULKA, F.; SAJDL, O.; ROUBAL, Z.; DOHNAL, P. A Real Model of a Micro-Grid to Improve Network Stability. *Applied Sciences - Basel*, 2017, no. 8, p. 1-16. ISSN: 2076-3417.

BUTKO, P.; VITTEK, J.; FEDOR, T.; VAVRÚŠ, V.; MYNÁŘ, Z. Energy saving control strategy of servodrives with asynchronous motor. *Archiv fuer Elektrotechnik*, 2017, vol. 99, no. 3, p. 1-12. ISSN: 1432-0487.

LIU, D.; HAVRÁNEK, Z.; MARBURG, S.; PETERS, H.; KESSISSOGLU, N. Non-negative intensity and back-calculated non-negative intensity for analysis of directional structure-borne sound. *JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA*, 2017, vol. 142, no. 1, p. 117-123. ISSN: 0001-4966.

BOŠTÍK, O.; HORÁK, K.; KLEČKA, J.; DAVÍDEK, D. BUBBLE CAPTCHA - A START OF THE NEW DIRECTION OF TEXT CAPTCHA SCHEME DEVELOPMENT. *Mendel Journal series*, 2017, vol. 2016, no. 22, p. 57-64. ISSN: 1803-3814.

FRANEK, L.; FIEDLER, P. A Multiconductor Model of Power Line Communication in Medium-Voltage Lines. *ENERGIES*, 2017, vol. 10, no. 816, p. 1-16. ISSN: 1996-1073.

FRANEK, L. Smart Grids - data concentrator or gateway. *Metering & Smart Energy International*, 2017, vol. 2017, no. 2, p. 54-56. ISSN: 1025-8248.

VAŠINA, M.; ŽALUD, L. SHAPE MEMORY ALLOYS (SMA) – MODELLING OF NONLINEARITIES HYSTERESIS TYPE. *European International Journal of Science and Technology*, 2017, vol. 6, no. 2, p. 1-6. ISSN: 2304-9693.

MAŠLÁŇ, S.; ŠÍRA, M.; NOVÁKOVÁ ZACHOVALOVÁ, V.; STREIT, J. Digital Sampling Setup for Measurement of Complex Voltage Ratio. *IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT*, 2017, vol. 66, no. 6, p. 1355-1363. ISSN: 0018-9456.

## Bachelor's Courses

Computer Control  
(prof. Ing. Petr Pivoňka, CSc.)

Databases Systems  
(Ing. Radovan Holek, CSc.)

Logical Circuits and Systems  
(Ing. Radovan Holek, CSc.)

Measurement of Physical Quantities  
(doc. Ing. Petr Beneš, Ph.D.)



Measurement in Electroengineering  
(Ing. Soňa Šedivá, Ph.D.)  
Microprocessors  
(Ing. Tomáš Macho, Ph.D.)  
Modeling and Simulation  
(prof. Ing. Pavel Václavek, Ph.D.)  
Modern Means in Automation  
(doc. Ing. Václav Jirsík, CSc.)  
Computers and Programming 1  
(Ing. Tomáš Macho, Ph.D.)  
Computers and Programming 2  
(Ing. Miloslav Richter, Ph.D.)  
Practical Robotics and Computer Vision  
(prof. Ing. Luděk Žalud, Ph.D.)  
Practical Programming in C++  
(Ing. Miloslav Richter, Ph.D.)  
Programmable Logic Controllers  
(Ing. Radek Štohl, Ph.D.)  
Industrial Automation  
(Ing. Radek Štohl, Ph.D.)

## Master's Courses

Process Control  
(Ing. Václav Kaczmarczyk, Ph.D.)  
Distributed Systems and Networks  
(doc. Ing. Petr Fiedler, Ph.D.)  
Electronic Measurement Systems  
(Ing. Marie Havlíková, Ph.D.)  
Embedded Systems for Industrial Control  
(doc. Ing. Petr Fiedler, Ph.D.)  
Machinery Safety for Industry Automation  
(Ing. Radek, Štohl, Ph.D.)  
Fuzzy systems  
(prof. Ing. Pavel Jura, CSc.)  
Measuring Techniques for Technical Diagnostics  
(Ing. Stanislav Klusáček, Ph.D.)  
Modelling and Identification  
(doc. Ing. Petr Blaha, Ph.D.)  
Operating Systems and Networks  
(Ing. Tomáš Macho, Ph.D.)  
Optimization of Controllers  
(prof. Ing. Petr Pivoňka, CSc.)  
Embedded Systems for Industrial Control  
(doc. Ing. Zdeněk Bradáč, Ph.D.)

## Ph.D. Courses

Selected Chaps from Measuring Techniques  
(doc. Ing. Petr Beneš, Ph.D.)

Control Theory 1  
(doc. Ing. Petr Blaha, Ph.D.)  
Control Theory 2  
(prof. Ing. Pavel Václavek, Ph.D.)  
Signals and Systems  
(prof. Ing. Pavel Jura, CSc.)  
Sensors  
(doc. Ing. Petr Beneš, Ph.D.)  
PC systems  
(Ing. Soběslav Valach)  
Virtual Instrumentation in Automation  
(Ing. Zdeněk Havránek, Ph.D.)  
Computer Science in Automation  
(Ing. Miloslav Richter, Ph.D.)  
Fundamentals of Robotics  
(prof. Ing. Luděk Žalud, Ph.D.)  
Processing and Digitizing of Analogue Signals  
(Ing. Zdeněk Havránek, Ph.D.)  
Processing of Multidimensional Signals  
(Ing. Karel Horák, Ph.D.)

Computer Vision  
(Ing. Karel Horák, Ph.D.)  
Robotics  
(prof. Ing. Luděk Žalud, Ph.D.)  
Robust and Algebraic Control  
(doc. Ing. Petr Blaha, Ph.D.)  
Recognition  
(Ing. Karel Horák, Ph.D.)  
Data Acquisition, Analysis and Processing  
(Ing. Marie Havlíková, Ph.D.)  
Special Sensors  
(Ing. Stanislav Klusáček, Ph.D.)  
Machine Learning  
(Ing. Karel Horák, Ph.D.)  
Discrete Event Systems  
(prof. Ing. Pavel Václavek, Ph.D.)  
Theory of Dynamic Systems  
(doc. Ing. Petr Blaha, Ph.D.)  
Artificial Intelligence  
(doc. Ing. Václav Jirsík, CSc.)

Selected Chaps from Automatic Control  
(prof. Ing. Petr Pivoňka, CSc.)

## Laboratories

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

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

**Laboratory of Electronic Measurement** (instruction in Measurement in Electrical Engineering for first-year study areas BAMT, B-MET, Soňa Šedivá)

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

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

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

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

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

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

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

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

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

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

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

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

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

**CVVOZE Laboratory of Automation** (safe control systems, experimental power grid, František Zezulka)

**CVVOZE Testing Laboratory** (accredited testing of machines, electrotechnical and electronic components, products and parts, ČSN EN 60068-2-xx tests (vibrations, shocks, cold, heat, moisture, combined, Petr Beneš.)

**CVVOZE Calibration Laboratory** (accredited calibration laboratory for primary and secondary calibration of images of vibrations, laser vibrometers, reference sensors, calibrators and sensors with very low calibration uncertainty, Petr Beneš)

# Department of Biomedical Engineering

## Prof. Ing. Ivo Provazník, Ph.D.

Head

Technická 3082/12  
616 00 Brno  
Tel.: 541 146 667  
Fax: 541 146 619  
e-mail: [ubmi@feec.vutbr.cz](mailto:ubmi@feec.vutbr.cz)



## Professors

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

## Associate Professors

Doc. Ing. Milan Chmelař, CSc.  
Doc. Ing. Radim Kolář, Ph.D.  
Doc. Ing. Jana Kolářová, Ph.D.  
Doc. Ing. Jiří Kozumplík, CSc.  
Doc. Ing. Jiří Rozman, CSc.  
Doc. Ing. Daniel Schwarz, Ph.D.

## Lecturers

RNDr. Mgr. Michal Bittner, Ph.D., Ing. Vratislav Čmiel, Ph.D., Ing. Oto Janoušek, Ph.D., Ing. Radovan Jiřík, Ph.D., Ing. Vratislav Harabiš, Ph.D., Ing. Denisa Maděránková, Ph.D., Ing. Martin Mézl, Ph.D., Ing. Jan Odstrčilík, Ph.D., Ing. Marina Ronzhina, Ph.D., Sudeep Roy, Ph.D., Ing. Jiří Sekora, Mgr. Josef Skopalík, Ing. Lukáš Smital, Ph.D., Ing. Helena Škutková, Ph.D., Ing. Martin Vítek, Ph.D.

## Ph.D. Students

Ing. Loyal Abo Khayal, Ing. Larisa Baiazitova, Ing. Jaroslav Balogh, Ing. Mgr. Jan Cimbálník, Ing. Jakub Hejč, Ing. Branislav Hesko, Ing. Michal Hracho, Ing. Jiří Chmelík, Ing. Roman Jakubíček, Ing. Robin Jugas, Ing. Kateřina Jurečková, Ing. Jakub Kašpar, Ing. Jakub Křenek, Ing. Pavlína Koščová, Ing. Markéta Koťová, Ing. Martin Králík, Ing. Jiří Kratochvíla, Ing. Kristýna Kupková, Ing. Alena Kubičková (roz. Drkošová), Ing. René Labounek, Ing. Martin Lamoš, Ing. Ivana Labounková (roz. Liberdová), Ing. Lucie Maršánová, Ing. Pavel Leinveber, Ing. Ondřej Macíček, Ing. Magdaléna Matejková, Ing. Andrea Němcová, Ing. Petra Novotná, Ing. Tomáš Potočňák, Ing. Karel Sedlář, Ing. Jiří Sekora, Ing. Tomáš Slaviček, Ing. Radovan Smíšek, Ing. Ladislav Soukup, Ing. Ondřej Svoboda, Ing. Veronika Svozilová, Ing. Tomáš Šikner, Ing. Petra Štohanzlová (roz. Podlipná), Ing. Petr Veselý, Ing. Tomáš Vičar, Ing. Petr Walek

## Administrative and Technical Staff

Ing. Gabriela Petrovičová, Miroslava Prášilová, Hana Rýznarová, MUDr. Šárka Sekorová

## Main Interests

The department provides instruction in processing of signals and images, biomedical and ecological engineering, environmental studies, biomedical technology and bioinformatics in Bachelor, Master and Ph.D. programmes.

The department is involved in basic and applied research on engineering principles in neuroscience, cardiology, physiology, electrochemistry, botany, genetics and molecular biology. The main areas of interest are digital processing and analysis of especially cardiological signals, including experimental cardiology in cooperation with Faculty of Medicine, Masaryk University. Other research interests are analyses of polysomnographic data, EEG signals as related to temporal studies or fMRI acquisition, digital processing and analysis of medical images for different imaging modalities, mainly ultrasonography, MRI, CT, microscopy and computer vision. The latest methods of processing large data volumes are applied including methods of deep learning or parallelisation of complex calculations on GPU. Research is also focused on cell biology. It is mainly utilisation of confocal microscopy or fast fluorescence microscopy for study of viability and proliferation of cells, impact of nanoparticles on cellular behaviour, measurement of intracellular calcium of cardiomyocytes or using optical methods to study mechanical properties of cells. There has been rapid development in research on bioinformatics, proteomics, genomics, and lately metagenomics. Projects are centred on methods of evolutionary and similarity analysis of genomic and proteomic data, methods for construction of bacterial genomes from de novo sequence data, search for genes in all genome data and analysis of pharmacofore of natural molecules of potentially healing substances.

Research issues relate to education. The department supports a wider education of students. In 2017 Bachelor and Master programme students visited a number of top research institutions (national Tissue Centre, Masaryk Oncological Institute, Institute of Instrument Technology, Academy of Sciences etc.)

In research and instruction the department closely cooperates with Ophthalmological Clinic of Friedrich-Alexander-University Erlangen (Germany), University of Bergen (Norway), the companies Philips Czech Republic, Philips Nederlands, MIKRO s.r.o., VUP Medicem, MDT-Medical Data Transfer, s.r.o., Touchless Biometric Systems s.r.o., Smart Brain Sale, s.r.o., Institute of Instrument Technology of Academy of Sciences, Faculty of Medicine of Masaryk University in Brno, Mendel University, Research Institute of Veterinary Medicine, University of Chemistry and Technology in Prague, Faculty Hospital Bohunice and Faculty Hospital U sv. Anny in Brno.



Interactive exhibition organised by the department in Gallery Vaňkova

## Major Achievements

In 2017 members of the department published more than 20 papers, most of them in non-zero impact factor journals. Among the most notable achievements are papers in 'Biotechnology Advances', 'Scientific Reports' and 'Neural Computation'. Scientific outcomes were presented at conferences such as 'Computing in Cardiology' or 'European Signal Processing Conference'. Some members of the department organised a specialised section

focused on processing of ophthalmological images in the framework of the conference 'ECCOMAS Thematic Conferences on Computational Vision and Medical Image Processing'.

Members of the department co-organise the 'World Congress on Medical Physics and Biomedical Engineering', the major world conference on research in biomedical engineering. They are involved in preparation of the conference 'Computing in Cardiology' that will be held in Brno in 2021 and will be organised by the department.

In 2017 the department organised a scientific show 'Biomedical engineering – sci-fi becomes a reality' for wide public to promote biomedical engineering through specific presentations and applications. The event was held in Gallery Vaňkovka 1-10 March. This event was followed by a one-day exposition of research issues in the Technical Museum of Brno in the framework of 'Medicine Yesterday and Today'. Hundreds of visitors had an opportunity to examine interactive biomedical exhibits at the 'Night of Scientists' in September 2017. Education activities of the department are not targeted on Bachelor and Master studies. The department educated gifted secondary school students in seminars and workshops, passed professional know-how at meetings of graduates with students and arose interest in technical disciplines in elementary school pupils at the competition 'Merkur perFEKT Challenge' designed to develop skills of the participants.

## Major Research Projects

**Output Techniques for Construction and Annotation of Bacterial Genome Using Digital Processing of Genomic Signals** – standard GAČR projects

Investigator: Helena Škutková

**The Relationship between Butanol Efflux and Tolerance of Butanol in Clostridia** – standard GACR project

Investigator: Ivo Provazník

**Development of Infrastructure for Interdisciplinary Research of Technologies in Biomedical Engineering and Bioinformatics** – development project of MŠMT

Investigator: Radim Kolář

**Development of Interdisciplinary Ph.D. Programme Biomedical Technology and Bioinformatics** – development project MŠMT

Investigator: Ivo Provazník

**Infrastructure for Instruction in New Study Programme Sports Technology at Brno University of Technology** – development project of MŠMT

In cooperation with Centre of Sports Activities

Investigator: Pavel Korvas

## Selected Publications

PATÁKOVÁ, P.; KOLEK, J.; SEDLÁŘ, K.; KOŠČOVÁ, P.; BRANSKÁ, B.; KUPKOVÁ, K.; PAULOVÁ, L.; PROVAZNÍK, I. Comparative analysis of high butanol tolerance and production in clostridia. *BIOTECHNOLOGY ADVANCES*, 2017, vol. 35, no. 8, p. 1-38. ISSN: 0734-9750.

HESKO, B.; KOLÁŘ, R.; HARABIŠ, V. Design of an experimental laser speckle contrast imaging system and image evaluation. *Lékař a technika*, 2017, vol. 47, no. 3, p. 101-107. ISSN: 0301-5491.

JAKUBÍČEK, R.; CHMELÍK, J.; JAN, J. Vertebrae segmentation in 3D CT data: a review of methods and evaluation approaches. *CURRENT MEDICAL IMAGING REVIEWS*, 2017, vol. 14, no. 1, p. 1-14. ISSN: 1573-4056.

CHMELÍK, J.; JAKUBÍČEK, R.; JAN, J. Tumorous Spinal Lesions: Computer Aided Diagnosis and Evaluation Based on CT Data – A Review. *CURRENT MEDICAL IMAGING REVIEWS*, 2017, vol. 13, no. 4, p. 1-9. ISSN: 1573-4056.

LANGER, P. Improved assessment of arterial stiffness using corrected cardio-ankle vascular index (CAVI0) in overweight adolescents with white-coat and essential hypertension. *SCANDINAVIAN JOURNAL OF CLINICAL & LABORATORY INVESTIGATION*, 2017, vol. 50, no. 50, p. 1-8. ISSN: 0036-5513.

KOLEK, J.; DIALLO, M.; VASYLKIVSKA, M.; BRANSKÁ, B.; SEDLÁŘ, K.; LOPEZ-CONTRERAS, A.; PATÁKOVÁ, P. Comparison of expression of key sporulation, solventogenic and acetogenic genes in *C. beijerinckii* NRRL B-598 and its mutant strain overexpressing *spo0A*. *Applied Microbiology and Biotechnology*, 2017, vol. 101, no. 22, p. 8279-8291. ISSN: 1432-0614.

STANGELAND, M.; ENGJOM, T.; MÉZL, M.; JIŘÍK, R.; GILJA, O.; DIMCEVSKI, G.; NYLUND, K. Interobserver Variation of the Bolus-and-Burst Method for Pancreatic Perfusion with Dynamic – Contrast-Enhanced Ultrasound. *Ultrasound International Open*, 2017, vol. 3, no. 3, p. E99 (E106 p.) ISSN: 2199-7152.

MARŠANOVÁ, L.; RONZHINA, M.; SMÍŠEK, R.; VÍTEK, M.; NĚMCOVÁ, A.; SMITAL, L.; NOVÁKOVÁ, M. ECG features and methods for automatic classification of ventricular premature and ischemic heartbeats: A comprehensive experimental study. *Scientific Reports*, 2017, no. 7, p. 1-11. ISSN: 2045-2322.

- SVOZILOVÁ, V.; KOZUMPLÍK, J. Automatická detekce začátků svalové aktivity ke stanovení doby svalové odezvy řidiče. *Elektrorevue - Internetový časopis (http://www.elektrorevue.cz)*, 2017, roč. 19, č. 4, s. 43-49. ISSN: 1213-1539.
- NĚMCOVÁ, A.; JANOUŠEK, O.; VÍTEK, M.; PROVAZNÍK, I. Testing of features for fatigue detection in EOG. *BIO-MEDICAL MATERIALS AND ENGINEERING*, 2017, vol. 28, no. 4, p. 379-392. ISSN: 0959-2989.
- ROY, S.; GUMULEC, J.; KUMAR, A.; RAUDENSKÁ, M.; BAIG, M.; POLANSKÁ, H.; BALVAN, J.; GUPTA, M.; BABULA, P.; ODSTRČILÍK, J.; CHOI, I.; PROVAZNÍK, I.; MASARÍK, M. The effect of Benzothiazolone-2 on the expression of Metallothionein-3 in modulating Alzheimer's disease. *Brain and Behavior*, 2017, vol. 7, no. 9, p. 1-9. ISSN: 2162-3279.
- RONZHINA, M.; OLEJNÍČKOVÁ, V.; STRAČINA, T.; NOVÁKOVÁ, M.; JANOUŠEK, O.; HEJČ, J.; KOLÁŘOVÁ, J.; HLAVÁČOVÁ, M.; PAULOVÁ, H. Effect of increased left ventricle mass on ischemia assessment in electrocardiographic signals: rabbit isolated heart study. *BMC Cardiovascular Disorders*, 2017, vol. 17, no. 216, p. 1-11. ISSN: 1471-2261.
- ŠIKNER, T.; KOLÁŘ, R. Impact of gain on high-frequency contrast-enhanced ultrasound video and radio frequency data. *Elektrorevue - Internetový časopis (http://www.elektrorevue.cz)*, 2017, vol. 19, no. 3, p. 73-77. ISSN: 1213-1539.
- KRÁLÍK, M.; KOZUMPLÍK, J. Využití analýzy variability srdečního rytmu pro detekci spánkové apnoe. *Elektrorevue - Internetový časopis (http://www.elektrorevue.cz)*, 2017, roč. 19, č. 3, s. 91-96. ISSN: 1213-1539.
- POTOČNÁK, T.; KOZUMPLÍK, J. [submitted] Časovo-frekvenční analýza spánkového EEG s využitím metod založených na okamžité frekvenci. *Elektrorevue - Internetový časopis (http://www.elektrorevue.cz)*, 2017, roč. xy, č. xy, s. x (y s.) ISSN: 1213-1539.
- VÍTEČEK, J.; GURYČA, O.; NĚMCOVÁ, A. Měření tepové frekvence s využitím chytrého telefonu. *Elektrorevue - Internetový časopis (http://www.elektrorevue.cz)*, 2017, roč. 19, č. 2, s. 66-72. ISSN: 1213-1539.
- KATEŘINA, S.; SEDLÁŘ, K.; BOSÁK, J.; CHALOUPKOVÁ, E.; SEDLÁČEK, I.; PROVAZNÍK, I.; ŠMAJS, D. Free-Living *Enterobacterium Pragia fontium* 24613: Complete Genome Sequence and Metabolic Profiling. *EVOLUTIONARY BIOINFORMATICS*, 2017, vol. 13, no. 1, p. 1-7. ISSN: 1176-9343.
- MAREČEK, R.; LAMOŠ, M.; LABOUNEK, R.; BARTOŇ, M.; SLAVÍČEK, T.; MIKL, M.; REKTOR, I.; BRÁZDIL, M. Multiway array decomposition of EEG spectrum: Implications of its stability for the exploration of large-scale brain networks. *NEURAL COMPUTATION*, 2017, vol. 29, no. 4, p. 968-989. ISSN: 0899-7667.
- BEHÁŇOVÁ, A.; VÍTEK, M. Detekcia QRS komplexov v 12-svodovom EKG signáli s použitím adaptívneho kvantovacieho prahu. *Elektrorevue - Internetový časopis (http://www.elektrorevue.cz)*, 2017, roč. 19, č. 1, s. 7-16. ISSN: 1213-1539.
- HLAVÁČOVÁ, M.; OLEJNÍČKOVÁ, V.; RONZHINA, M.; STRAČINA, T.; JANOUŠEK, O.; NOVÁKOVÁ, M.; BABULA, P.; KOLÁŘOVÁ, J.; PROVAZNÍK, I.; PAULOVÁ, H. Tolerance of isolated rabbit hearts to short ischemic periods is affected by increased LV mass fraction. *Physiological Research*, 2017, vol. 66, no. 4, p. 581-589. ISSN: 1802-9973.
- ŠTOHANZLOVÁ, P.; KOLÁŘ, R. Tissue perfusion modelling in optical coherence tomography. *BIOMED ENG ONLINE*, 2017, vol. 16, no. 1, p. 1-16. ISSN: 1475-925X.
- KOZUMPLÍK, J.; PROVAZNÍK, I. Fast Time-Varying Linear Filters for Suppression of Baseline Drift in Electrocardiographic Signals. *BIOMED ENG ONLINE*, 2017, vol. 16, no. 24, p. 1-16. ISSN: 1475-925X.
- PEŠL, M.; PŘIBYL, J.; ČMIEL, V.; AČIMOVIĆ, I.; JELÍNKOVÁ, Š.; DVOŘÁK, P.; STÁREK, Z.; SKLÁDAL, P.; ROTREKL, V. Phenotypic assays for analysis of pluripotent stem cell derived cardiomyocytes. *JOURNAL OF MOLECULAR RECOGNITION*, 2017, vol. 30, no. 6, p. 1-14. ISSN: 0952-3499.
- SEDLÁŘ, K.; KOLEK, J.; PROVAZNÍK, I.; PATÁKOVÁ, P. Reclassification of non-type strain *Clostridium pasteurianum* NRRL B-598 as *Clostridium beijerinckii* NRRL B-598. *Journal of Biotechnology*, 2017, vol. 244, no. 1, p. 1-3. ISSN: 0168-1656.

## Bachelor's Courses

Algorithms and Programming  
(doc. Ing. Jana Kolářová, Ph.D.)

Biological Signal Analysis  
(doc. Ing. Jiří Kozumplík, CSc.)

Bioelectric Phenomena  
(doc. RNDr. Ing. Jiří Šimurda, CSc.)

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

Bioinformatics  
(prof. Ing. Ivo Provažník, Ph.D.)

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

Digital Signal Processing and Analysis  
(prof. Ing. Jiří Jan, CSc.)

Digital Signal and Image Processing  
(prof. Ing. Jiří Jan, CSc.)

Ecology in Electrotechnical Profession  
(doc. Ing. Jiří Rozman, CSc.)

Ecology in Healthcare  
(Ing. Lukáš Smital, Ph.D.)

Electronic Systems and Measurement  
(Ing. Jiří Sekora)  
Medical Diagnostic Devices  
(doc. Ing. Radim Kolář, Ph.D.)  
Models in Biology and Epidemiology  
(Ing. Martin Vítek, Ph.D.)  
General Biophysics  
(prof. MUDr. Vojtěch Mornstein, CSc.)  
Pathological Physiology  
(prof. MUDr. Anna Vašků, CSc.)  
Computers and Programming 1  
(prof. Ing. Ivo Provazník, Ph.D.)  
Practics of Bioinformatics  
(doc. Ing. Jana Kolářová, Ph.D.)  
Radiology and Nuclear Medicine  
(prof. MUDr. Vlastimil Válek, CSc.)  
Heavy Current and Equipment Electronics  
(Ing. Jiří Sekora, Ph.D.)  
Standardization in Medicine  
(doc. Ing. Milan Chmelař, CSc.)  
Therapeutic and Prothetic Instruments  
(doc. Ing. Jana Kolářová, Ph.D.)

## Master's Courses

Analysis and Interpretation of Biological Data  
(doc. Ing. Jiří Kozumplík, CSc.)  
Analysis of Biological Sequences  
(prof. Ing. Ivo Provazník, Ph.D.)  
Analysis of Biomedical Images  
(prof. Ing. Jiří Jan, CSc.)  
Analysis of Signals and Images  
(prof. Ing. Jiří Jan, CSc.)  
Bioethics  
(Ing. Iva Pipalová)  
Biophysics  
(doc. RNDr. Ing. Jiří Šimurda, CSc.)  
Human Biology  
(prof. MUDr. Jindřich Vomela, CSc.)  
Diagnostics of the Bio- and Ecosystems  
(doc. Ing. Radim Kolář, Ph.D.)  
Ecological Engineering  
(Ing. Lukáš Smital, Ph.D.)  
Evolution Algorithms  
(doc. Ing. Jiří Kozumplík, CSc.)  
Traditional Medical and Ecological Imaging Systems  
(doc. Ing. Daniel Schwarz, Ph.D.)  
Clinical Physiology  
(prof. MUDr. Jindřich Vomela, CSc.)  
Laboratory Technology for Genomics and Proteomics  
(doc. Ing. Jana Kolářová, Ph.D.)  
Medical Information Systems  
(prof. Ing. Ivo Provazník, Ph.D.)

Artificial Intelligence in Medicine  
(doc. Ing. Jiří Kozumplík, CSc.)  
Introduction to Biology of Man  
(prof. MUDr. Jindřich Vomela, CSc.)  
Introduction to Clinical Medicine  
(doc. MUDr. Miroslav Souček, CSc.)  
Introduction to Medical Informatics  
(prof. Ing. Ivo Provazník, Ph.D.)  
Introduction to Molecular Biology and Genetics  
(doc. Ing. Petr Dvořák, CSc.)  
Basics of Anatomy and Histology  
(doc. MUDr. Pavel Matonoha, CSc.)  
Basics of First Aid  
(MUDr. Lukáš Dadák)  
Health Ethics  
(Mgr. Josef Kuře, Dr. phil.)  
Health Legislation and Law  
(Ing. Oto Janoušek Ph.D.)  
Medical Imaging Systems  
(doc. Ing. Daniel Schwarz, Ph.D.)

Microscopic Imaging Technology  
(doc. Ing. Radim Kolář, Ph.D.)  
Biological System Modelling  
(Ing. Martin Vítek, Ph.D.)  
Molecular Biology  
(doc. PharmDr. Petr Babula, Ph.D.)  
Computer-Aided Medical Diagnostics  
(prof. Ing. Ivo Provazník, Ph.D.)  
Advanced Analysis of Biological Signals  
(doc. Ing. Jiří Kozumplík, CSc.)  
Advanced Methods in Biostatistics  
(doc. RNDr. Ladislav Dušek, Ph.D.)  
Programming in Bioinformatics  
(doc. Ing. Jana Kolářová, Ph.D.)  
Special Devices for Healthcare and Ecology  
(Ing. Oto Janoušek Ph.D.)  
System Biology  
(prof. Ing. Ivo Provazník, Ph.D.)  
Tomographic Imaging Systems  
(doc. Ing. Daniel Schwarz, Ph.D.)  
Introduction to Environmental Studies  
(RNDr. Mgr. Michal Bittner, Ph.D.)  
Biomedical Data Visualization  
(Ing. Vratislav Harabiš, Ph.D.)  
Advanced Methods of Signal Processing  
(prof. Ing. Jiří Jan, CSc.)  
Basics of Research Methodology  
(doc. Ing. Radim Kolář, Ph.D.)

Healthcare  
(prof. MUDr. Jindřich Vomela, CSc.)  
Urgent Health Care  
(doc. MUDr. Vladimír Šrámek, Ph.D.)

Medical Information Systems  
(prof. Ing. Ivo Provazník, Ph.D.)

## Ph.D. Courses

Modern Methods in Electrophysiology Research  
(prof. MUDr. Marie Nováková, Ph.D.)  
Modern Approaches of Biomedical Image Analysis  
(doc. Ing. Radim Kolář, Ph.D.)  
New Trends in the Analysis and Classification of  
Biomedical Data  
(doc. Ing. Jiří Kozumplík, CSc.)  
Advanced Analysis of Large Genomic Data  
(prof. Ing. Ivo Provazník, Ph.D.)

Advanced Microscopic Techniques in Biology  
(doc. PharmDr. Petr Babula, Ph.D.)  
Selected Problems of Biomedical Engineering  
(prof. Ing. Ivo Provazník, Ph.D.)  
Advanced Methods of Processing and Analysis of  
Images  
(prof. Ing. Jiří Jan, CSc.)

## Laboratories

**Laboratory of Electronics** (manufacture and testing of electromechanical and electronic components for research and student projects, Jiří Sekora)  
**Laboratory of Biophysics I and II** (instruction in Biophysics, Bioelectric Phenomena, research on electrophysiology of cells, Vratislav Čmiel)  
**Laboratory of Biomedical Technology** (instruction in Design and Operation of Complex Systems, Electronic Systems and Measurement, experimental research and student projects, Jiří Sekora)  
**Laboratory of Bionics** (instruction in Human Biology, Biophysics, Clinical Physiology, Healthcare, Therapeutic and Prosthetic Technology, experimental measurements for research and student projects, Oto Janoušek)  
**Laboratory of Diagnostic Technology** (instruction in Medical Diagnostic Technology, Diagnostics of bio- and ecosystems, experiments for research and student projects, Vratislav Harabiš)  
**Laboratory of Environmental Technology** (instruction in Special Medical and Ecological Technology, Ecology in Electrical Engineering, Ecology in Healthcare, experiments for research and student projects, Jiří Lukáš Smital)  
**Laboratory of Functional Diagnostics** (instruction in Electronic Systems and Measurements, research of brain and muscle electrophysiology, Marina Ronzhina)  
**Laboratory of Genomics and Proteomics I and II** (clean environment for isolation and handling of biological samples, measurement and diagnostics of DNA, RNA and proteins, instruction in Molecular Biology, research on bioinformatics, Helena Škutková)  
**Laboratory of Information Systems** (instruction in Evolution Algorithms, Medical Information Systems, Artificial Intelligence in Medicine, Bioinformatics, Algorithmisation and Programming, Computers and Programming, Analysis of Biological Sequences, Bioinformatics Practice, Denisa Maděránková)  
**Laboratory of Microscopy I and II** (instruction in Microscopic Imaging Technology, experiments for research and student projects, research on optical coherent tomography, Jan Odstrčilík)  
**Laboratory of Rehabilitation Technology** (experimental measurements for research and students projects, research on rehabilitation technology, Marina Ronzhina)  
**Laboratory of Ultrasound Tomography** (research and measurement of ultrasonographic data, calibration of devices and ultrasound probes, Vratislav Harabiš)  
**Laboratory of Imaging Systems** (instruction in Introduction in Medical Informatics, Medical Information Systems, experiments for research and student projects, Radim Kolář)  
**Laboratory of Image Processing** (instruction in Analysis of Biological Signals, Bioinformatics, Conventional Imaging Systems in Medicine, Advanced Analysis of Biological Signals, Analysis and Interpretation of Biological Data, Digital Processing of Signals and Images, Tomography Imaging Systems, Jiří Sekora)  
**Laboratory of Signal Processing** (instruction in Programming in Bioinformatics, Computer Support for Medical Diagnostics, Introduction in Medical Informatics, Analysis of Signals and Images, Biomedical Data Visualisation, Analysis of Biomedical Images, Models in Biology and Epidemiology, System Biology, Digital Signal Processing and Analysis, Martin Vítek)



# Department of Power Electrical Engineering

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

Head

Technická 3082/10  
616 00 Brno 16  
Tel.: 541 146 220  
Fax: 541 146 210  
e-mail: [ueen@feec.vutbr.cz](mailto:ueen@feec.vutbr.cz)



## Associate Professors

Doc. Ing. Petr Baxant, Ph.D.  
Doc. RNDr. Oldřich Coufal, CSc.  
Doc. Ing. Jiří Drápela, Ph.D.  
Doc. Ing. Ilona Lázníčková, Ph.D.  
Doc. Ing. Petr Mastný, Ph.D.  
Doc. Ing. Jaroslava Orságová, Ph.D.  
Doc. Ing. Petr Toman, Ph.D.

## Lecturers

Ing. Branislav Bátora, Ph.D., Ing. Karel Katovský, Ph.D., Ing. Michal Krbal, Ph.D., Ing. Jan Macháček, Ph.D., Ing. Jiří Martinec, Ph.D., Ing. Karel Máslo, CSc., Ing. Martin Paar, Ph.D., Ing. Michal Ptáček, Ph.D., Ing. Lukáš Radil, Ph.D., Ing. Stanislav Sumec, Ph.D., Ing. Jan Škoda, Ph.D., Ing. David Topolánek, Ph.D.

## Ph.D. Students

Ing. Tomáš Bajánek, Ing. Mayada Daboul, Ing. Štěpán Foral, Ing. Miroslav Haluza, Ing. Tomáš Kolacia, Ing. Marek Kopicčka, Ing. Jan Morávek, Ing. Filip Novotný, Ing. Luděk Ondroušek, Mgr. Mikuláš Parma, Ing. Tomáš Pavelka, Ing. Jiří Pěcha, Ing. Jiří Pitron, Ing. Josef Svoboda, Ing. Miroslav Šajdler, Ing. Ondřej Šťastný, Ing. Jaroslav Štěpánek, Ing. Jan Varmuža, Ing. Jitka Vojáčková, Ing. Michal Vrána, Ing. Václav Vyčítal, Ing. Kinan Wannous, Ing. Vojtěch Wasserbauer, Ing. Miroslav Zeman

## Administrative and Technical Staff

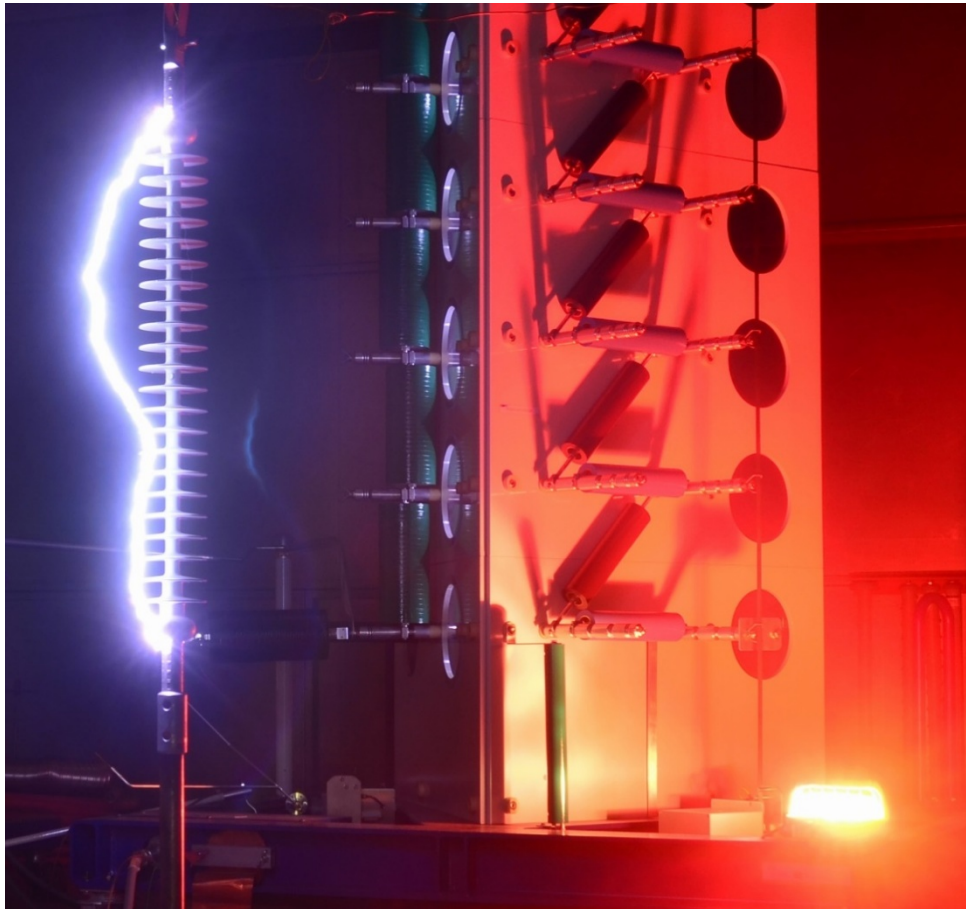
Ing. Filip Koval, Ing. Leoš Kukačka, Jitka Langerová, Ing. Lucie Langerová, Josef Němec, Ing. Ladislav Suk, Ing. Josef Šenk, CSc.

## Major Interests

The department provides instruction in the Bachelor programme 'Power Electrical and Electronic Engineering' (B-SEE) in cooperation with the Department of Power Electrical and Electronic Engineering, and independently in the Master programme 'Power Electrical Engineering' (M1-EEN). The offered courses deal with conventional and renewable power sources, transmission and distribution of energy, electrical power utilisation in light and heat sources, transient phenomena, solutions of system failures and liberalised energy market

Research is focused on electrical power generation in conditions of sustainable development i.e. search for new ways of power generation from renewable sources and increasing operation efficiency of power sources, loss reduction and fast localisation of network failures, impact of electrical appliances on electric energy quality, load optimisation in small variable-output power sources, optimisation of the structure of power sources for services in conditions of liberalised market with electrical energy, use of energy accumulation for support services and optimisation of electromobile charging stations operation, analysis of major system failures and appropriate measures, analysis of connection into the network, design and implementation of protection systems for indoor and outdoor illumination evaluation systems.

The department cooperates in solution of technical problems, research and graduate and postgraduate training with a number of companies, e.g. Skupina E. ON, Skupina ČEZ, ČEPS, a.s., ABB, s.r.o., EGÚ Brno, a.s., KMB Systems s.r.o., MEG A – Měřicí Energetické Aparáty, a.s., Teplárny Brno, a.s., Siemens, s.r.o., etc. We have had long-term cooperation in research and instruction with departments of power electrical engineering at all Czech and Slovak technical universities.



Jump over 110 kV insulator

## Major Achievements

The department was involved in research conducted by the 'Centre for Research and Utilisation of Renewable Energy' (CVVOZE). Members of the department's staff participated in 1 GAČR project, 9 TAČR projects, 1 OP PIK, 8 projects of SUJV Dubna, 1 OP VVV project and 43 contract research projects. The most significant research project conducted in 2017 was 'Energy in Conditions of Sustainable Development' (ENPUR) funded from the 'National Sustainability Programme I', where the department is responsible for the research part 'Generation, Transmission, Distribution and Utilisation of Electrical Energy'.

Research infrastructure of the CVVOZE laboratory (CVVOZEPowerLab) received institutional support from the national budget and therefore since 2016 it is available to the scientific community within the framework of an open access project. Funds were also allocated for the development of infrastructure exploitation for experiments, and for this purpose several unique devices were purchased in 2017.

In cooperation with Aalto University, The University of Edinburgh, Tallinn University of Technology, TU Dresden and five industrial partners, we prepared and submitted in February 2017 the project 'Enhancing PV Hosting Capacity of Grids by Power Quality Management' for H2020.

Cooperation continued with E.ON Česká republika, s.r.o. dealing with issues of electric lines safety in the case of failures and localisation of failures and exploitation of accumulation for operation of the distribution network, with ČEZ, a.s and E.ON Distribuce, a.s. in noise resistance of electrometers in the 2-150kHz band, and Lucis in development of new types of lighting devices. And the department cooperated with Second University of Naples in quality assessment of electrical energy. The staff was involved in 2 projects focused on an analysis of the possibility of exploitation of data from Smart Metering for operation and development of distribution networks.

## Major Research Projects

### Centre of Advanced Nuclear Technology (CANUT) – TE01020455

Investigator: Karel Katovský

### A Modular System for Complex Monitoring and Management in DC and Hybrid AC/DC Smart Networks – TH01020327

Investigator: Jiří Drápela

### Elements for Smart Grids Deployment in Distribution Networks – TA04021490

Investigator: Petr Toman

### A System of High Voltage Network Protection Using Current and Voltage Sensors with Standardized Digital Output IEC 61850-9-2 - TA03010444

Investigator: Jaroslava Orságová

### Development of a Combined Failure Indicator – TA04021491

Investigator: David Topolánek

### Research of Activation Detectors for Use in Systems with Highly Energetic Neutrons – TJ01000184

Investigator: Jitka Vojáčková

### Carbon-Free Hybrid Energetic System with Accumulation as an Active Element of Electrification System

Investigator: Petr Mastný

## Selected Publications

NEKVAPIL, J.; ŠKODA, J. Experimentální měření světlovodů v laboratoři. *Světlo*, 2017, roč. 20, č. 6, s. 24-27. ISSN: 1212-0812.

ŠŤASTNÝ, O., TICHÝ, A. Verifikace vyhořelého jaderného paliva v hlubinných úložištích. *Bezpečnost jaderné energie. Státní úřad pro jadernou bezpečnost ČR, Úřad jadrového dozoru SR JF DL*, 2017, č. 9/10, s. 256-261. ISSN: 1210-7085.

PRONSKIKH, V.; ADAM, J.; ZEMAN, M. et al. Secondary particle distributions in an extended uranium target under irradiation by proton, deuteron, and carbon beams. *NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH SECTION A-ACCELERATORS SPECTROMETERS DETECTORS AND ASSOCIATED EQUIPMENT*, 2017, no. 872, p. 87-92. ISSN: 0168-9002.

RADIL, L.; TŮMA, J. Skladování elektrické energie v energetice. *Electro*, 2017, roč. 2017, č. 10, s. 6-10. ISSN: 1210-0889.

HALUZA, M.; TOMAN, P.; MACHÁČEK, J. Utilization of knowledge systems and bases for selection and evaluation of domestic electrical installations. *International Journal for Innovation Education and Research (IJIER)*, 2017, vol. 5, no. 09, p. 88-110. ISSN: 2411-3123.

DRÁPELA, J.; LANGELLA, R.; ŠLEZINGR, J.; TESTA, A. Generalized lamp model for light flicker studies. *ELECTRIC POWER SYSTEMS RESEARCH*, 2017, vol. 154, no. JAN2018, p. 413-422. ISSN: 0378-7796.

ŠENK, J.; LÁZNIČKOVÁ, I.; JAKUBOVÁ, I. Calculation of Arc Power Losses in the Simplified Model of Intensively Blasted Electric Arc. *Plasma Physics and Technology*, 2017, vol. 4, no. 1, p. 40-43. ISSN: 2336-2626.

VOJÁČKOVÁ, J.; NOVOTNÝ, F.; KATOVSKÝ, K. Safety analyses of reactor VVER 1000. *Energy Procedia*, 2017, no. 127, p. 352-359. ISSN: 1876-6102.

MÁSLO, K.; KASEMBE, A. Mitigation measures for photovoltaics retrofit. *IEEE Transactions on Sustainable Energy*, 2017, , no. 99, p. 1-5. ISSN: 1949-3029.

MASTNÝ, P.; MORÁVEK, J.; VOJTEK, M.; DRÁPELA, J. Hybrid Photovoltaic Systems with Accumulation—Support for Electric Vehicle Charging. *ENERGIES*, 2017, vol. 10, no. 834, p. 1-24. ISSN: 1996-1073.

COUFAL, O. Current density in two parallel cylindrical conductors and their inductance. *ELECTRICAL ENGINEERING*, 2017, vol. 99, no. 2, p. 519-523. ISSN: 0948-7921.

COUFAL, O. Faraday's law of electromagnetic induction in two parallel conductors. *INTERNATIONAL JOURNAL OF APPLIED ELECTROMAGNETICS AND MECHANICS*, 2017, vol. 54, no. 2, p. 263-280. ISSN: 1383-5416.

ŠTĚPÁNEK, J.; ŠKODA, J. Cirkadiánní aktivační index denního světla. *Světlo*, 2017, č. 3, s. 41-43. ISSN: 1212-0812.

ROLEČEK, J.; FORAL, Š.; KATOVSKÝ, K.; SALAMON, D. A Feasibility study of using of CeO<sub>2</sub> as a surrogate material during investigation of UO<sub>2</sub> thermal conductivity enhancement. *Advances in Applied Ceramics*, 2017, vol. 115, no. 8, p. 123-131. ISSN: 1743-6753.

## Bachelor's Courses

Electrical Power Distribution

(doc. Ing. Petr Toman, Ph.D.)

Economy and Ecology of Power Engineering

(Ing. Michal Ptáček, Ph.D.)

Nuclear Energetic Equipments

(Ing. Karel Katovský, Ph.D.)

Protection of Electrical Power Equipment

(doc. Ing. Petr Toman, Ph.D.)

Computers and Programming 2

(Ing. Stanislav Sumec, Ph.D.)

Design of Power and Data Networks

(Ing. Branislav Bátora, Ph.D.)

Distribution Equipment

(doc. Ing. Jaroslava Orságová, Ph.D.)

Machinery of Power Plants

(Ing. Karel Katovský, Ph.D.)

Technical Mechanics

(doc. Ing. Ilona Lázničková, Ph.D.)

Energy Use

(doc. Ing. Jiří Drápela, Ph.D.)

Electrical Power Generation

(doc. Ing. Petr Mastný, Ph.D.)

Electrical Power Production and Distribution

(doc. Ing. Petr Toman, Ph.D.)

## Master's Courses

Electric Arc Application

(doc. Ing. Ilona Lázničková, Ph.D.)

Diagnostics in Electricity Industry

(doc. Ing. Jiří Drápela, Ph.D.)

Distribution and Industrial Networks

(Ing. David Topolánek, Ph.D.)

Economy of Electrical Power Engineering

(Ing. Lukáš Radil, Ph.D.)

Power Plants and Heating Power Stations

(doc. Ing. Jaroslava Orságová, Ph.D.)

Substations and Lines

(doc. Ing. Jaroslava Orságová, Ph.D.)

Electrical Heat Technology

(doc. Ing. Ilona Lázničková, Ph.D.)

Integrated Protection Systems

(doc. Ing. Petr Toman, Ph.D.)

Nuclear Power Plant

(Ing. Karel Katovský, Ph.D.)

The Power Quality and EMC

(doc. Ing. Jiří Drápela, Ph.D.)

Low Power Electrical Sources

(doc. Ing. Petr Mastný, Ph.D.)

Unconvention Conversions

(Ing. Lukáš Radil, Ph.D.)

Lighting Systems

(Ing. Jan Škoda, Ph.D.)

Power Systems

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

Design of Power and Data Networks

(Ing. Branislav Bátora, Ph.D.)

Transient Phenomena

(Ing. Branislav Bátora, Ph.D.)

Power Transmission Networks

(Ing. Michal Ptáček, Ph.D.)

Power Systems Control

(doc. Ing. Petr Toman, Ph.D.)

Lighting Technology

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

High Voltages Technology

(Ing. Michal Krbal, Ph.D.)

## Ph.D. Courses

Mathematical Modelling of Electrical Power Systems

(doc. Ing. Petr Toman, Ph.D.)

Selected Problems of Electricity Production

(doc. Ing. Petr Mastný, Ph.D.)

## Laboratories

**Laboratory of Electrical Protection** (instruction in Distribution Facilities, Electrical Stations and Lines, Protection and Security of Facilities, Integrated Protection Systems, preparation of measurements in real networks, research, Jaroslava Orságová)

**Laboratory of Diagnostics** (instruction in Diagnostics in Power Electrical Engineering, research on diagnostics and measurement, Jiří Drápela)

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

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

**Laboratory of Heating Technology** (instruction in Electrical Power Utilisation and Electrical Heating Technology, Ilona Lázníčková)

**Laboratory of Light and Illumination Technology** (instruction in Light Technology, Illumination Systems, Testing of Light Sources and Fittings, research projects, Jan Škoda)

**Laboratory of Electrical Networks** (instruction in Electrical Power Distribution, Transmission Networks, Electrical Stations and Line Networks, Distribution and Industrial Networks, research projects, Michal Ptáček)

**Design Laboratory** (instruction in Design of Power and Data Distribution Systems, training and research on modern electroinstallations, Branislav Batora)

**Laboratory of Electric Energy Generation** (instruction in Electric Energy Generation, Power Stations and Heating Plants, Small Sources of Electric Energy, research and diploma theses, Petr Mastný)

**Laboratory of Ionising Radiation** (instruction in Nuclear Power Facilities, Karel Katovský)

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

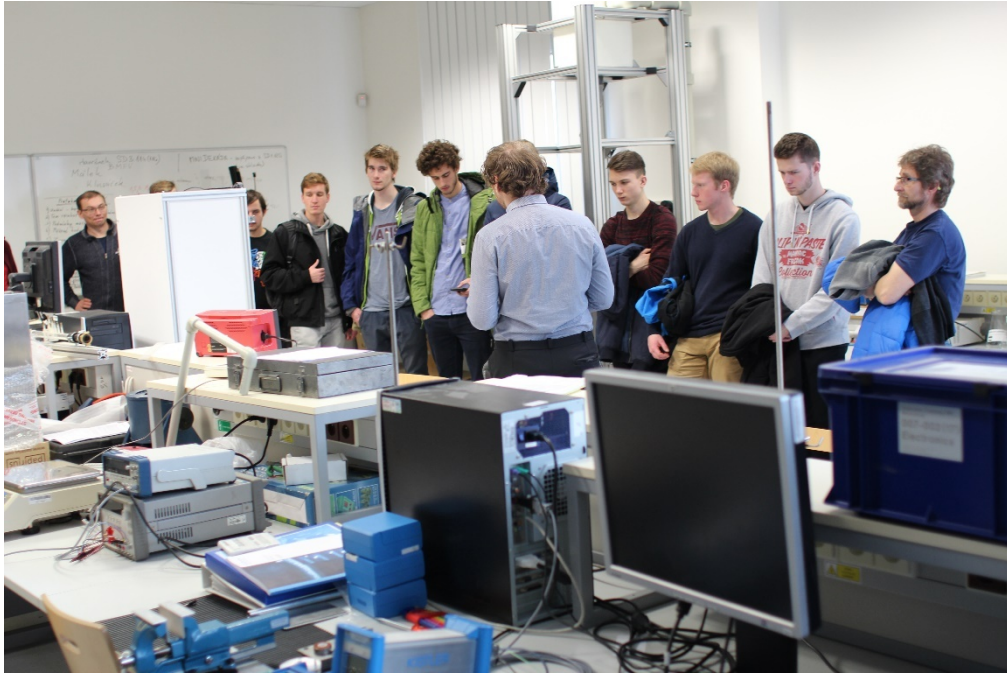
**Solar Energy Laboratory** (research of full solar energy exploitation, development and verification of operating models in real operation conditions, Petr Mastný)

**Ultra High Voltage Laboratories** (instruction in Distribution Facilities, Electrical Stations and Lines, High Voltage Technology, testing by superimposed and pulse voltage, Jaroslava Orságová)

**Computer Laboratories (2)** (instruction in Computers and Programming 2, planning in power engineering, steady states and transient phenomena in electrification systems, Branislav Batora)



Final examinations



'OpenDays'

# Department of Electrical and Electronic Technology

## Doc. Ing. Petr Bača, Ph.D.

Head

Technická 3058/10  
616 00 Brno  
Tel.: 541 146 148  
Fax: 541 146 147  
e-mail: [uete@feec.vutbr.cz](mailto:uete@feec.vutbr.cz)



## Professors

Prof. Ing. Jiří Kazelle, CSc.  
Prof. RNDr. Petr Vanýsek, CSc.  
Prof. Ing. Jiří Vondrák, DrSc.

## Associate Professors

Doc. Ing. Petr Bača, Ph.D.  
Doc. Ing. Petr Křivík, Ph.D.  
Doc. Ing. Jiří Maxa, Ph.D.  
Doc. Ing. Vítězslav Novák, Ph.D.  
Doc. Ing. Marie Sedlářiková, CSc.  
Doc. Ing. Jiří Vaněk, Ph.D.

## Lecturers

Ing. Ondřej Čech, Ph.D., Ing. Pavel Čudek, Ph.D. Ing. Ladislav Chladil, Ph.D., Ing. Kristýna Jandová, Ph.D.,  
Ing. Tomáš Kazda, Ph.D., Ing. Jiří Libich, Ph.D, Ing. Helena Polsterová, CSc., Ing. Jiří Starý, Ph.D., Ing. Jiří Špinka, Ing. Petr Vyroubal, Ph.D.

## Ph.D. Students

Ing. Robert Bayer, Ing. Michal Bílek, Ing. Tomáš Dvořák, Ing. Daniel Frýda, Ing. Tomáš Gottwald, Ing. Jiří Hudec,  
Ing. Josef Hylský, Ing. Michal Jahn, Ing. Kamil Jaššo, Ing. Martin Juračka, Ing. Michl Kadlec, Ing. Pavel Lepík,  
Ing. Josef Máca, Ing. Michal Musil, Ing. David Pléha, Ing. Marek Solčanský, Ing. Dávid Strachala, Ing. Lucie Šimonová, Ing. Jiří Šubarda, Ing. Jiří Tichý, Ing. Sebastian Vaculík, Ing. Iulia Veselkova, Ing. Jana Zimáková

## Administrative and Technical Staff

Gabriela Dominiková, František Chudáček, Ing. Petr Kahle, František Kořínek, Martin Šturm, Ing. Miroslav Zatloukal

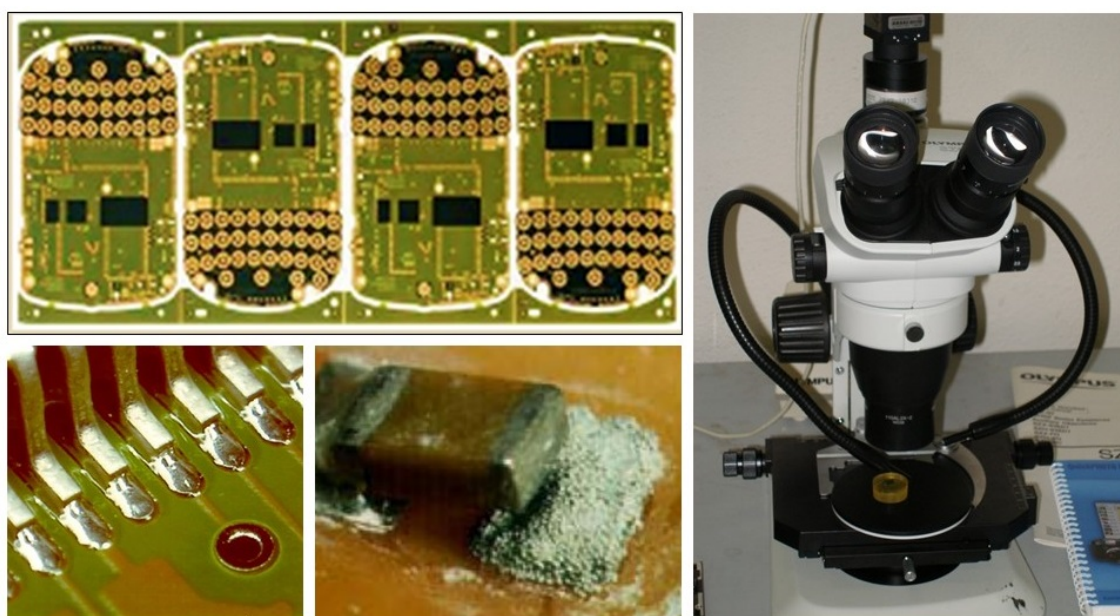
## Main Interests

The department provides instruction in electrotechnical materials, manufacturing processes and their control, printed circuit board and surface mount technology, diagnostics, testing and reliability of electrotechnical materials

and processes, quality assurance in systems and alternative electrical power sources in the Bachelor and the Master programme 'Electrical, Electronic, Control and Communication Technology' (EECR), in full-time and part-time form of study. Instruction in the subject 'Materials and Technical Documentation' is provided to all first-year full-time and part-time students in the EECR Bachelor programme.

Research areas of interest are electrotechnical, electronic and optoelectronic materials and components, technologies, diagnostics and prognosis, electron microscopy, electrochemical power sources, lead and alkaline accumulators, development of new materials for lithium-ion batteries, electrocatalysts and ion-exchange membranes for fuel cells, thin-layer electrodes for electrochromic systems, photovoltaic systems, non-destructive diagnostics of defects and quality control, reliability and lifetime of solar cells, detection of signal electrons and methods of environmental scanning electron microscopy of atomic forces, lead-free soldering, quality and reliability of soldered joints, degradation and diagnostics of dielectric systems.

The department cooperates with Technische Universität Wien, Padova University, Universität Ulm – Zentrum für Sonnenenergie und Wasserstoff-Forschung, École Polytechnique de Montréal, surface analysis workplace Nanolytics in Feldkirchen, Austria, Graphite AG Kropfmühl AG, Institute of Scientific Instruments, Academy of Sciences CR, Institute of Inorganic Chemistry Academic of Sciences CR, Institute of Physical Chemistry, Academy of Sciences CR, Institute of Macromolecular Chemistry, Academy of Sciences CR, Bochemie Bohumín, EPRONA Rokytnice nad Jizerou, Elmarco Liberec, Solartec Rožnov pod Radhoštěm, ERD Praha, LINET Slaný, ENERG-SERVIS Brno, ČeMeBo Blansko, Honeywell Brno, ALPS Electric Czech Sebranice. The department also cooperates with INIFTA Universidad Nacional de La Plata, Argentina and Università degli Studi di Palermo, Italy in the programme KONTAKT.



Diagnostics of surface mount boards

## Major Achievements

The department co-organised the 38th international conference 'Non-Conventional Energy Sources' in Hustopeče 11-12 May 2017. The conference was organised in cooperation with the Czech Electrotechnical Society, group for chemical sources of electrical energy.

Members of the department participated in the meeting of Czech and Slovak colleagues in the framework of the 45th international conference 'Electrotechnology 2017', organised by the Department of Technology and Measurement, University of West Bohemia 24-26 May 2017 in Plzeň.

The 18th international conference 'Advanced Batteries, Accumulators and Fuel Cells', organised by the department under the auspices of American electrotechnical group 'International Society of Electrochemistry' and BUT Brno was held 10-13 September 2017.

The conference was attended by 80 experts from all over the world, e.g. Guenther Fafílek, Tu Wien, Grzegorz Lota with a group of his Ph.D. students, Poznań, Poland, Andrea Straková-Fedorková, Pavel Jozef Šafárik University, Košice, Slovakia, Elena Shembel, University in Kiev (Ukraine), Petr Vanýšek, University in Illinois (USA), Madani Seyed, University Aalborg (Denmark) etc. An outcome of the conference was a special issue of 'Transactions of Electrochemical Society', volume 81 with full texts of presented papers (published in Scopus).



The bilateral project of Ministry of Education, Czech Republic – Austria (Vienna Technical University) ‘Ionic liquids for intercalation reactions of sodium ions for advanced batteries’ continued. The project included exchange placements for 3 Czech and 3 Austrian academics.

The TAČR project TA 04010085 ‘Flexible Autonomous Power Systems for Smart Textiles’, focused on flexible electrodes for supercapacitors and accumulators entered its fourth year. In November 2016 we won the project NATO SPS 985148 ‘Development of New Cathodes for Stable and Safer Lithium Sulphur Batteries’.

During 2017 we started work on project TH02010473 ‘General Battery Monitoring System – BUMS’ within the framework of programme Epsilon, in cooperation with EPRONA, a.s. Rokytnice nad Jizerou.

Research continued in the framework of the ‘National Sustainability Programme I’ for support of research, experimental development and innovations within the framework of the Regional VaV project ‘Centre for Research and Utilisation of Renewable Energy’ (CVVOZE), research programme 2 – ‘Chemical and Photovoltaic Energy Sources’.

In 2017 we continued research and commercial activities in the accredited Testing Laboratory CVVOZE where the department tests VA characteristics of photovoltaic panels. In 2017 the offered verification services for the condition and operability of photovoltaic power stations were used by 5 companies, and over 80 photovoltaic panels of different types were tested. Research results and some student works were published at one of the most notable conferences on photovoltaics EU PVSEC 2017 in Amsterdam.

In cooperation with University of West Bohemia the department participated in the European project of Operational Programme ‘Partnership in Electrical and Mechanical Engineering’, priority axis 7.2 ‘Tertiary Education, Research and Development’. In 2017 the project was completed.

## Major Research Projects

### **Project AKTION Czech Republic – Austria ‘ Ionic Liquids for Intercalation Reactions of Lithium and Sodium Ions in Modern Batteries’**

Investigator: Marie Sedlaříková

### **Project no TA04010085 ‘Flexible Autonomous Power Systems for Smart Textiles’**

Investigator: Marie Sedlaříková

### **Project TH02010473 ‘Universal Battery Monitoring System – BUMS’**

Investigator: Jiří Kazelle

### **Project no. 1618BS\_CP1 ‘INVESTIGATION OF THE MUTUAL INTERACTION OF CARBON AND OTHER ADDITIVES IN THE PERFORMANCE OF NEGATIVE LEAD ACCUMULATOR ELECTRODES DURING PSoC OPERATION’**

Investigator: Petr Bača

### **Project EUPRO II ‘Participation of Research Institutions in Energy Research European Alliance’ (European Energy Research Alliance - EERA) - implementation of EUPRO II Project**

Investigator: Ladislav Chladil

### **Project NATO SPS ‘Lithium Batteries’ no. 985148 ‘Development of New Cathodes for Stable and Safer Lithium Sulphur Batteries’**

Investigator: Marie Sedlaříková

## Selected Publications

LIBICH, J.; VONDRÁK, J.; SEDLAŘÍKOVÁ, M.; MÁČA, J.; ČECH, O. Elimination of Irreversible Effects During the First Charging of the Lithium Battery Anodes. *SURF ENG APPL ELECT+*, 2017, vol. 6, no. 53, p. 597-605. ISSN: 1068-3755.

HLAVATÁ, P.; MAXA, J.; BÍLEK, M.; LEPLTOVÁ, K.; BAYER, R. Influence of Critical Flow in the Differentially Pumped Chamber AQUASEM. *Advances in Military Technology*, 2017, no. 2, p. 301-310. ISSN: 1802-2308.

VYROUBAL, P.; KAZDA, T. Finite Element Approach of Interior Permanent Magnet Motor Acoustics Noise. *Advances in Military Technology*, 2017, no. 2, p. 1-11. ISSN: 1802-2308.

JANDOVÁ, K.; JANDA, M. Model of airflow around the roof installation of photovoltaic modules. *ECS Transactions*, 2017, vol. 81, no. 1, p. 217-222. ISSN: 1938-5862.

KŘIVÍK, P.; VACULÍK, S. Impedance methods for SoC determination of lead acid battery cell. *ECS Transaction*, 2017, vol. 81, no. 1, p. 151-161. ISSN: 1938-6737.

VESELKOVA, I.; JAHN, M.; SEDLAŘÍKOVÁ, M.; VONDRÁK, J. Effect of cross-linking agents and flame retardants on gel polymer electrolyte properties. *ECS Transaction*, 2017, vol. 81, no. 1, p. 41-46. ISSN: 1938-6737.

SEDLAŘÍKOVÁ, M.; VONDRÁK, J.; ČUDEK, P.; GALANOVÁ, Z. Pyrolytic Preparation of Novel Iron Alloys for Biodegradable Implants. *ECS Transactions*, 2017, vol. 81, no. 1, p. 1-8. ISSN: 1938-5862.

- VONDRÁK, J.; SEDLAŘÍKOVÁ, M.; MÁČA, J.; SMILEK, J.; JAHN, M. Lithium Containing Ionic Liquids for Lithium Batteries. *ECS Transactions*, 2017, vol. 81, no. 1, p. 1-8. ISSN: 1938-5862.
- STRACHALA, D.; HYLSKÝ, J.; VANĚK, J.; FAFILEK, G.; JANDOVÁ, K. Methods for recycling photovoltaic modules and their impact on environment and raw material extraction. *Acta Montanistica Slovaca*, 2017, vol. 22, no. 3, p. 257-269. ISSN: 1335-1788.
- LIBICH, J.; MÁČA, J.; VONDRÁK, J.; ČECH, O.; SEDLAŘÍKOVÁ, M. Irreversible capacity and rate-capability properties of lithium-ion negative electrode based on graphite. *Journal of Energy Storage*, 2017, vol. 14, no. 3, p. 383-390. ISSN: 2352-152X.
- ČECH, O.; ČÁSTKOVÁ, K.; CHLADIL, L.; DOHNAL, P.; ČUDEK, P.; LIBICH, J.; VANÝSEK, P. Synthesis and Characterization of Na<sub>2</sub>Ti<sub>6</sub>O<sub>13</sub> and Na<sub>2</sub>Ti<sub>6</sub>O<sub>13</sub>/Na<sub>2</sub>Ti<sub>3</sub>O<sub>7</sub> Sodium Titanates with Nanorod-like Structure as Negative Electrode Materials for Sodium-ion Batteries. *Journal of Energy Storage*, 2017, vol. 1, no. 1, p. 1-8. ISSN: 2352-152X.
- KAZDA, T.; ČUDEK, P.; VONDRÁK, J.; SEDLAŘÍKOVÁ, M.; TICHÝ, J.; SLÁVIK, M.; FAFILEK, G.; ČECH, O. Lithium-sulphur batteries based on biological 3D structures. *Journal of Solid State Electrochemistry*, 2017, no. 1, p. 1-7. ISSN: 1432-8488.
- VANÝSEK, P.; NOVÁK, V. Redox Flow Batteries as the Means for Energy Storage. *Journal of Energy Storage*, 2017, vol. 13, no. N/A, p. 435-441. ISSN: 2352-152X.
- NOVÁK, V.; VANÝSEK, P. Palivové články. *Electro*, 2017, roč. 2017, č. 8-9, s. 54-59. ISSN: 1210-0889.
- BARTUŠEK, K.; MARCOŇ, P.; FIALA, P.; MÁČA, J.; DOHNAL, P. The Effect of a Spiral Gradient Magnetic Field on the Ionic Conductivity of Water. *Water*, 2017, vol. 9, no. 9, p. 1-8. ISSN: 2073-4441.
- VANÝSEK, P. Weston, The Weston Cell, and the Volt. *Electrochemical Society Interface*, 2017, vol. 26, no. 3, p. 36-38. ISSN: 1064-8208.
- ZIMÁKOVÁ, J.; VACULÍK, S.; FRYDA, D.; BAČA, P. Combined effect of acrylic fibers and carbon in negative active mass of lead-acid battery. *Journal of Energy Storage*, 2017, vol. EST, no. 244, p. 1-5. ISSN: 2352-152X.
- VANÝSEK, P. 1917. *Electrochemical Society Interface*, 2017, vol. 26, no. 2, p. 3-3. ISSN: 1064-8208.
- VYROUBAL, P.; KAZDA, T. Numerical Methods in Advanced Power Sources. *Journal of Energy Storage*, 2017, vol. 11-12, no. EST220, p. 1-9. ISSN: 2352-152X.
- VONDRÁK, J.; SEDLAŘÍKOVÁ, M.; LIBICH, J.; JAHN, M. Insights on electrochemical properties of gel polymer electrolytes based on methylmethacrylate. *Journal of Solid State Electrochemistry*, 2017, vol. 21, no. 5, p. 1-3. ISSN: 1433-0768.
- KŘIVÍK, P.; VANÝSEK, P. Changes of temperature during pulse charging of lead acid battery cell in a flooded state. *Journal of Energy Storage*, 2017, vol. 2017, no. 14, p. 364-371. ISSN: 2352-152X.
- KOŘÍNEK, R.; MIKULKA, J.; HŘIB, J.; HUDEC, J.; HAVEL, L.; BARTUŠEK, K. Characterization of the Embryogenic Tissue of the Norway Spruce Including a Transition Layer between the Tissue and the Culture Medium by Magnetic Resonance Imaging. *Measurement Science Review*, 2017, vol. 17, no. 1, p. 19-26. ISSN: 1335-8871.
- VANÝSEK, P. Interface at Twenty-Five: The Editors of Interface - The First Twenty-Five Years. *Electrochemical Society Interface*, 2017, vol. 25, no. 4, p. 20-23. ISSN: 1064-8208.

## Bachelor's Courses

Diagnostics and Testing (Ing. Jandová Kristýna, Ph.D.)	Printed Circuits and Surface Mount Technology (Ing. Jiří Starý, Ph.D.)
Electrotechnical Materials and Production Processes (prof. Ing. Jiří Kazelle, CSc.)	Computer Projecting of Productions, Logistic and Ecology (doc. Ing. Jiří Vaněk, Ph.D.)
Materials and Components for Biomedicine (Ing. Tomáš Kazda, Ph.D.)	Computer Support for Technical and Managerial Work (doc. Ing. Jiří Maxa, Ph.D.)
Materials and Technical Documentation (doc. Ing. Jiří Vaněk, Ph.D.)	Quality Management and Checking (Ing. Helena Polsterová, CSc.)
Design and Technology of Electric Devices (doc. Ing. Vítězslav Novák, Ph.D.)	Quality Management and Metrology (Ing. Helena Polsterová, CSc.)
Design Systems of Printed Circuit Boards (doc. Ing. Petr Bača, Ph.D.)	Reliability in Electrical Engineering (Ing. Helena Polsterová, CSc.)
Selected Topics in Renewable Energy Sources and Energy Storage (doc. Ing. Petr Bača, Ph.D.)	

## Master's Courses

Alternative Energy Sources  
(doc. Ing. Jiří Vaněk, Ph.D.)

Diagnostic Methods in Electroengineering  
(Ing. Pavel Čudek, Ph.D.)

Ecology in Manufacturing  
(doc. Ing. Petr Bača, Ph.D.)

Climatotechnology in Electrical Engineering  
(Ing. Helena Polsterová, CSc.)

Materials and Components for Biomedicine  
(doc. Ing. Marie Sedlaříková, CSc.)

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

Interconnection and Assembly Technology  
(Ing. Jiří Starý, Ph.D.)

Renewable Energy Sources  
(Ing. Petr Křivík, Ph.D.)

Computer Systems for Projects  
(Ing. Vítězslav Novák, Ph.D.)

Properties and Production of Electrotechnic Materials  
(Ing. Ladislav Chladil, Ph.D.)

Control and Data Administration  
(doc. Ing. Jiří Maxa, Ph.D.)

Reliability and Quality  
(Ing. Helena Polsterová, CSc.)

Structure and Properties of Materials  
(doc. Ing. Vítězslav Novák, Ph.D.)

Technological Projecting and Logistic  
(Ing. Vyroubal Petr, Ph.D.)

3D Modeling  
(doc. Ing. Jiří Maxa, Ph.D.)

Production Processes  
(prof. Ing. Jiří Kazelle, CSc.)

Fundamentals of Reliability in Electrical Engineering  
(Ing. Helena Polsterová, CSc.)

## Ph.D. Courses

Electrotechnical Materials, Material Systems and  
Production Processes  
(prof. Ing. Jiří Kazelle, CSc.)

Selected Diagnostic Methods, Reliability and Quality  
(prof. Ing. Jiří Kazelle, CSc.)

## Laboratories

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

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

**Laboratory of Diagnostic Methods** (diagnostics of materials and testing methods, experiments for semester projects, Bachelor and Master theses, Kristýna Jandová)

**Laboratory of Electrical Insulation Materials** (instruction on diagnostic methods in electrical engineering and climatology, experimental small current measurements and diagnostics of electroinsulation liquids, Vítězslav Novák)

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

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

**Electrometric Measurement Laboratory 1** (analysis of the properties of dielectric materials by measurements on special devices, Petr Vanýsek)

**Electrometric Measurement Laboratory 2** (diagnostic analysis of the properties of dielectric materials, samples from commercial producers are measured on current measuring devices, Helena Polsterová)

**Laboratory of Electrotechnical Materials 1** (analysis of electrotechnical materials, laboratory exercises for Materials and Technical Documentation, Electrotechnology for FSI, Petr Křivík)

**Laboratory of Electrotechnical Materials 2** (computer modelling and measurement of parameters of semiconductor and dielectric materials, instruction in Electrotechnical Materials and Manufacturing, Material Structure and Properties, Jiří Libich)

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

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

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

**Laboratory of Renewable Sources 2** (testing of electrical and mechanical properties of photovoltaic cells, laboratory instruction in Renewable Energy Sources and Alternative Energy Sources, Jiří Libich)

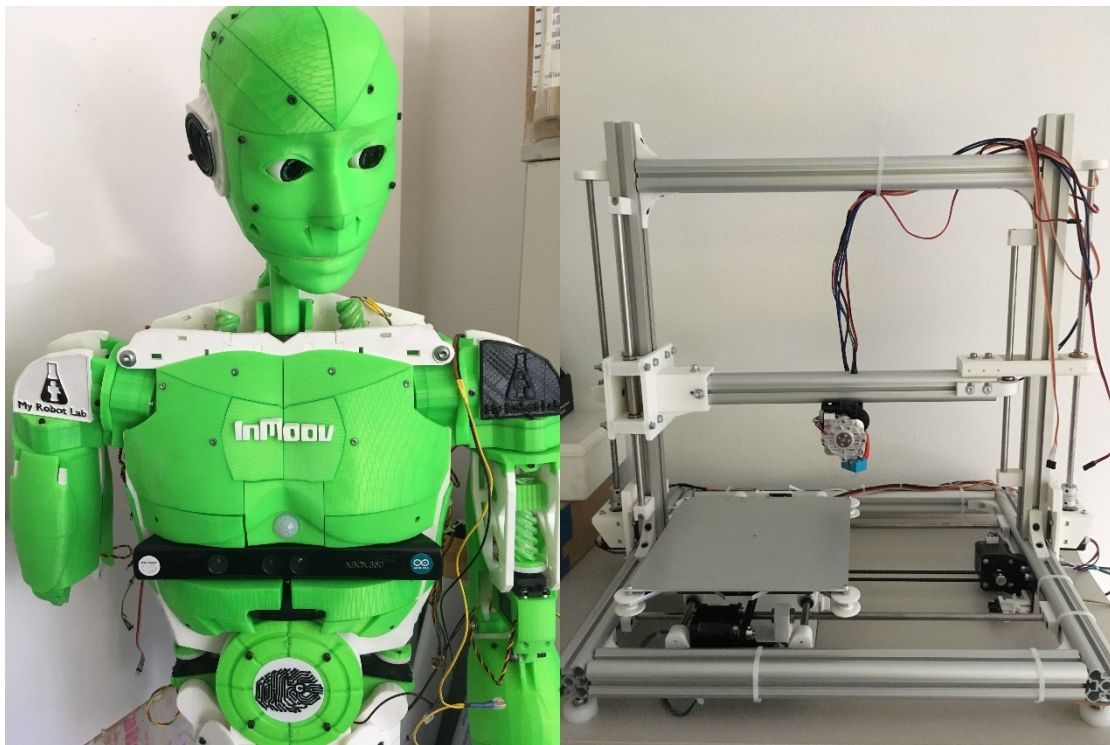
**Laboratory of Lead-Acid Accumulators 1,2** (research and development of new applications of lead-acid accumulators for hybrid electromobiles and as renewable energy storage, Petr Bača)

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

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

**Laboratory of Printed Circuits, PROTOCAD and Photoprocesses** (laboratory production of printed circuit boards, preparation of microsections, instruction in Printed Circuits and Surface Mounting Technology, Mounting and Assembly Technology, Jiří Starý)

**Laboratory of Biomaterials** (testing of the content and PH of ions in solutions, corrosion measurements, instruction in Materials and Components for Biomedical Engineering, Tomáš Kazda)



3D printing

# Department of Physics

## Prof. Ing. Lubomír Grmela, CSc.

Head

Technická 2848/8  
616 00 Brno 16  
Tel: 541 146 002  
Fax: 541 146 033  
e-mail: [ufyz@feec.vutbr.cz](mailto:ufyz@feec.vutbr.cz)



## Professors

Prof. Ing. Lubomír Grmela, CSc.  
Prof. Ing. Pavel Koktavý, CSc., Ph.D.  
Prof. RNDr. Ing. Josef Šíkula, DrSc.  
Prof. RNDr. Pavel Tománek, CSc.

## Associate Professors

Doc. RNDr. Milada Bartlová, Ph.D.  
Doc. Ing. Karel Liedermann, CSc.  
Doc. Mgr. Jan Pavelka, CSc., Ph.D.  
Doc. Ing. Petr Sedlák, Ph.D.  
Doc. Ing. Vlasta Sedláková, Ph.D.

## Lecturers

Ing. Jitka Brüstlová, CSc., RNDr. Pavel Dobis, CSc., Ing. Vladimír Holcman, Ph.D., Ing. Robert Macků, Ph.D.,  
Ing. Pavel Škarvada, Ph.D.

## Research Workers

Ing. Jiří Majzner, Ph.D., Ing. Pavel Tofel, Ph.D., Mgr. Dinara Sobola, Ph.D., Ing. Ondřej Šik, Ph.D.

## Ph.D. Students

Mgr. Rashid Dallaev, Ing. Adam Gajdoš, Ing. Michal Jurčík, Ing. Pavel Kaspar, Ing. Tomáš Kuparowitz,  
Ing. Martin Kuparowitz, Ing. Jan Mucha, Mgr. Jindřich Oulehla, Ing. Nikola Papež, Ing. Alexander Podshivalov,  
Ing. Josef Pokorný, Ing. Elena Prokopyeva, Ing. Milan Spohner, Ing. L'ubomír Škvarenina, Ing. Marek Vondra

## Administrative and Technical Staff

Mgr. Naděžda Bogatyreva, Ph.D., Ing. Miloš Chváta, Ph.D., Ing. Michal Jurčík, Ing. Pavel Kaspar, Ing. Alexandr Knápek, Ph.D., Ing. Elena Prokopyeva, Miroslav Sadovský, Ing. Petr Sadovský, Ph.D., Ing. Milan Spohner, Ing. Jiří Šicner, Ph.D., Ing. L'ubomír Škvarenina, Ing. Tomáš Trčka, Ph.D., Ing. Alena Václavíková, Ing. Marek Vondra, Radimír Vrba

## Main Interests

The department provided tuition in Bachelor's courses Physics 1 and Physics 2 (full-time and part-time study), Physics for students of information technology, Physics 1 and 2 for the programme Biomedical Technology and Bioinformatics, Physics 1 for Audio Engineering, and Physics in Electrical Engineering H-AEI and a Physics seminar for FEEC and FIT. The courses offered in the Master programme included Nanotechnology, Modern Physics, Solid Phase Physics and Non-Destructive Diagnostics, Physics of Dielectrics for FEEC, Interfaces and

Nanostructures and Spectroscopic Methods for Non-Destructive Diagnostics (for FEEC) and Optics (for FIT) for Ph.D. programme.

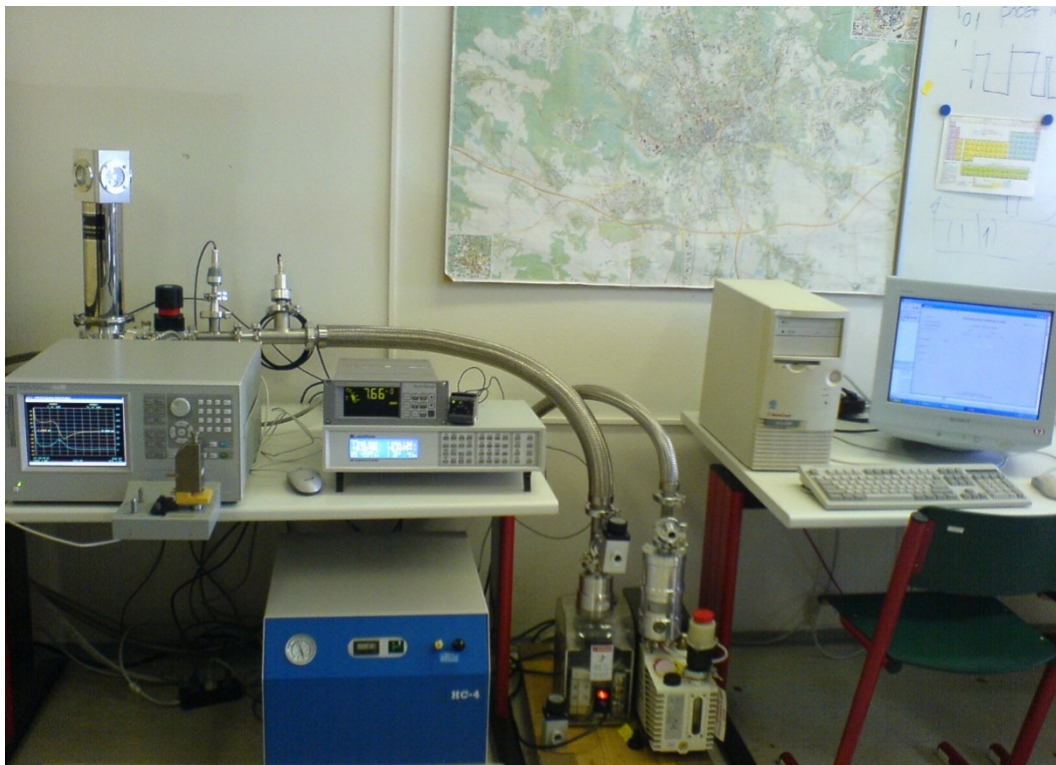
Assignments for Physical Practice and multimedia study materials were updated and innovated for instruction in the computer room and for self-study.

Research was centred on basic and applied research of the physical parameters of semiconductors and dielectric materials and components and nanosensors. The main areas of interest were noise spectroscopy, local characterisation with nanodistinction, measurement of nonlinearities, design of quality and reliability indicators and dielectric spectroscopy. Outstanding results were achieved in research on the characteristics of acoustic and electromagnetic emission sensors.

The department cooperated with European and Japanese laboratories in the field of noise spectroscopy and nanotechnology, and in research on dielectrics, with American universities in Orlando and Rapid City in nanometrology, and with leading Czech laboratories in the development and enhancement of the parameters of CdTe radiation detectors.

Contract research has been expanding. Our major partners have been the world leaders Semiconductor Components Industries, AVX, IMI International and Konštrukta Industry, a.s.

Our top laboratory equipment includes electron microscope LYRA with 1 nm distinction, analyser Alfa Novocontrol for measurement of dielectric spectra over 12 frequency orders, infrared spectrometer-Nicolet, workstation for experimental study of semiconductor and dielectric samples at low temperatures (up to 10K), optical spectroscopy by SNOM, spectral analysers of signals for the entire technical frequency band, the automatic meter of characteristics and non-linearities Keithley 4200 and a vacuum system for research on autoemission cathodes in electron microscopy.



Laboratory of dielectric spectroscopy

## Major Achievements

The department participated in the Regional Centre for Research and Development CZ.1.05/2.1.00/03.0072 'Centre for Sensor, Information and Communication Systems' (SIX). Two research laboratories were included in the project 'Laboratory of Electron Microscopy and Laboratory of Nanometrology'.

The department's staff cooperated in the project CEITEC 2020 (LQ1601) in the frame of the 'National Sustainability Programme II'. Project outcomes in 2017 were 2 publications in impact journals Q1, 5 publications in the database SCOPUS, 5 papers in conference proceedings and 2 research reports.

Work was under way on: a GAČR project, a TAČR project, an INWITE project, a H2020 project, an OP PIK project, one bilateral project and a specific research project of BUT and 11 economic contracts with industrial companies.

The GAČR project, in cooperation with Charles University Prague, was focused on passivation of emission detector surfaces, the TAČR project, with Třinec Iron and Steel Works and VŠB Ostrava, involved surface defects of continuously cast billets. The goal of the OP PIK project (in cooperation with ESL, a.s.) is the development of knowledge transfer to accelerate innovation processes in the company. In the frame of H2020 the department focuses on an analysis of degradation processes in LiS structures.

The BUT specific research project deals with the methodology of enhancing the quality of optoelectronic materials and components.

Commercial contracts dealt with temperature measurements in MOS structures, measurements of anomalous currents in manufacturing of supercapacitors, monitoring of electromagnetic emission in rocks deformation, analysis of samples for automotive industry and methods of detecting small metal particles for analyses in rubber industry.

## Major Research Projects

### Passivation of CdTe/CdZnTe Surfaces in Emission Detectors – GAČR 15-052595

Investigator at Department of Physics: Lubomír Grmela

### Enhancement of Surface Quality of Cast Billets – TAČR TA04010312

Investigator at Department of Physics: Lubomír Grmela

### Interdisciplinary Research on Wireless Technology – LO1401 (INWITE)

Investigators: Lubomír Grmela, Vladimír Holcman

### European Consortium for Lithium-Sulphur Power for Space Environments (ECLIPSE) – project H2020

Investigator at Department of Physics: Vlasta Sedláková

### Development and Innovation of INVYSYS Systems – project OPPIK – CZ.01.1.02/0.0/0.0/15\_013/0005044

Investigator at Department of Physics: Lubomír Grmela

### Gas Sensors for Breath Analysis – 7AMB16PL039 – bilateral project MŠMT Czech Republic - Poland

Investigator at Department of Physics: Petr Sedlák

## Selected Publications

SOBOLA, D.; TALU, S.; SADOVSKÝ, P.; PAPEŽ, N.; GRMELA, L. Application of AFM Measurement and Fractal Analysis to Study the Surface of Natural Optical Structures. *Advances in Electrical and Electronic Engineering - internetový časopis* (<http://advances.etc.sk>), 2017, vol. 3, no. 15, p. 569-576. ISSN: 1804-3119.

ČAIROVIĆ, D.; ZLÁMAL, M.; ŠTĚPÁNEK, P.; TRČKA, T.; ŠKARVADA, P.; MACKŮ, R. DETERMINATION OF SURFACE ROUGHNESS PARAMETERS BY OPTICAL PROFILOMETRY AND SAND PATCH TEST. *Solid State Phenomena*, 2017, no. 259, p. 15-20. ISSN: 1012-0394.

SOBOLA, D.; TALU, S.; SOLAYMANI, S.; GRMELA, L. INFLUENCE OF SCANNING RATE ON QUALITY OF AFM IMAGE: STUDY OF SURFACE STATISTICAL METRICS. *Microscopy research and technique*, 2017, vol. 80, no. 7, p. 1-11. ISSN: 1059-910X.

TALU, S.; STACH, S.; RAMAZANOV, S.; SOBOLA, D.; RAMAZANOV, G. Multifractal characterization of epitaxial silicon carbide on silicon. *MATERIALS SCIENCE-POLAND*, 2017, no. 3, p. 1-9. ISSN: 2083-134X.

POKORNÝ, J. PROGRAM PROCESSING DATABASE DATA FOR CALCULATION OF SPECTRAL LINES WIDTH AND SHIFT IN PLASMA. *Plasma Physics and Technology*, 2017, vol. 4, no. 3, p. 277-280. ISSN: 2336-2626.

BOGATYREVA, N.; BARTLOVÁ, M.; AUBRECHT, V.; KLOC, P. Radiation Transfer in Arc Plasmas. *Plasma Physics and Technology*, 2017, vol. 4, no. 3, p. 253-256. ISSN: 2336-2626.

BARTLOVÁ, M.; KLOC, P.; BOGATYREVA, N.; AUBRECHT, V.; POKORNÝ, J. MODELLING OF RADIATIVE TRANSFER IN AIR ARC PLASMA. *Plasma Physics and Technology*, 2017, vol. 4, no. 3, p. 261-264. ISSN: 2336-2626.

KLOC, P.; AUBRECHT, V.; BARTLOVÁ, M. Objective function for numerical mean absorption bands optimization. *Plasma Physics and Technology*, 2017, vol. 4, no. 3, p. 269-272. ISSN: 2336-2626.

SOBOLA, D.; TALU, S.; TOMÁNEK, P. Surface Condition of GaAs Solar Cells. *ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering*, 2017, vol. 10, no. 3, p. 27-32. ISSN: 2067-3809.

BAI, Y.; TOFEL, P.; PALOSAARI, J.; JANTUNEN, H.; JUUTI, J. A Game Changer: A Multifunctional Perovskite Exhibiting Giant Ferroelectricity and Narrow Bandgap with Potential Application in a Truly Monolithic Multienergy Harvester or Sensor. *ADVANCED MATERIALS & PROCESSES*, 2017, vol. 29, no. 29, p. 1-7. ISSN: 0935-9648.

KLOC, P.; AUBRECHT, V.; BARTLOVÁ, M. Numerically optimized band boundaries of Planck mean absorption coefficients in air plasma. *Journal of Physics D: Applied Physics*, 2017, vol. 50, no. 30, p. 1-10. ISSN: 0022-3727.

ŤÁLU, Š.; PAPEŽ, N.; SOBOLA, D.; ACHOUR, A.; SOLAYMANI, S. Micromorphology investigation of GaAs solar cells: case study on statistical surface roughness parameters. *JOURNAL OF MATERIALS SCIENCE-MATERIALS IN ELECTRONICS*, 2017, vol. 28, no. 15, p. 1-12. ISSN: 0957-4522.

KUPAROWITZ, M.; SEDLÁKOVÁ, V.; GRMELA, L. LEAKAGE CURRENT DEGRADATION DUE TO ION DRIFT AND DIFFUSION IN TANTALUM AND NIOBIUM OXIDE CAPACITORS. *METROL MEAS SYST*, 2017, vol. 24, no. 2, p. 255-264. ISSN: 0860-8229.

GARCZYK, Ž.; STACH, S.; TALU, S.; SOBOLA, D.; WRÓBEL, Z. Stereometric parameters of butterfly wings. *Journal of Biomimetics, Biomaterials, and Tissue Engineering*, 2017, no. 31, p. 1-11. ISSN: 1662-100X.

KNÁPEK, A.; SÝKORA, J.; CHLUMSKÁ, J.; SOBOLA, D. Programmable set-up for electrochemical preparation of STM tips and ultra-sharp field emission cathodes. *MICROELECTRONIC ENGINEERING*, 2017, no. 173, p. 42-47. ISSN: 0167-9317.

SOBOLA, D.; PAPEŽ, N.; ŠKARVADA, P.; TOMÁNEK, P. Srovnání metod SEM a SPM pro charakterizaci solárních článků. *Jemná mechanika a optika*, 2017, č. 62, s. 81-83. ISSN: 0447-6441.

TRČKA, T.; MACKŮ, R.; KOKTAVÝ, P.; ŠKARVADA, P.; BAROŇ, I.; STEMBERK, J. Field Measurement of Natural Electromagnetic Emissions near the Active Tectonic and Mass-Movement Fractures in Caves. *Solid State Phenomena*, 2017, vol. 258, no. 1, p. 460-464. ISSN: 1662-9779.

ŠKVARENINA, L.; MACKŮ, R. Application of electrical measurements to investigation of solar cell microstructure defects. *Solid State Phenomena*, 2017, vol. 258, no. 8, p. 473-476. ISSN: 1662-9779.

ŠKARVADA, P.; MACKŮ, R.; ŠKVARENINA, L. Investigation of Defects at Cu(In,Ga)Se<sub>2</sub> Flexible Solar Cells on Macroscopic and Microscopic Level and their Influence on Solar Cell Performance. *Solid State Phenomena*, 2017, vol. 258, no. 1, p. 469-473. ISSN: 1662-9779.

## Bachelor's Courses

Physics 1

(RNDr. Pavel Dobis, CSc.)

Physics 2

(doc. RNDr. Milada Bartlová, Ph.D.)

Physics in Electrical Engineering (H-AEI)

(doc. Ing. Karel Liedermann, CSc.)

Physics for Audio Engineering (J-AUD)

(prof. Ing. Pavel Koktavý, CSc., Ph.D.)

Physics 1 (T-IBP)

(prof. Ing. Lubomír Grmela, CSc.)

Physics for FIT

(prof. Ing. Lubomír Grmela, CSc.)

Seminar of Physics BFYS

(Ing. Jitka Brüstlová, CSc.)

Seminar of Physics IFS

(doc. RNDr. Milada Bartlová, Ph.D.)

## Master's Courses

Solid State Physics

(prof. Ing. Pavel Koktavý, CSc., Ph.D.)

Modern Physics

(doc. Ing. Karel Liedermann, CSc.)

Fyzikální optika pro informatiky

(doc. Ing. Petr Sedlák, Ph.D.)

Nanotechnology

(Ing. Pavel Škarvada, Ph.D., Ing. Robert Macků, Ph.D.)

Non-Destructive Diagnostics and Physics of Dielectrics

(Ing. Vladimír Holcman, Ph.D.)

## Ph.D. Courses

Junctions and Nanostructures

(Ing. Robert Macků, Ph.D.)

Spectroscopic Methods for Non-destructive Diagnostics

(doc. Ing. Karel Liedermann, CSc.)





Devices for testing of physical properties of components

## Laboratories

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

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

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

**Laboratory of Optical Nanometrology – SIX** (contactless investigation of local optical and electrical characteristics of optoelectronic and photonic structures with horizontal superresolution by scanning optical near field microscopy, Vladimír Holcman)

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

**Laboratory of Electron Microscopy** (equipped with the latest electron microscope LYRA with 1nm resolution, Lubomír Grmela)

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



'Mercur perFEKT' competition for secondary-school students in a department' s laboratory

# Department of Languages

## Doc. PhDr. Milena Krhutová, Ph.D.

Head

Technická 3058/10  
616 00Brno  
Tel.: 541 146 040  
Fax: 541 146 349  
e-mail: [ujaz@feec.vutbr.cz](mailto:ujaz@feec.vutbr.cz)



## Associate Professor

Doc. PhDr. Milena Krhutová, Ph.D.

## Lecturers

PaedDr. Alena Baumgartnerová, PhDr. Petra Fílová, Ph.D., PhDr. Marcela Borecká, Mgr. et Ing. Eva Ellederová, Kenneth Froehling, M.A., Mgr. Jaromír Haupt, Ph.D., Mgr. Jana Jašková, Ph.D., Ing. Martin Jílek, Mgr. Miroslav Kotásek, Ph.D., Mgr. Petra Langerová, Mgr. et Mgr. Hana Mihai, Ph.D., Mgr. Pavel Reich, Ph.D., Mgr. Šárka Rujbrová, Mgr. Pavel Sedláček, PhDr. Milan Smutný, Ph.D., Mgr. Magdalena Šedrllová, Mgr. et Bc. Dagmar Šťastná, Mgr. Agata Walek, Mgr. Petra Zmrzlá, Ph.D., Mgr. Marie Žouželková Bartošová

## Administrative and Technical Staff

Miroslava Purová

## Main Interests

In 2017 Department of Languages provided tuition for three faculties – Faculty of Electrical Engineering and Communication, Faculty of Management and Faculty of Information Technology. Another group of graduates in the philological study area ‘English in Electrical Engineering and Informatics’ completed their studies. The department is responsible for language education in the Bachelor programme ‘Electrical, Electronic, Communication and Control Technology’ and provides tuition in all courses.

The programme ‘English in Electrical Engineering and Informatics’ provides education in the theory of linguistics and specific language skills for professionals in various disciplines of electrical engineering and information technology. The programme, unique in the Czech Republic, educates graduates with specific interdisciplinary knowledge and skills required in the current job market. The subjects Introduction in Linguistics, Professional Style in Czech and English, Practical English 1 – 5, Grammar Structures, Discourse Analysis, Linguistics Pragmatics, Translation Exercises were launched and instruction materials produced. The department provides instruction in professional English for all specialisations in the Bachelor and Master programmes EECR, the Ph.D. programme and the interdisciplinary programmes BT-BIO and AUDIO. The courses are focused on professional English in electrical engineering and information technology, social skills and competences in technical as well as commercial language.

A new topic dealt with in research and often in Bachelor theses is the influence of English on the Czech language and on the methods of communication in general, the impact of IT on various areas of everyday life, professional as well as free time activities. Research of English as a language of profession continued and its results have been gradually implemented in the teaching materials. Professional discourse analysis considered not only the

pragmatic approach, but also the sociolinguistic approach taking into account the environment where English is spoken as a first or a second language.



Courses of foreign languages and professional English are incorporated in all study programmes

### Major Achievements

In September 2017 the department organised an international conference 'Teaching English for Specific Purposes at Universities' based on our research results and teaching experience. Guests from abroad were invited to present their contributions, and members of the department presented their papers. The conference was very successful and will be held again in 2018.

The department coordinated instruction at three faculties – Faculty of Electrical Engineering and Communication, Faculty of Information Technology and Faculty of Management. Each semester the department provides instruction for 3,500 students. This requires effective testing and posting of study materials in the system Moodle.

The chief objective of the department in 2017 was the continuation of the Bachelor study programme 'English in Electrical Engineering and Informatics', mainly preparation of final examinations and defence of Bachelor theses in the 3rd year of study and related instruction materials, examination regulations and topics. Language courses offered in this programme are based on our long-term research on the specific discourse in English in electrical engineering and communication technologies. Research results have been incorporated in the courses and in specific methods that this type of instruction requires. A new line of research is forming of compound technical terms and the producer's strategy in transmission of professional information and reality structuring in forming the terms.

Staff members visited universities in Great Britain and Lithuania where they focused on interdisciplinary programmes connecting technical specialisations and professional English.

### Selected Publications

SMUTNÝ, M. The Language of Science and Technology: Linguistics as a Part of a Multidisciplinary Study Program. In *María del Carmen Arau Ribeiro, Anna Goncalves and Manuel Moreira da Silva (eds.): Languages*

*and the Market: A ReCLes.pt Selection of International Perspectives and Approaches.* Lisabon, Portugalsko: ReCLes.pt - Associação de Centros de Linguas do Ensino Superior em Portugal www. recles.pt, 2017. p. 32-41. ISBN: 978-989-8557-78-0.

## Bachelor's Courses

Praktická angličtina

(Mgr. Pavel Sedláček, Mgr. et Ing. Eva Ellederová, Mgr. Petra Langerová, Mgr. Pavel Reich, Ph.D.)

Úvod do lingvistiky

(PhDr. Milan Smutný, Ph.D.)

Angličtina – mluvnická cvičení

(PaedDr. Alena Baumgartnerová)

Jazyk odborného stylu v češtině a angličtině

(Mgr. Miroslav Kotásek, Ph.D.)

Jazyk jako diskurz ve vědě a technice

(doc. PhDr. Milena Krhutová, Ph.D.)

Lingvistická pragmatika

(Mgr. Jaromír Haupt, Ph.D.)

Diskurzní analýza

(Mgr. Petra Zmrzlá, Ph.D.)

English for Engineering

(Mgr. Jaromír Haupt, Ph.D.)

Kulturní studia I

(Mgr. Pavel Sedláček)

Kulturní studia II

(Kenneth A. Froehling, M.A.)

English for Bachelors - Pre-Intermediate 1

(PaedDr. Alena Baumgartnerová)

English for Bachelors - Pre-Intermediate 2

(PaedDr. Alena Baumgartnerová)

English for Bachelors - Intermediate 1

(Mgr. Agata Walek)

English for Bachelors - Intermediate 2

(Mgr. Pavel Sedláček)

English for Europe

(PhDr. Milan Smutný, Ph.D.)

Business English

(Mgr. Pavel Reich, Ph.D.)

Professional Ethics

(Ing. Martin Jílek)

Engineering Pedagogy and Didactics

(Ing. Martin Jílek)

Culture of Speech and the Generation of Texts

(Ing. Martin Jílek)

Professional English for Electr. Engineering and Comp. Science

(PhDr. Milan Smutný, Ph.D.)

Laboratory Didactics

(Ing. Martin Jílek)

Bookkeeping for Managers

(Ing. Martin Jílek)

German for Lower-Intermediate

(Mgr. Pavel Sedláček)

German for Intermediate Students

(Mgr. Pavel Sedláček)

German for Beginners

(Mgr. Pavel Sedláček)

Pedagogical Psychology

(Ing. Martin Jílek)

Russian Pre-Intermediate

(PaedDr. Alena Baumgartnerová)

Russian for Beginners

(PaedDr. Alena Baumgartnerová)

Spanish for Lower-Intermediate Students

(PhDr. Marcela Borecká)

Spanish for Beginners

(PhDr. Marcela Borecká)

## Master's Courses

English for Europe

(PhDr. Milan Smutný, Ph.D.)

English for Life

(Mgr. Pavel Sedláček, Kenneth Froehling, M.A.)

Professional Ethics

(Ing. Martin Jílek)

Culture of Speech and the Generation of Texts

(Ing. Martin Jílek)

Professional English for Electr. Engineering and Comp. Science

(PhDr. Milan Smutný, Ph.D.)

Business English

(Mgr. Pavel Reich, Ph.D.)

Professional English

(Mgr. Pavel Reich, Ph.D.)

Bookkeeping for Managers

(Ing. Martin Jílek)

German for Lower-Intermediate

(Mgr. Pavel Sedláček)

German for Intermediate Students

(Mgr. Pavel Sedláček)

German for Beginners

(Mgr. Pavel Sedláček)

Russian for Beginners

(PaedDr. Alena Baumgartnerová)

Spanish for Beginners

(PhDr. Marcela Borecká)

## **Ph.D. Courses**

English for post-graduates  
(Mgr. Petra Zmrzlá, Ph.D.)

English for IT  
(doc. PhDr. Milena Krhutová, Ph.D.)

# Department of Mathematics

## Doc. RNDr. Zdeněk Šmarda, CSc.

Head

Technická 2848/8  
616 00 Brno 16  
Tel.: 541 143 130  
Fax: 541 143 392  
e-mail: [umat@feec.vutbr.cz](mailto:umat@feec.vutbr.cz)



## Professor Emeritus

Prof. RNDr. Václav Havel, DrSc.

## Professors

Prof. RNDr. Josef Diblík, DrSc.  
Prof. RNDr. Jan Chvalina, DrSc.

## Associate Professors

Doc. RNDr. Jaromír Baštinec, CSc.  
Doc. RNDr. Dana Hliněná, Ph.D.  
Doc. RNDr. Edita Kolářová, Ph.D.  
Doc. RNDr. Martin Kovár, Ph.D.  
Doc. RNDr. Zdeněk Šmarda, CSc.

## Lecturers

RNDr. Petr Fuchs, Ph.D., Ing. Michal Fusek, Ph.D., Mgr. Irena Hlavičková, Ph.D., RNDr. Vlasta Krupková, CSc., Mgr. Michal Novák, Ph.D., RNDr. Zdeněk Svoboda, CSc., Mgr. Marie Tomšová, Mgr. Jiří Vítovec, Ph.D.

## Ph.D. Students

Ing. Marie Klimešová, Hanna Demchenko, Mgr. Jan Šafařík, Mgr. Kristýna Mencáková, Ing. Zuzana Piskořová, Mgr. David Staněk, RNDr. Bedřich Smetana, Mgr. Gabriela Vanžurová

## Administrative and Technical Staff

Eva Šimečková

## Main Interests

In 2017 Department of Mathematics provided instruction in mathematics in full-time and part-time Bachelor and Master programmes. The department also provided instruction in two Ph.D. courses and in a number of courses in the Bachelor programme at the Faculty of Information Technology.

Research was conducted on the basis of contracts with international partners - the team of Professor D. Khusainov, Institute of Dynamical System Modelling, Faculty of Cybernetics, Kiev State University, the team of Professor I. Dzalladova, Institute of Mathematics, Faculty of Information Systems and Technologies, Kiev National Economic University.

The department cooperated with leading world experts – Professor Leonid Berezansky, Beer-Sheva University, Israel, Professor S. Stevic, Serbian Academy of Sciences, Belgrade, Professor I. Cristeou, School of Applied Sciences, University of Nova Gorica, Slovenia.

Research was focused on the stability of linear delay systems of differential equations, solutions of linear delay and slight delay discrete systems and asymptotic characteristics of delay matrix functions. Research of stochastic

differential equations dealt with RLGC circuits with a stochastic source and study of differences between parameters of white and coloured noise.

We dealt with the operability of second-order linear discrete systems, functional differential equations with delayed and forward arguments, dominant and subdominant solutions of generalised Dickman equation, application of the theory of standard stochastic differential equations to a model of homogeneous and nonhomogeneous transmission lines with the possibility of multiple stochastic triggering.

Research on algebraic hyperstructures followed three lines: generalisation of certain terms of the theory of ideals to Krasner hypercircles, study of EL-hyperstructures when the relation is not antisymmetric, reduction of requirements necessary to create specialised hyperstructures (mainly EL).

Research of statistical methods focused on censored probability distribution of type I, particularly exponential and Weibull distribution. In certain situations the Weibull distribution may be too complicated and the simpler exponential distribution, a specific case of Weibull distribution, would suffice. The possibilities of substituting the Weibull model with an exponential submodel were examined. To detect metastases in some types of carcinoma, a suitable mathematical model is to be found, based on the radioactive decay of the modified heat conduction equation that would yield so far concealed information, derivation of certain geometric characteristics of the examined tumor for high precision diagnostics. Prognosis of the development of untreated disease may be included.



Also girls can be interested in mathematics

## Major Achievements

The research team dealing with continuous and discrete dynamics participates in the project 'European Centre of Excellence OP VAVpl CEITEC', group 'Cybernetics for Material Sciences focused on dynamic systems analysis'. The team was involved in two GAČR projects and one specific research project.

In the study of slightly delayed linear discrete systems, patterns describing asymptotic behaviour of solutions were derived for a system of two equations with multiple delays, and conditioned stability results were proved. For three equations with one delay, slight delay criteria were derived and methods of analytical solution construction proposed. Using discrete delayed matrix functions (sine and cosine) it was possible to develop representations of solution of second-order linear discrete systems with delay that can be used in solution of the relative operability problem. The study of functional differential equations yielded results relating to the existence of global solutions (defined along the whole real axis) and semi-global solutions (defined on the left or on the right real semi-axis). We derived optimality conditions for solution of linear differential equations and control functions minimising the given functional were found. For generalised Dickman equation, the asymptotic behaviour of dominant and subdominant solutions was derived and initial functions that define them were determined.

Variability assessment of stochastic responses in hybrid systems with concentration and distribution parameters was based on the theory of stochastic differential equations, or rather stochastic differential-algebraic equations due to the presence of a lumped-parameter part of a general form. The MTL itself is modelled by a cascade connection of generalised LRCG cells and is described via a state-variable method. The variation approach in the



theory of stochastic partial differential equations was applied to formulate a transmission-line model with random source.

Three test statistics based on the maximum likelihood method were designed. Their efficiency was estimated via simulated force-function testing for different types of censored choice. On the basis of the so called isoperimetric inequality and Brunn-Minkowski theorem a mathematical model was designed for estimation of the coefficient of tumor 'roundness' representing the relationship between its surface and volume. The rate of a radiopharmaceutical accumulation in tumor tissue is significantly affected by its effective surface as related to its effective volume, while poorly enclosed tumors with large surface grow and expand more rapidly. However, a CT image cannot help to determine the coefficient of 'roundness' due to the low-resolution of the method (tenths of mm).

In 2017 the department's staff published 9 papers in impact journals and 47 papers in international conference proceedings.

## Major Research Projects

### Dynamic Systems Identification on Time Scales

Investigator: Josef Diblík

### Signal Integrity Research in High-Velocity Linking Structures

Co-investigator: Edita Kolářová

### Representation of Dynamic Systems with Focus on Algebraic and Topological Structure

Chief investigator: Zdeněk Šmarda

## Selected Publications

STEVIČ, S.; IRIČANIN, B.; ŠMARDA, Z. On a Solvable Class of Product-type Systems of Difference Equations. *Filomat*, 2017, vol. 31, no. 19, p. 6113-6129. ISSN: 0354-5180.

STEVIČ, S.; IRIČANIN, B.; ŠMARDA, Z. Boundary Value Problems for Some Important Classes of Recurrent Relations with Two Independent Variables. *Symmetry*, 2017, vol. 9, no. 12, p. 1-16. ISSN: 2073-8994.

DIBLÍK, J.; CALAMAI, A.; FRANCA, M.; POSPÍŠIL, M. On the Position of Chaotic Trajectories. *Journal of Dynamics and Differential Equations*, 2017, vol. 29, no. 4, p. 1423-1458. ISSN: 1040-7294.

STEVIČ, S.; IRIČANIN, B.; ŠMARDA, Z. NOTE ON BOUNDED SOLUTIONS TO NONHOMOGENOUS LINEAR DIFFERENCE EQUATIONS. *Electronic Journal of Differential Equations*, 2017, vol. 2017, no. 286, p. 1-22. ISSN: 1072-6691.

KOLÁŘOVÁ, E.; BRANČÍK, L. Confidence intervals for RLCG cell influenced by coloured noise. *COMPEL The international journal for computation and mathematics in electrical and electronic engineering*, 2017, vol. 36, no. 4, p. 838-849. ISSN: 0332-1649.

FUSEK, M. On testing reduction of a left-censored Weibull distribution to an exponential submodel. *Mendel Journal series*, 2017, vol. 23, no. 1, p. 179-184. ISSN: 1803-3814.

DIBLÍK, J.; HALFAROVÁ, H.; ŠAFAŘÍK, J. Conditional Stability and Asymptotic Behavior of Solutions of Weakly Delayed Linear Discrete Systems in  $R^2$ . *Discrete Dynamics in Nature and Society*, 2017, vol. 2017, no. 2017, p. 1-10. ISSN: 1607-887X.

BORDBAR, H.; CRISTEA, I.; NOVÁK, M. Height of hyperideals in Noetherian Krasner hyperring. *UNIVERSITY POLITEHNICA OF BUCHAREST SCIENTIFIC BULLETIN-SERIES A-APPLIED MATHEMATICS AND PHYSICS*, 2017, vol. 79, no. 2, p. 31-42. ISSN: 1223-7027.

SVOBODA, Z. Representation of Solutions of Linear Differential Systems of the Second Order with Constant Delays. *Journal of Mathematical Sciences*, 2017, vol. 222, no. 3, p. 345-358. ISSN: 1072-3374.

DIBLÍK, J.; KÚDELČÍKOVÁ, M. Two classes of asymptotically different positive solutions to advanced differential equations via two different fixed-point principles. *Mathematical Methods in the Applied Sciences*, 2017, vol. 40, no. 3, p. 1422-1437. ISSN: 1099-1476.

## Bachelor's Courses

Discrete Mathematics

(doc. RNDr. Martin Kovár, Ph.D.)

Mathematical Seminar

(RNDr. Petr Fuchs, Ph.D.)

Mathematics 1

(doc. RNDr. Edita Kolářová, CSc.)

Mathematics 2

(prof. RNDr. Jan Chvalina, DrSc.)

Mathematics 3

(Mgr. Irena Hlavičková, Ph.D.)

Probability and Statistics

(doc. RNDr. Jaromír Baštinec, CSc.)

Mathematics 2 for Audio Engineering

(RNDr. Zdeněk Svoboda, CSc.)

Selected parts from mathematics I.

(doc. RNDr. Zdeněk Šmarda, CSc.)

Selected parts from mathematics II.  
(doc. RNDr. Zdeněk Šmarda, CSc.)

Mathematics in Electrical Engineering  
(RNDr. Petr Fuchs, Ph.D.)

### Master's Courses

Differential Equations in Electrical Engineering  
(prof. RNDr. Josef Diblík, DrSc.)  
Matrices and Tensors Calculus  
(doc. RNDr. Martin Kovár, Ph.D.)  
Modern Numerical Methods  
(doc. RNDr. Jaromír Baštinec, CSc.)

Probability, Statistics and Operations Research  
(doc. RNDr. Jaromír Baštinec, CSc.)  
Stochastic Processes  
(doc. RNDr. Jaromír Baštinec, CSc.)  
Coding in Informatics  
(RNDr. Petr Fuchs, Ph.D.)

### Ph.D. Courses

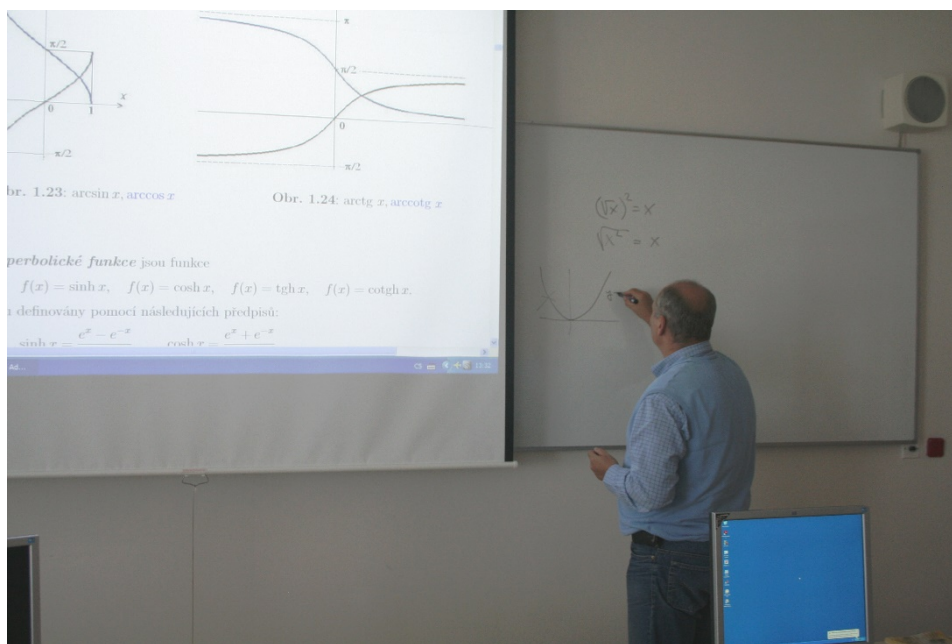
Discrete Processes in Electrical Engineering  
(prof. RNDr. Josef Diblík, DrSc.)

Probability, Statistics and Operations Research  
(doc. RNDr. Jaromír Baštinec, CSc.)

### Laboratories

**Computer Laboratories** (2) (simulation of application mathematical thematic wholes using Matlab, Maple, Mathematica, Petr Fuchs)

**Computer Laboratory for Mathematical Modelling** (data simulation and processing using StatSoft and Maple-Sim, Michal Novák)



Instruction in a computer laboratory

# Department of Microelectronics

## Doc. Ing. Jiří Háze, Ph.D.

Head

Technická 3058/10  
616 00 Brno  
Tel.: 541 146 159  
Fax: 541 146 298  
e-mail: [umel@feec.vutbr.cz](mailto:umel@feec.vutbr.cz)



## Professors

Prof. RNDr. Vojtěch Adam, Ph.D.  
Prof. Ing. Dalibor Biolek, CSc.  
Prof. Ing. Jaroslav Boušek, CSc.  
Prof. Ing. Vladislav Musil, CSc.  
Prof. Ing. Radimír Vrba, CSc.

## Associate Professors

Doc. Ing. Jana Drbohlavová, Ph.D.  
Doc. Ing. Lukáš Fojcik, Ph.D.  
Doc. Ing. Jiří Háze, Ph.D.  
Doc. Ing. Jaromír Hubálek, Ph.D.  
Doc. Ing. Jaroslav Kadlec, Ph.D.  
Doc. Ing. Fabian Khateb, Ph.D.  
Doc. RNDr. Pavel Kopel, Ph.D.  
Doc. Ing. Radek Kuchta, Ph.D.  
Doc. Ing. Pavel Legát, CSc.  
Doc. Ing. Radovan Novotný, Ph.D.  
Doc. Ing. Josef Šandera, Ph.D.  
Doc. Ing. Pavel Šteffan, Ph.D.  
Doc. Ing. Ivan Szendiuch, CSc.  
Doc. Ing. František Urban, CSc.

## Lecturers

Ing. Martin Adámek, Ph.D., Ing. Edita Hejátková, Ing. Vilém Kledrowetz, Ph.D., Ing. Michal Pavlík, Ph.D., Ing. Jan Pekárek, Ph.D., Ing. Jana Pekárková, Ph.D., Ing. Jan Prášek, Ph.D., Ing. Roman Prokop, Ph.D., Ing. Michal Řezníček, Ph.D., Ing. Ondřej Sajdl, Ph.D., Ing. Martin Štáva, Ph.D., Ing. Jaromír Žák, Ph.D.

## Research Workers

M.Sc. Amitava Moulick, Ph.D., Ing. Nabhan Khatib, Ph.D., Ing. Pavel Neužil, Ph.D., Stella Vallejos Vargas, Dr.  
Dr. Alon Ascoli, Mgr. Zdenka Fohlerová, Ph.D., Ing. Lukáš Nejdli, Ph.D., RNDr. Lukáš Richtera, Ph.D., prof. Dr. Ulrich Schmid, Dr. Michael Schneider, prof. Ronald Tetzlaff

## Ph.D. Students

Ing. Pavel Cícha, Ing. Vojtěch Dvořák, Ing. Jaromír Ambrož, Salma Bay Abo Dabbous, Ing. Pavel Hejlek, Ing. Jiří Hofman, Ing. Milan Holík, Ing. Milan Hurban, Ing. Ondřej Chmela, Ing. Tomáš Janůš, Ing. Michal Jelínek, Ing. Milan Jílek, Ing. Michal Kerndl, Ing. Stanislav Krátký, Mgr. Zdeňka Kuchtová, Ing. Hana Kynclová, Ing. Radek Lang, Ing. Vladimír Levek, Ing. Barbora Mojrová, Ing. Tomáš Musil, Ing. Lukáš Novák, Ing. Václav Novotný, Ing. Alexandr Otáhal, Ing. Karel Ptáček, Ing. Bc. Pavel Řihák, Ing. Jiří Sedláček, Ing. Josef Skácel, Ing. Jakub

Somer, Ing. Matúš Šedivý, Ing. Kateřina Urbánková, Ing. Radek Vala, Ing. Martin Vala, Ing. Jan Valíček, Ing. David Veverka, Ing. Radim Zahradníček, Ing. Laila Znbill

## Administrative and Technical Staff

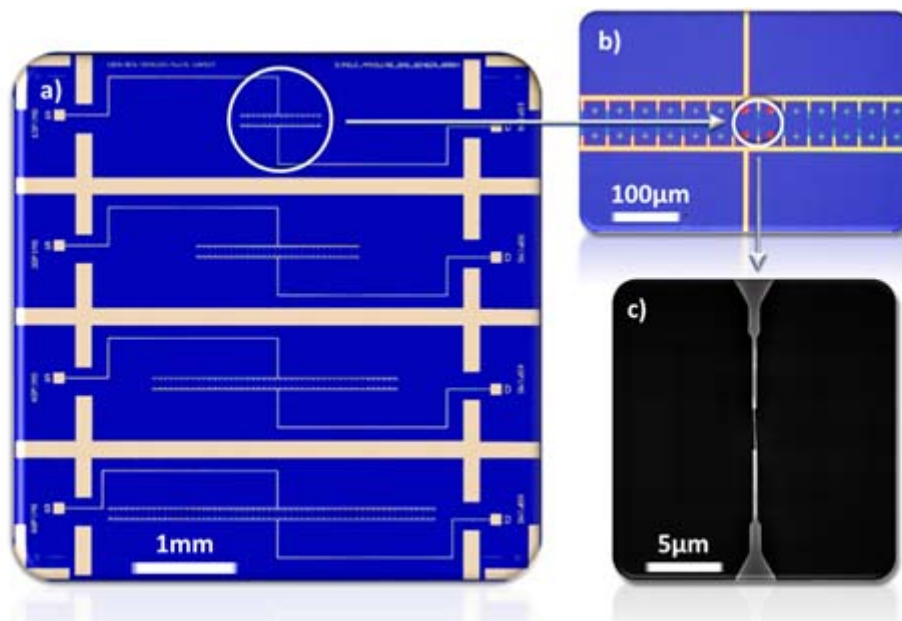
Ing. Marek Bohrn, Ph.D., Ing. Martin Buršík, Ph.D., Mgr. Jana Helena Církvová, Ing. Imrich Gablech, Ing. Martina Gaňová, Ph.D., Ing. Ondřej Hégr, Ph.D., Ing. Radim Hrdý, Ph.D., Ing. Jaroslav Jankovský, PhDr. Jarmila Jurášová, Ph.D., Ing. Jiří Kudr, Ph.D., RNDr. Michal Masařík, Ph.D., Ing. Břetislav Mikel, Ph.D., Bc. David Nejezchleb, Ph.D., Mgr. Michaela Pekarová, Ing. Evelína Polievková, Petra Procházková DiS, Ing. Vojtěch Svatoš, Ing. Jiří Šubarda

## Main Interests

The department is responsible for instruction in basic subjects, mainly electronic components and circuits, and subjects specialised in the design of integrated circuits and microelectronic technology in Bachelor and follow-up Master degree programmes.

Basic and applied research was focused on integrated circuits, sensors and microelectronic technologies. The main areas of interest were:

- design of voltage, current and mixed-mode circuits
- design of circuits with switched capacitors and switched currents
- cosmic applications
- basic research of memristors, memcapacitors and meminductors
- MEMS structures design and simulation through COMSOL a ANSYS
- methods of sensor signal evaluation including integration in ASIC
- advanced technologies for components, surfaces and sensors
- formation of nanostructures (nanodots, nanotubes, nanocolumns) using advanced nanotechnologies
- simulation and evaluation of the reliability of 3D linking systems
- novel methods of thixotropic material nonvacuum deposition in 3D circuits
- reliability of lead-free solders
- advanced methods of semiconductor chips interconnection and packaging
- simulation of electronic kits and packages in ANSYS
- non-conventional application of thick films (sensors, attenuators, shielding, antennas etc)



Gas-sensitive on-chip sensor developed from microelectrodes with nanowire  $\text{WO}_3$

The department closely cooperated (student placements) with Technical University in Sofia (Bulgaria), TU Ilmenau and IMMS Erfurt, Germany, and maintained research cooperation with Autoflug, Hamburg, Catalonia

University Rovira i Virgili in Tarragona, research laboratory IMEC-KHBO in Belgium, UC Berkeley, UC San Diego, Tampere University of Technology, Politecnico Di Torino, and TU Dresden.

With Pbt Rožnov pod Radhoštěm, the department worked on new cleaning methods in electronics directly related to manufacture of modern cleaning equipment (with focus on cleaning after soldering and cleaning of templates). Prototypes of sensors developed on the principle of balance thermodynamics (cooperation with HIT s.r.o.) were tested. In cooperation with TU Wien new types of flow sensors were implemented by the LTCC.

With Fill Factory, Rožnov pod Radhoštěm (former Solartec) and research centre ISC Konstanz, we started research on the effect of the surface structure of crystalline quartz cells on their properties. The department closely cooperates with the 'Centre of Excellence CEITEC'.

## Major Achievements

The department's staff participated in 3 GAČR, 3 MPO and 1TAČR project. In November 2017 the department co-organised the 'international IMAPS flash Conference 2017' with participation of Czech and international experts. There were 60 papers on microelectronics and technology.

The group involved in microelectronic technology and casting headed by M. Řezníček provided instruction in subjects BMTS, MMTE, MVSK, MEP for full-time students and instruction in another two subjects for part-time students. The group centred its activities on very high resolution deposition of viscose materials, and in 2017 completed a TAČR GAMA project. The group was granted European patent EP2746235 'Method of Creating an Interlayer on Glass Test Substrates Designed for Bonding of Chips and Coating Devices for Carrying Out This Method'. Another research area was melting of ceramic materials for ceramic casing implementation. The group was involved in assembly and repair of BGA casting including the impact of residual oxygen concentration in atmosphere during alloy remelting. Research also focused on optimisation of novel method of reballing electronic BGA packages. A novel method of peening on two-layer printed circuit boards using ultrasound energy and vacuum was developed. An interesting and unconventional area of research was the construction of a simple electronic nose for use of edible insects and identification and authentication of foodstuffs, the so called detection of minerals in edible insects by means of X-ray spectrometry, analysis the of nutrition characteristics of edible insects and conditions for their keeping.

The group LabSensNano (Laboratory of microsensors and nanotechnology) led by J. Hubálek continued their involvement in the centre SIX and Central European Technology Institute. The team was engaged in research and development of physical and chemical sensors and biosensors for medical, environmental and specific applications using micro- and nanotechnologies. An IR camera with novel characteristics for scanning in a broader spectrum than usual in thermovision cameras was designed. Development of the Lab on a chip technology for ultra-fast analysis in mobile devices continued. Technology for creating 3D sensitive nanostructure gas sensors was developed. Research outcomes were published in impact journals and presented at Web of Science (ISI) conferences.

The team working on custom integrated circuits led by L. Fucik focused on the development of intelligent sub-micron structures and systems for modern microsensors and low-input and low-voltage applications. An integrated circuit for basic evaluation circuit (future building block of a line evaluation system) was designed for measurement of temperature changes in resistivity of a bolometer sensor working as an integrator based on the principle of  $\Delta\Sigma$  modulation. The integrated circuit has been designed to evaluate the change in bolometer resistivity due to heating by incident infrared radiation. This structure was patented and then published in impact journals. Over the last years the group for design of custom integrated circuits has become involved in the development of devices for use in the space, mainly smaller devices able to affect significantly certain key functions of space satellites. We are currently involved in the project 'METOP SG 3MI' where we are developing all electronics, from power components to signal processing, control and automation of engine. It is an optical experiment for monitoring of the surface area of earth, climate, atmospheric temperature and moisture. A new generation of meteo satellites is being developed to provide high quality data on climate development. These are projects of the 'European space agency' (ESA). They are very complex and require high technical competence, therefore many European top teams are involved, and we closely cooperate with them.

A joint team of the department and companies CROSS Zlín and NETWORK GROUP, s.r.o. continued development of a novel sensor for the system of dynamic weighing of vehicles. Research focused on low pressure and vacuum pressure sensor. With other partners we worked on wireless network and communication protocols. The key objective of this cooperation was the development of reliable identification systems based on wireless technology from MICRORISC s.r.o

Research team led by Professor Biolk participated in the COST LD15033 project and focused on memsystems, particularly the theory of memristors and their utilisation for analog applications. Research was conducted in the framework of European programme COST IC1401 MemoCIS. Our most important partners were TU Dresden and NamLab Dresden. Achieved results on memristive dual gates, predictive models, simulations of extensive memristive networks, synthesis of required behaviour systems and expansion of Chua modelling concept to non-electric nanosystems can act as an accelerator of future useful analog applications of memristive nanosystems. Results were published in prestigious impact journals.

## Major Research Projects

### Pressure Sensors for the Internet of Things – FV20693

Investigator: Radimír Vrba

### System for Process Monitoring with Utilisation of Modern Tools for Their Optimisation (SYMONPRO) – FV10562

Investigator: Radimír Vrba

### Theory and Application of Memristors – LD15033, MŠMT project

Investigator: Dalibor Bielek

### Development of Intelligent Tunable White Universal Connectivity Lights – TH03010472

Investigator: Pavel Šteffan

### Microfluidics-Based Ultrafast Differential Fluometry for Pharmaceutical Research ( $\mu$ DSF) – GAČR 16-11140S

Investigator: Jaromír Hubálek

### Surface Modified Nanowires for Selective Detection of Volatile Organic Substances (NoWSens) - GAČR 17-16531S

Investigator: Stella Vallejos Vargas

### Novel Analog Integrated Circuit Principles for Implementable and Portable Battery Operated Biomedical Devices– GA15-21942S

Investigator: Fabian Khateb

### Universal Nanotechnology-Based Surveillance Camera – VI20152019043

Investigator: Jaromír Hubálek

### High-Resolution Dispenser Printer – TG01010054

Investigator: Jaromír Hubálek

## Selected Publications

NOVÁK, L.; ŠTEFFAN, P. Error rate of USART in NRWW Section. *ElectroScope* - <http://www.electroscope.zcu.cz>, 2017, vol. 2017, no. 2, p. 1-3. ISSN: 1802-4564.

ZNBILL, L.; BOUŠEK, J. Printed thermoelectric generators. *ElectroScope* - <http://www.electroscope.zcu.cz>, 2017, vol. 2017, no. 2, p. 4-7. ISSN: 1802-4564.

MLČEK, J.; ADÁMEK, M.; ADÁMKOVÁ, A.; BORKOVCOVÁ, M.; BEDNÁŘOVÁ, M.; SKÁCEL, J. Detection of selected heavy metals and micronutrients in edible insect and their dependency on the feed using XRF spectrometry. *Potravinářstvo*, 2017, vol. 11, no. 1, p. 725-730. ISSN: 1337-0960.

NOVOTNÝ, R. Rizikové IPO. *Fond Shop*, 2017, č. 23/2017, s. 22-23. ISSN: 1211-7277.

PŘIKRYLOVÁ, K.; POLIEVKOVÁ, E.; DRBOHLAVOVÁ, J.; VESELÁ, M.; HUBÁLEK, J. Nanostructured titania decorated with silver nanoparticles for photocatalytic water disinfection. *Monatshefte fuer Chemie*, 2017, vol. 148, no. 11, p. 1913-1919. ISSN: 0026-9247.

MOURALOVÁ, K.; BENEŠ, L.; ZAHRADNÍČEK, R. Defects in the surface layer of pure molybdenum after WEDM. *Manufacturing TECHNOLOGY*, 2017, vol. 2017, no. 5, p. 786-790. ISSN: 1213-2489.

ZAHRADNÍČEK, R.; PROKEŠ, T.; BENEŠ, L. The graphene oxide spincoating optimization by planned experiment. *Manufacturing TECHNOLOGY*, 2017, vol. 2017, no. 4, p. 635-639. ISSN: 1213-2489.

MOURALOVÁ, K.; KOVÁŘ, J.; KLAKURKOVÁ, L.; BEDNÁŘ, J.; BENEŠ, L.; ZAHRADNÍČEK, R. Analysis of the surface morphology and topography of pure aluminium machined using WEDM. *MEASUREMENT, Journal of the International Measurement Confederation (IMEKO)*, 2017, vol. 2018, no. 114, p. 169-176. ISSN: 0263-2241.

GABLECH, I.; CAHA, O.; SVATOŠ, V.; PEKÁREK, J.; NEUŽIL, P.; ŠIKOLA, T. Stress-free deposition of [001] preferentially oriented titanium thin film by Kaufman ion-beam source. *Thin Solid Films*, 2017, vol. 638, no. NA, p. 57-62. ISSN: 0040-6090.

VÁVRA, J.; BIOLEK, D. An Envelope Detector Based on Memristive Systems. *Journal of Telecommunication, Electronic and Computer Engineering*, 2017, vol. 9, no. 2-7, p. 183-186. ISSN: 2180-1843.

BIOLEK, D.; BIOLKOVÁ, V.; KOLKA, Z.; VÁVRA, J. Synthesis of Memristive Systems. *Journal of Telecommunication, Electronic and Computer Engineering*, 2017, vol. 9, no. 2-7, p. 171-175. ISSN: 2180-1843.

HRDÝ, R.; KYNCLOVÁ, H.; KLEPÁČOVÁ, I.; BARTOŠÍK, M.; NEUŽIL, P. Portable Lock-in Amplifier-Based Electrochemical Method to Measure an Array of 64 Sensors for Point-of-Care Applications. *ANALYTICAL CHEMISTRY*, 2017, vol. 86, no. 17, p. 8731-8737. ISSN: 0003-2700.

MOURALOVÁ, K.; KOVÁŘ, J.; PROKEŠ, T.; BEDNÁŘ, J.; HRABEC, P. Optimization of WEDM settings parameters when machining pure aluminium using DoE. *MM Science Journal*, 2017, vol. 2017, no. 4, p. 2105-2108. ISSN: 1803-1269.

MOURALOVÁ, K.; ZAHRADNÍČEK, R.; HRDÝ, R. Using WEDM machine a pure molybdenum welding electrode. *MM Science Journal*, 2017, vol. 2017, no. 4, p. 2109-2113. ISSN: 1803-1269.

MOJROVÁ, B.; CHU, H.; PETER, C.; PREIS, P.; LOSSEN, J.; MIHAILETCHI, V.; KOPECEK, R. A comparison study of boron emitter passivation by silicon oxide and a PECVD silicon nitride stack. *Energy Procedia*, 2017, no. 124, p. 288-294. ISSN: 1876-6102.

KULEJ, T.; KHATEB, F. 0.3-V Bulk-driven Programmable Gain Amplifier in 0.18 um CMOS. *International Journal of Circuit Theory and Applications*, 2017, vol. 2017 (45), no. 8, IF: 1.571, p. 1077-1094. ISSN: 0098-9886.

PEKÁREK, J.; PROKOP, R.; SVATOŠ, V.; GABLECH, I.; HUBÁLEK, J.; NEUŽIL, P. Self-compensating method for bolometer-based IR focal plane arrays. *Sensors and Actuators*, 2017, vol. 265C, no. NA, p. 40-46. ISSN: 0924-4247.

KUMAR RANJAN, R.; RAJ, N.; BHUWAL, N.; KHATEB, F. Single DVCCTA based high frequency incremental/decremental memristor emulator and its application. *AEU - International Journal of Electronics and Communications*, 2017, vol. 2017 (82), no., IF: 1.147, p. 177-190. ISSN: 1434-8411.

ADÁMKOVÁ, A.; ADÁMEK, M.; MLČEK, J.; BORKOVCOVÁ, M.; BEDNÁŘOVÁ, M.; KOUŘIMSKÁ, L.; SKÁCEL, J.; VÍTOVÁ, E. Welfare of the Mealworm (*Tenebrio molitor*) Breeding With Regard to Nutrition Value and Food Safety. *Potravinářstvo*, 2017, vol. 11, no. 1, p. 460-465. ISSN: 1337-0960.

ADÁMEK, M.; ADÁMKOVÁ, A.; BORKOVCOVÁ, M.; MLČEK, J.; BEDNÁŘOVÁ, M.; KOUŘIMSKÁ, L.; SKÁCEL, J.; ŘEZNÍČEK, M. Electronic Nose In Edible Insects Area. *Potravinářstvo*, 2017, vol. 11, no. 1, p. 446-451. ISSN: 1337-0960.

PEJOVIĆ SIMEUNOVIĆ, J.; PEKÁRKOVÁ, J.; ŽÁK, J.; CHAMRADOVÁ, I.; HUBÁLEK, J. Studying of quantum dot luminescence quenching effect caused by covalent conjugation with protein. *Monatshefte für Chemie*, 2017, vol. 148, no. 11, p. 1901-1909. ISSN: 1434-4475.

KHATEB, F.; VLASSIS, S.; KULEJ, T.; SOULIOTIS, G. Bulk-driven class AB fully-balanced differential difference amplifier. *ANALOG INTEGRATED CIRCUITS AND SIGNAL PROCESSING*, 2017, vol. 2017 (93), no. 1, IF: 0.623, p. 179-187. ISSN: 0925-1030.

KHATEB, F.; JAIKLA, W.; KULEJ, T.; KUMNGERN, M.; KUBÁNEK, D. Shadow filters based on DDCC. *IET Circuits, Devices and Systems*, 2017, vol. 2017 (11), no. 6, IF: 1.092, p. 631-637. ISSN: 1751-858X.

PROMMEE, P.; MANOSITTHICHAI, N.; KHATEB, F. Active-only variable-gain low-pass filter for dual-mode multiphase sinusoidal oscillator application. *TURK J ELECTR ENG CO*, 2017, vol. 2017 (25), no., IF: 0.578, p. 4326-4340. ISSN: 1300-0632.

BIOLEK, Z.; BIOLEK, D. Euler-Lagrange Equations of Networks with Higher-Order Elements. *Radioengineering*, 2017, vol. 26, no. 2, p. 397-405. ISSN: 1210-2512.

ADÁMKOVÁ, A.; MLČEK, J.; KOUŘIMSKÁ, L.; BORKOVCOVÁ, M.; BUŠINA, T.; ADÁMEK, M.; BEDNÁŘOVÁ, M.; KRAJSA, J. Nutritional Potential of Selected Insect Species Reared on the Island of Sumatra. *International Journal of Environmental Research and Public Health*, 2017, vol. 14, no. 5, p. 1-10. ISSN: 1660-4601.

CHMELA, O.; SADÍLEK, J.; VALLEJOS VARGAS, S.; HUBÁLEK, J. Microelectrode array system as platforms for single nanowire based sensors. *Journal of Electrical Engineering*, 2017, vol. 68, no. 2, p. 158-162. ISSN: 1335-3632.

SZENDIUCH, I. IMAPS a rostoucí význam pouzdrění v moderní mikroelektronice. *DPS Elektronika od A do Z*, 2017, roč. 25, č. 3, s. 40-43. ISSN: 1805-5044.

BERTSIAS, P.; KHATEB, F.; KUBÁNEK, D.; KHANDAY, F.; PSYCHALINOS, C. Capacitorless Digitally Programmable Fractional-Order Filters. *AEU - International Journal of Electronics and Communications*, 2017, vol. 2017 (78), no., IF: 1.147, p. 228-237. ISSN: 1434-8411.

KULEJ, T.; KHATEB, F. Sub 0.5-V Bulk-driven LTA in 0.18 um CMOS. *AEU - International Journal of Electronics and Communications*, 2017, vol. 2017 (77), no., IF: 1.147, p. 67-75. ISSN: 1434-8411.

JEŘÁBEK, J.; ŠOTNER, R.; POLÁK, J.; LANGHAMMER, L.; HERENCSÁR, N.; PROKOP, R.; VRBA, K. Resistorless Single-purpose or Reconfigurable Biquads Utilizing Single Z-Copy Controlled-Gain Voltage Differencing Current Conveyor. *JOURNAL OF CIRCUITS SYSTEMS AND COMPUTERS*, 2017, vol. 26, no. 3, p. 1-21. ISSN: 1793-6454.

POTREBIC, M.; TOSIC, D.; BIOLEK, D. Reconfigurable microwave filters using memristors. *International Journal of Circuit Theory and Applications*, 2017, vol. 2017, no. 1, p. 1-12. ISSN: 1097-007X.

BIOLEK, D.; KOLKA, Z.; BIOLKOVÁ, V.; BIOLEK, Z.; POTREBIC, M.; TOSIC, D. Modeling and simulation of large memristive networks. *International Journal of Circuit Theory and Applications*, 2017, vol. 2017, no. 1, p. 1-16. ISSN: 1097-007X.

ŠETKA, M.; DRBOHLAVOVÁ, J.; HUBÁLEK, J. Nanostructured Polypyrrole-Based Ammonia and Volatile Organic Compound Sensors. *SENSORS*, 2017, vol. 17, no. 3, p. 1-28. ISSN: 1424-8220.

KHATEB, F.; KULEJ, T.; KUMNGERN, M.; KLEDROWETZ, V. Low-voltage diode-less rectifier based on fully differential difference transconductance amplifier. *JOURNAL OF CIRCUITS SYSTEMS AND COMPUTERS*, 2017, vol. 2017 (26), no. 11, IF: 0.481, p. 1750172-1 (1750172-8 p.) ISSN: 0218-1266.

KHAW-NGAM, K.; KUMNGERN, M.; KHATEB, F. Mixed-Mode Third-Order Quadrature Oscillator Based on Single MCCFTA. *Radioengineering*, 2017, vol. 2017 (26), no. 2, IF: 0.945, p. 522-535. ISSN: 1210-2512.

- BANNOV, A.; PRÁŠEK, J.; JAŠEK, O.; ZAJÍČKOVÁ, L. Investigation of pristine graphite oxide as room-temperature chemiresistive ammonia gas sensing material. *SENSORS*, 2017, vol. 17, no. 2, p. 320-329. ISSN: 1424-8220.
- KLEDROWETZ, V.; PRISTACH, M.; HÁZE, J.; PAVLÍK, M.; FUJCIK, L.; DVOŘÁK, V. A novel low order delta-sigma modulator without harmonic distortion. *ANALOG INTEGRATED CIRCUITS AND SIGNAL PROCESSING*, 2017, vol. Volume 90, no. Issue 2, p. 487-497. ISSN: 0925-1030.
- VLASSIS, S.; KULEJ, T.; KHATEB, F.; SOULIOTIS, G. 0.5 V bulk-driven ring amplifier based on master-slave technique. *ANALOG INTEGRATED CIRCUITS AND SIGNAL PROCESSING*, 2017, vol. 2017 (90), no. 1, IF: 0.623, p. 189-197. ISSN: 0925-1030.
- ŠOTNER, R.; JEŘÁBEK, J.; PROKOP, R.; KLEDROWETZ, V.; POLÁK, J. A CMOS Multiplied Input Differential Difference Amplifier: A New Active Device and Its Applications. *Applied Sciences - Basel*, 2017, vol. 7, no. 1, p. 1-13. ISSN: 2076-3417.
- BIOLEK, Z.; BIOLEK, D.; BIOLKOVÁ, V.; KOLKA, Z.; ASCOLI, A.; TETZLAFF, R. Analysis of memristors with nonlinear memristance versus state maps. *International Journal of Circuit Theory and Applications*, 2017, vol. 2017, no. 1, p. 1-19. ISSN: 1097-007X.
- KHATEB, F.; KULEJ, T.; VLASSIS, S. Extremely low-voltage bulk-driven tunable transconductor. *CIRCUITS SYSTEMS AND SIGNAL PROCESSING*, 2017, vol. 2017 (36), no. 2, IF: 1.694, p. 511-524. ISSN: 0278-081X.
- KUMNGERN, M.; KHATEB, F.; KULEJ, T. A Fully Balanced Four-Terminal Floating Nullor for Ultra-Low Voltage Analog Filter Design. *IET Circuits, Devices and Systems*, 2017, vol. 2017 (11), no. 2, IF: 1.092, p. 173-182. ISSN: 1751-858X.
- KULEJ, T.; KHATEB, F. Sub 0.5-V bulk-driven winner take all circuit based on a new voltage follower. *ANALOG INTEGRATED CIRCUITS AND SIGNAL PROCESSING*, 2017, vol. 2017 (90), no. 3, IF: 0.623, p. 687-691. ISSN: 0925-1030.
- SANGYAEM, S.; SIRIPONGDEE, S.; JAIKLA, W.; KHATEB, F. Five-Inputs Single-Output Voltage Mode Universal Filter with High Input and Low Output Impedance Using VDDAs. *OPTIK*, 2017, vol. 2017 (128), no., IF: 0.835, p. 14-25. ISSN: 0030-4026.

## Bachelor's Courses

Analogue Electronic Circuits (prof. Ing. Dalibor Biolek, CSc.)	Microelectronic Practice 2 (doc. Ing. Josef Šandera, Ph.D.)
Diagnostics and Testing of Electronic Systems (Ing. Michal Pavlík, Ph.D.)	Microelectronics and Assembly Technology (Ing. Michal Řezníček, Ph.D.)
Digital Circuits (doc. Ing. Lukáš Fucik, Ph.D.)	Microsensors and Micromechanical Systems (doc. Ing. Jaromír Hubálek, Ph.D.)
Digital Circuits and Microprocessors - HDOM (doc. Ing. Pavel Šteffan, Ph.D.)	Modelling and Computer Simulation (prof. Ing. Dalibor Biolek, CSc.)
Analog Technology – HANA (Ing. Vilém Kledrowetz, Ph.D.)	Design and Technology of Electronic Instruments (prof. Ing. Vladislav Musil, CSc.)
Electronic Devices - BESO, HESO (prof. Ing. Jaroslav Boušek, CSc.)	Design of Analog Integrated Circuits (doc. Ing. Jiří Háze, Ph.D.)
Design of Vacuum Systems for Technologies in Microelectronics (doc. Ing. Josef Šandera, Ph.D.)	Optoelectronics and Optical Communications (doc. Ing. František Urban, CSc.)
Microelectronic Practice (doc. Ing. Josef Šandera, Ph.D.)	Management Minimum (doc. Ing. Radovan Novotný, Ph.D.)

## Master's Courses

Analogue Integrated Circuits (doc. Ing. Jiří Háze, Ph.D.)	Design and Technology of Electronic Equipments (prof. Ing. Vladislav Musil, CSc.)
Applied Computer Technology (Ing. Radovan Novotný, Ph.D.)	Methods of Analog Integrated Circuits Design (Ing. Roman Prokop, Ph.D.)
Digital Integrated Circuits (doc. Ing. Pavel Šteffan, Ph.D.)	Methods of Digital Integrated Circuits Design (doc. Ing. Lukáš Fucik, Ph.D.)
Integrated Optoelectronics (doc. Ing. František Urban, CSc.)	Microelectronics in English (doc. Ing. Jiří Háze, Ph.D.)



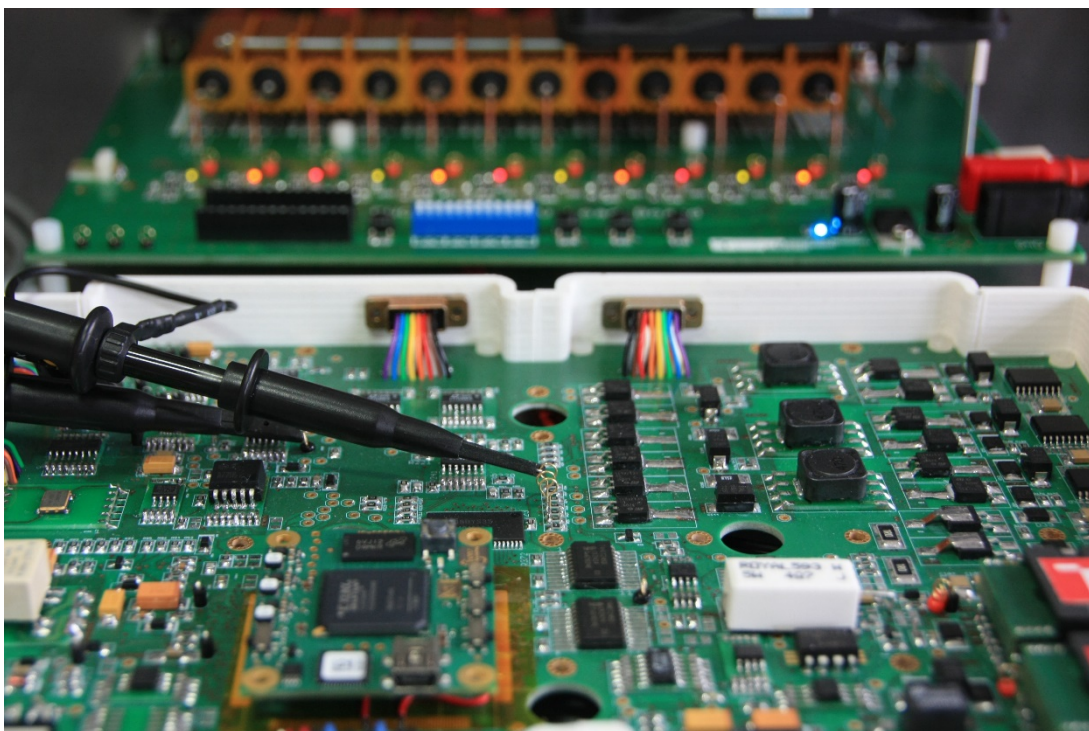
Microelectronic Devices and Structures  
(prof. Ing. Vladislav Musil, CSc.)  
Modelling and Simulation in Microelectronics  
(doc. Ing. Jaroslav Kadlec, Ph.D.)  
New Technology for Microelectronic Circuits  
(doc. Ing. Ivan Szendiuch, CSc.)  
Design of Electronic Instruments  
(doc. Ing. Radek Kuchta, CSc.)  
New Circuit Principles for Integrated System Design  
(doc. Ing. Fabian Khateb, Ph.D.)

Management Minimum  
(doc. Ing. Radovan Novotný, Ph.D.)  
Theory of AD and DA Signal Conversion  
(doc. Ing. Jiří Háze, Ph.D.)  
Vacuum Technology  
(prof. Ing. Jaroslav Boušek, CSc.)  
Electronic Components Production  
(doc. Ing. Ivan Szendiuch, CSc.)

## Ph.D. Courses

Microelectronic Systems  
(prof. Ing. Vladislav Musil, CSc.)

Microelectronic Technologies  
(doc. Ing. Jaromír Hubálek, Ph.D.)



Prototype of meteosat control unit

## Laboratories

**Laboratory of Electronic Components** (instruction in Electronic Components, Martin Adámek, Jaroslav Boušek). New measuring devices were provided by ON Semiconductor.

**Laboratory of Analog Circuits and Microelectronic Practice** (instruction in Analog Integrated Circuits and Microelectronic Practice, Jiří Háze, Josef Šandera)

**Laboratory of Microsensors and Nanotechnologies** (research laboratory of chemistry, chemical sensors and biosensors, development of electronic devices, electron microscopy and lithography, dispersive X-ray spectroscopy, Jaromír Hubálek)

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

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

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

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

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

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

**Computer Laboratory** (computer exercises for various subjects, student self-study, internet, David Nejezchleb)

**Laboratory for Characterisation of Semiconductor Components – testing of chips** (instruction in Manufacturing of Components and Construction elements, student projects, Jaromír Hubálek)

# Department of Radioelectronics

## Prof. Ing. Tomáš Kratochvíl, Ph.D.

Head

Technická 3082/12  
616 00, Brno  
Tel.: 541 146 538  
Fax: 541 146 597  
e-mail: [urel@feec.vutbr.cz](mailto:urel@feec.vutbr.cz)



## Professors Emeriti

Prof. Ing. Tomáš Dostál, DrSc.  
Prof. Ing. Václav Říčný, CSc.  
Prof. Ing. Vladimír Šebesta, CSc.

## Professors

Prof. Ing. Lubomír Brančík, CSc.  
Prof. Ing. Stanislav Hanus, CSc.  
Prof. Ing. Miroslav Kasal, CSc.  
Prof. Dr. Ing. Zdeněk Kolka  
Prof. Ing. Tomáš Kratochvíl, Ph.D.  
Prof. Ing. Roman Maršálek, Ph.D.  
Prof. Ing. Aleš Prokeš, Ph.D.  
Prof. Dr. Ing. Zbyněk Raida  
Prof. Ing. Milan Sigmund, CSc.  
Prof. Ing. Otakar Wilfert, CSc.

## Lecturers

Ing. Viera Biolková, Ing. Jiří Dřínovský, Ph.D., Ing. Lucie Hudcová, Ph.D., Ing. Ivana Jakubová, Ing. Michal Kubíček, Ph.D., Ing. Tomáš Urbanec, Ph.D.

## Research Workers

Ing. Peter Barčík, Ph.D., Ing. Jiří Blumenstein, Ph.D., Ing. Libor Boleček, Ph.D., Dr. Techn. Vojtěch Derbek, doc. Ing. Pavol Galajda, CSc., Ing. Tomáš Götthans, Ph.D., Ing. Milan Guzan, Ph.D, Ing. Petr Kadlec, Ph.D., prof. Dr. Ing. Christoph Mecklenbräuker, Ing. Tomáš Mikulášek, Ph.D., Ing. Jiří Miloš, Ph.D., Ing. Ladislav Polák, Ph.D., Ing. Aleš Povalač, Ph.D., Ing. Vladimír Šeděnka, Ph.D., Ing. Filip Záplata, Ph.D.

## Ph.D. Students

Ing. Nawfal Al-Zubaidi R-Smith, Ing. Miroslav Cupal, Ing. Aleš Dobesch, Ing. Ondřej Domanský, Ing. Michal Harvánek, Ing. Erik Herceg, Ing. Martin Hrabina, Ing. Patrik Hubka, Ing. Lukáš Janík, Ing. Ondřej Kaller, Ing. Aslihan Kartci, Ing. Eva Klejmová, Ing. Martin Kokolia, Ing. Martin Kotol, Ing. Jan Král, Ing. Daniel Kresta, Ing. David Krutílek, Ing. Jan Kufa, Ing. Lukáš Langhammer, Ing. Tobiáš Malach, Ing. Martin Marek, Ing. Michal Mrnka, Ing. Lenka Nagyová, Ing. Marek Novák, Ing. Martin Pospíšil, Ing. Stanislav Rozum, Ing. Petr Sedláček,

Ing. Jan Špůrek, Ing. Petr Vašina, Ing. Jan Vélím, Ing. Josef Vychodil, Ing. Dominika Warmowska, Ing. Ondřej Zach

### Administrative and Technical Staff

Ing. Josef Báňa, Ing. Philip Bělohávek, Bohuslava Raidová, Petra Šípová, Aleš Vanžura, Jaroslav Voráč

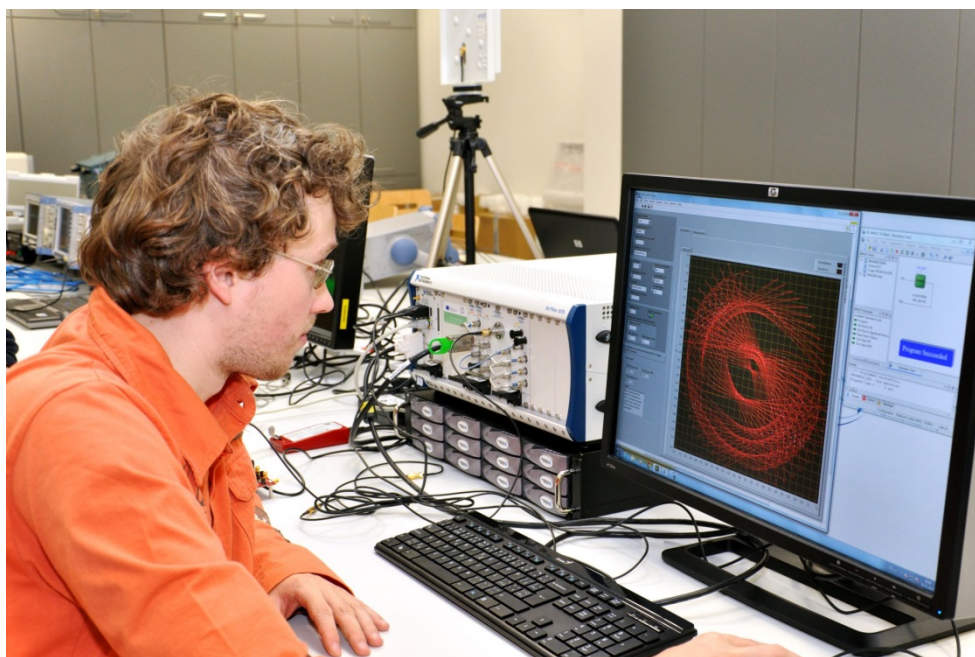
### Main Interests

Research is focused on modern electronic circuits, novel signal processing methods, microwave circuits, antennas and wireless communication. Our areas of interest are mobile, satellite and optical communications, analog and digital systems, microprocessor technology, low-frequency and audio electronics, digital radio and television technology and electromagnetic compatibility (EMC).

Research was financed from 6 projects of Czech Science Foundation (GA ČR) and 8 projects of the Technology Agency of the Czech Republic (TA ČR). The department was involved in 2 projects of Ministry of Industry and Trade (MPO ČR) and 3 internal specific research grants of Brno University of Technology.

The department participated in 4 European projects H2020 and CATRENE EU, 3 projects of international cooperation COST, and cooperated in contracts for leading international partners (Volkswagen, Honeywell, NXP Semiconductors) and nearly 20 direct contracts for Czech companies (Škoda Auto, URC Systems, ERA, CSRS, PBS etc).

We cooperate with many professional organisations and societies. Staff members are engaged in the committee of the Czech and Slovak section of IEEE and Radioengineering Society. There has been active cooperation with the Czech Electrotechnical Society. The department supports activities of Radioclub OK2KOJ and the Student Section of IEEE at Brno University of Technology and is a collective member of the international organisation AMSAT (Radio Amateur Satellite Corporation) and URSI (International Union of Radio Science).



Processing of signals from wireless communication systems

### Major Achievements

The department participates, in cooperation with departments of telecommunications, microelectronics, theoretical and experimental electrical engineering and physics in the regional 'Centre of Applied Research SIX' (Centre of Sensor, Information and Communication Systems). The centre receives institutional support, is involved in a number of national and European projects and employs research workers and Ph.D. students.

Research is centred on radiofrequency systems for transport vehicles (team leader Aleš Prokeš), future generations of mobile communication systems (Roman Maršálek) and applied electromagnetism (Jaroslav Láčík). The teams are involved in several national applied research projects of TAČR, MPO and European Agency CATRENE.

In 2017 the department joined three international activities COST (IC1407 'Advanced Characterisation and Classification of Radiated Emissions in Densely Integrated Technologies' (ACCREDIT), IC1301 'Wireless Power

Transmission for Sustainable Electronics' (WiPE) and IC1305 'Network for Sustainable Ultrascale Computing (NESUS).

The department was involved in national basic and applied research projects, in the European project H2020 'European Integrated Research and Training Network on Convergence of Electronics and Photonics Technologies for Enabling Terahertz Applications' (CELTA) and CATRENE 'Coexistence of RF Transmissions in the Future' (CORTIF).

Research results are immediately incorporated in the curricula of the Bachelor, Master and Ph.D. study area Electronics and Communications.

In 2017 the department was the chief organiser of the international conference 'Microwave and Radio Electronics Week 2017' (MAREW 2017) combining two traditional events - '27th International Conference RADIOELEKTRONIKA 2017' and '18th Conference on Microwave Techniques COMITE 2017'.

For secondary-school students, the department prepared the 'Radio Engineering Workshop' and the second finals of the competition 'Golden Transistor 2017' where student teams compete for the best technical project presentation and prizes from sponsors.

## Major Research Projects

### **Convergence of Electronics and Photonics Technologies for Enabling Terahertz Applications (CELTA) – European project H2020-MSCA-ITN-2015 no. 675683**

Investigator: Zbyněk Raida

### **Coexistence of RF Transmissions In the Future (CORTIF) – European project CATRENE no. CA116**

Investigator: Tomáš Kratochvíl

### **Future Transceiver Techniques for the Society in Motion – GA ČR no. GA17-18675S**

Investigators: Markus Rupp (TU Vienna) and Roman Maršálek

### **Mobile Channel Analysis and Modelling in Millimeter Wave Band – GA ČR no. 17-27068S**

Investigators: Christoph Mecklenbräuer (TU Vienna) and Aleš Prokeš

### **Development of an Efficient Climatisation System for Training Jet Aircraft – TA ČR no. TH02010981**

Investigator: Zdeněk Kolka

### **Tools for Synthesis of Aerials and Sensors – TA ČR no. TA04010457**

Investigator: Petr Kadlec

### **Digital Spectrometer of Mixed Fields of Photons and Neutrons– MPO ČR no. FV20453**

Investigator: Michal Kubíček

## Selected Publications

PACHMÁŇ, J.; KUNZEL, M.; KUBÁT, K.; ŠELEŠOVSKÝ, J.; MARŠÁLEK, R.; POSPÍŠIL, M.; KUBÍČEK, M.; PROKEŠ, A. OPTIMEX: Measurement of Detonation Velocity with a Passive Optical Fibre System. Central European Journal of Energetic Materials, 2017, vol. 14, no. 1, p. 233-250. ISSN: 1733-7178.

BIOLEK, Z.; BIOLEK, D.; BIOLKOVÁ, V.; KOLKA, Z.; ASCOLI, A.; TETZLAFF, R. Analysis of memristors with nonlinear memristance versus state maps. International Journal of Circuit Theory and Applications, 2017, vol. 2017, no. 1, p. 1-19. ISSN: 1097-007X.

ŠOTNER, R.; JEŘÁBEK, J.; PROKOP, R.; KLEDROWETZ, V.; POLÁK, J. A CMOS Multiplied Input Differential Difference Amplifier: A New Active Device and Its Applications. Applied Sciences - Basel, 2017, vol. 7, no. 1, p. 1-13. ISSN: 2076-3417.

JEŘÁBEK, J.; ŠOTNER, R.; DVOŘÁK, J.; POLÁK, J.; KUBÁNEK, D.; HERENCŠÁR, N.; KOTON, J. Reconfigurable Fractional-Order Filter with Electronically Controllable Slope of Attenuation, Pole Frequency and Type of Approximation. JOURNAL OF CIRCUITS SYSTEMS AND COMPUTERS, 2017, vol. 26, no. 10, p. 1750157-1 (1750157-21 p.) ISSN: 1793-6454.

BIOLEK, D.; KOLKA, Z.; BIOLKOVÁ, V.; BIOLEK, Z.; POTREBIC, M.; TOSIC, D. Modeling and simulation of large memristive networks. International Journal of Circuit Theory and Applications, 2017, vol. 2017, no. 1, p. 1-16. ISSN: 1097-007X.

PUSKELY, J.; MIKULÁŠEK, T.; LÁČÍK, J.; RAIDA, Z.; ARTHABER, H. SIW-Fed Vivaldi Antenna with Beam Steering Capabilities. Microwave and Optical Technology Letters, 2017, vol. 59, no. 5, p. 1022-1027. ISSN: 0895-2477.

ŠTUMPF, M. A Generalization of the Time-Domain Cooray–Rubinstein Formula. IEEE Transaction on Electromagnetic Compatibility, 2017, vol. 59, no. 5, p. 1-4. ISSN: 0018-9375.

JEŘÁBEK, J.; ŠOTNER, R.; POLÁK, J.; LANGHAMMER, L.; HERENCŠÁR, N.; PROKOP, R.; VRBA, K. Resistorless Single-purpose or Reconfigurable Biquads Utilizing Single Z-Copy Controlled-Gain Voltage Differencing Current Conveyor. JOURNAL OF CIRCUITS SYSTEMS AND COMPUTERS, 2017, vol. 26, no. 3, p. 1-21. ISSN: 1793-6454.

MILOŠ, J.; POLÁK, L.; HANUS, S.; KRATOCHVÍL, T. Wi-Fi Influence on LTE Downlink Data and Control Channel Performance in Shared Frequency Bands. *Radioengineering*, 2017, vol. 26, no. 1, p. 201-210. ISSN: 1210-2512.

VAŠINA, P.; LÁČÍK, J. Circularly polarized rectangular ring-slot antenna with chamfered corners for off-body communication at 5.8 GHz ISM band. *Radioengineering*, 2017, vol. 26, no. 1, p. 85-90. ISSN: 1210-2512.

KORÁB, P.; POMĚNKOVÁ, J. Credit Rationing in Greece During and After the Financial Crisis. *FINANCE A UVER-CZECH JOURNAL OF ECONOMICS AND FINANCE*, 2017, vol. 67, no. 2, p. 119-139. ISSN: 0015-1920.

FOJTLÍN, M.; FIŠER, J.; POKORNÝ, J.; POVALAČ, A.; URBANEC, T.; JÍCHA, M. An Innovative HVAC Control System: Implementation and testing in a vehicular Cabin. *JOURNAL OF THERMAL BIOLOGY*, 2017, vol. 69, no. 2017, p. 1-5. ISSN: 0306-4565.

KLEJMOVÁ, E.; POMĚNKOVÁ, J. Identification of a Time-Varying Curve in Spectrogram. *Radioengineering*, 2017, vol. 26, no. 1, p. 291-298. ISSN: 1210-2512.

ŠTUMPF, M. Modeling of Electromagnetic Fields in Parallel-Plane Structures: A Unified Contour-Integral Approach. *Radioengineering*, 2017, vol. 26, no. 1, p. 1-9. ISSN: 1210-2512.

KADLEC, P.; ŠEDĚNKA, V. Particle Swarm Optimization for Problems with Variable Number of Dimensions. *ENGINEERING OPTIMIZATION*, 2017, vol. 49, no. 4, p. 1-18. ISSN: 0305-215X.

ŠOTNER, R.; HERENCŠÁR, N.; JEŘÁBEK, J.; KARTCI, A.; KOTON, J.; DOSTÁL, T. Pseudo-Differential Filter Design Using Novel Adjustable Floating Inductance Simulator with Electronically Controllable Current Conveyors. *Elektronika Ir Elektrotechnika*, 2017, vol. 23, no. 2, p. 31-35. ISSN: 1392-1215.

CARVALHO, N.; RAIDA, Z. Europe and the future for WPT. *IEEE MICROWAVE MAGAZINE*, 2017, vol. 18, no. 4, p. 56-88. ISSN: 1527-3342.

DOBESCH, A.; ALVES, L.; WILFERT, O.; RIBEIRO, C. Optical Digital to Analog Conversion Performance Analysis for Indoor Set-up Conditions. *Optics Communications*, 2017, no. 400C, p. 115-122. ISSN: 0030-4018.

TUNTRAKOOL, S.; KUMNGERN, M.; ŠOTNER, R.; HERENCŠÁR, N.; SUWANJAN, P.; JAIKLA, W. High input impedance voltage-mode universal filter and its modification as quadrature oscillator using VDDAs. *INDIAN JOURNAL OF PURE & APPLIED PHYSICS*, 2017, vol. 55, no. 5, p. 324-332. ISSN: 0019-5596.

DOBESCH, A.; FIGUEIREDO, M.; ALVES, L.; WILFERT, O. Performance analysis of 8-bit ODACs for VLC applications. *Radioengineering*, 2017, vol. 2017, no. 2, p. 418-422. ISSN: 1210-2512.

ŠOTNER, R.; JEŘÁBEK, J.; PETRŽELA, J.; DOMANSKÝ, O.; TSIRIMOKOU, G.; PSYCHALINOS, C. Synthesis and design of constant phase elements based on the multiplication of electronically controllable bilinear immittances in practice. *AEU - International Journal of Electronics and Communications*, 2017, vol. 78, no. 8/2017, p. 98-113. ISSN: 1434-8411.

LANGHAMMER, L.; DVOŘÁK, J.; ŠOTNER, R.; JEŘÁBEK, J. Electronically Tunable Fully-Differential Fractional-Order Low-Pass Filter. *Elektronika Ir Elektrotechnika*, 2017, vol. 23, no. 3, p. 47-54. ISSN: 1392-1215.

ŠTUMPF, M. Coupling of Impulsive EM Plane-Wave Fields to Narrow Conductive Strips: An Analysis Based on the Concept of External Impedance. *IEEE Transaction on Electromagnetic Compatibility*, 2017, vol. 60, no. 2, p. 548-551. ISSN: 0018-9375.

ŠOTNER, R.; HERENCŠÁR, N.; JEŘÁBEK, J.; LANGHAMMER, L.; POLÁK, J. On practical construction of electronically controllable compact current amplifier based on commercially available elements and its application. *AEU - International Journal of Electronics and Communications*, 2017, vol. 81, no. 11/2017, p. 56-66. ISSN: 1434-8411.

KOLÁŘOVÁ, E.; BRANČÍK, L. Confidence intervals for RLCG cell influenced by coloured noise. *COMPEL The international journal for computation and mathematics in electrical and electronic engineering*, 2017, vol. 36, no. 4, p. 838-849. ISSN: 0332-1649.

ŠEVČÍK, B.; BRANČÍK, L.; KUBÍČEK, M. Optimized Signaling Method for High-Speed Transmission Channels with Higher Order Transfer Function. *Measurement Science Review*, 2017, vol. 17, no. 4, p. 178-186. ISSN: 1335-8871.

ŠENK, J.; LÁZNIČKOVÁ, I.; JAKUBOVÁ, I. Calculation of Arc Power Losses in the Simplified Model of Intensively Blasted Electric Arc. *Plasma Physics and Technology*, 2017, vol. 4, no. 1, p. 40-43. ISSN: 2336-2626.

BIOLEK, D.; BIOLKOVÁ, V.; KOLKA, Z.; VÁVRA, J. Synthesis of Memristive Systems. *Journal of Telecommunication, Electronic and Computer Engineering*, 2017, vol. 9, no. 2-7, p. 171-175. ISSN: 2180-1843.

PENG, L.; BLUMENSTEIN, J.; STEFAN PEROVIC, N.; DI RENZO, M.; SPRINGER, A. Performance of Generalized Spatial Modulation MIMO over Measured 60GHz Indoor Channels. *IEEE TRANSACTIONS ON COMMUNICATIONS*, 2017, vol. PP, no. 99, p. 1-16. ISSN: 0090-6778.

PETRŽELA, J.; GÖTTTHANS, T. New chaotic dynamical system with a conic-shaped equilibrium located on the plane structure. *Applied Sciences - Basel*, 2017, vol. 7, no. 10, p. 976-988. ISSN: 2076-3417.

ŠTUMPF, M.; DE HOOP, A. Loop-to-Loop Pulsed Electromagnetic Signal Transfer Across a Thin Metal Screen With Drude-Type Dispersive Behavior. *IEEE Transaction on Electromagnetic Compatibility*, 2017, vol. 60, no. 4, p. 1-5. ISSN: 0018-9375.

ŠPŮREK, J.; RAIDA, Z.; LÁČÍK, J.; MIKULÁŠEK, T.; VÉLIM, J.; PRÁŠEK, J. Circular Slot Antenna Array Printed on 3D Textile Substrate. *Elektrorevue - Internetový časopis* (<http://www.elektrorevue.cz>), 2017, vol. 19, no. 5, p. 141-144. ISSN: 1213-1539.

KOKOLIA, M.; LÁČÍK, J.; RAIDA, Z. Sklizení RF energie v pásmech GSM a WiFi. *Elektrorevue - Internetový časopis* (<http://www.elektrorevue.cz>), 2017, roč. 19, č. 5, s. 1-6. ISSN: 1213-1539.

FIGUEIREDO, M.; RIBEIRO, C.; DOBESCH, A.; ALVES, L.; WILFERT, O. Consumer LED lamp with ODAC technology for high-speed Visible Light Communications. *IEEE TRANSACTIONS ON CONSUMER ELECTRONICS*, 2017, vol. 63, no. 3, p. 285-290. ISSN: 0098-3063.

PETRŽELA, J.; GÖTTTHANS, T.; GUZAN, M. Current-mode network structures dedicated for simulation of dynamical systems with plane continuum of equilibrium. *JOURNAL OF CIRCUITS SYSTEMS AND COMPUTERS*, 2017, vol. 27, no. 9, p. 1-39. ISSN: 0218-1266.

## Bachelor's Courses

Analog Electronic Circuits

(prof. Ing. Lubomír Brančík, CSc.)

Electromagnetic Compatibility

(Ing. Jiří Dřínovský, Ph.D.)

EM Waves, Antennas and Lines

(prof. Dr. Ing. Zbyněk Raida)

Electronic Practice

(Ing. Ivana Jakubová)

Pulse and Digital Techniques

(doc. Ing. Tomáš Frýza, Ph.D.)

Communication Systems

(prof. Ing. Aleš Prokeš, Ph.D.)

Microprocessor Techniques and Embedded Systems

(doc. Ing. Tomáš Frýza, Ph.D.)

Microwave Techniques

(doc. Ing. Jaroslav Láčík, Ph.D.)

Modern Wireless Communication

(doc. RNDr. Jitka Poměnková, Ph.D.)

Power Supply Systems

(Ing. Michal Kubíček, Ph.D.)

Analog Filter Design

(doc. Ing. Jiří Petržela, Ph.D.)

Low-frequency and Audio Electronics

(prof. Ing. Tomáš Kratochvíl, Ph.D.)

Computers and Programming 1

(doc. Ing. Jiří Šebesta, Ph.D.)

Computers and Programming 2

(doc. Ing. Jiří Šebesta, Ph.D.)

CAD of Electronic Circuits

(prof. Dr. Ing. Zdeněk Kolka)

CAD in Communication Subsystems

(Ing. Petr Kadlec, Ph.D.)

Radio and Mobile Communication

(prof. Ing. Stanislav Hanus, CSc.)

Radio Receivers and Transmitters

(prof. Ing. Aleš Prokeš, Ph.D.)

Signals and Systems

(prof. Ing. Milan Sigmund, CSc.)

High Frequency Techniques

(Ing. Tomáš Urbanec, Ph.D.)

Optical Communication Fundamentals and Optoelectronics

(Ing. Lucie Hudcová, Ph.D.)

Fundamentals of TV Technology

(prof. Ing. Stanislav Hanus, CSc.)

## Master's Courses

Advanced radio communication systems

(doc. RNDr. Jitka Poměnková, Ph.D.)

Analysis of Radiocommunication Signals

(doc. RNDr. Jitka Poměnková, Ph.D.)

CAD in Microwaves

(prof. Dr. Ing. Zbyněk Raida)

Digital Television and Radio Systems

(prof. Ing. Tomáš Kratochvíl, Ph.D.)

Quantum and Laser Electronics

(Ing. Lucie Hudcová, Ph.D.)

Microcontrollers for Advanced Applications

(Ing. Aleš Povalač, Ph.D.)

Design of Antennas and Radio Links

(doc. Ing. Jaroslav Láčík, Ph.D.)

Computer and Communication Networks

(prof. Dr. Ing. Zdeněk Kolka)

Microprocessors with ARM Architecture

(Ing. Aleš Povalač, Ph.D.)

Programmable Logic Devices

(Ing. Michal Kubíček, Ph.D.)

Radiofrequency Identification

(Dr. Techn. Vojtěch Derbek)

Radioelectronic Measurement

(Ing. Jiří Dřínovský, Ph.D.)

Radars and Navigation Systems

(doc. Ing. Jiří Šebesta, Ph.D.)

Radio Relay and Satellite Communication

(Ing. Filip Záplata, Ph.D.)

Implementation of Software Communication Systems

(prof. Ing. Roman Maršálek, Ph.D.)

Mobile Communication Systems

(doc. Ing. Martin Slanina, Ph.D.)

Theory of Electronic Circuits  
(doc. Ing. Jiří Petržela, Ph.D.)  
Wireless Communication Theory  
(prof. Ing. Roman Maršálek, Ph.D.)

Video and Multimedia Technology  
(doc. Ing. Martin Slanina, Ph.D.)

## Ph.D. Courses

Modern Digital Wireless Communication  
(prof. Ing. Milan Sigmund, CSc.)

Modern Electronic Circuit Design  
(prof. Dr. Ing. Zdeněk Kolka)

## Laboratories

**Laboratory of Analog Electronic Circuits** (instruction in analog electronics, Ivana Jakubová, Lubomír Brančík, Jiří Petržela, Roman Šotner)

**Laboratory of Electromagnetic Compatibility EMC** (research and instruction in EMC and pre-certifying tests of interference and resistance according to European norms, Jiří Dřínovský)

**Laboratory of Low-Frequency Applications** (research and instruction in audio technology, low-frequency electronics and power supply systems for electronic devices, Tomáš Kratochvíl, Michal Kubíček)

**Laboratory of Signals and Digital Technology** (research and instruction in signals and digital technology, Viera Biolková, Milan Sigmund, Tomáš Frýza)

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

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

**Laboratory of Optoelectronics and Photonics** (research and instruction in optoelectronics, photonics and optical communications, Otakar Wilfert, Lucie Hudcová, Peter Barčík)

**Laboratory of TV and Video Technology** (research and instruction in digital TV and video technology, Martin Slanina, Ladislav Polák)

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

**Laboratory of Mobile Communications** (research and instruction in mobile wireless communication, Stanislav Hanus, Martin Slanina, Jiří Miloš)

**Laboratory of Antennas and Electromagnetic Field** (research and instruction in EM fields, antennas and design of radio links, Jaroslav Láčík, Tomáš Mikulášek)

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

**Laboratory for Student Research** (student projects, theses, self-study, Jiří Šebesta)

**Electronic Technology Laboratory** (dry and wet techniques for printed circuit boards, photographic production of patterns, Aleš Vančura, Jaroslav Voráč)

**Computer Laboratories** (two laboratories for computer-aided exercises in circuits, signals and systems, special areas of radioelectronics and communication technology, Josef Báža)

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

**Research Laboratory of Numerical Methods** (applied electromagnetism and electromagnetic field modelling, Zbyněk Rada, Petr Kadlec)

**Research Laboratory of Optical Communications** (research in measurement, testing and design of light-transmitting and atmospheric optical connectors, Otakar Wilfert, Lucie Hudcová, Peter Barčík)

**Research Laboratory of Signal Processing** (digital radio communication and methods for digital signal processing, Roman Maršálek)



# Department of Telecommunications

## Prof. Ing. Jiří Mišurec, CSc.

Head

Technická 3082/12  
616 00 Brno  
Tel.: 541 146 990  
e-mail: [utko@feec.vutbr.cz](mailto:utko@feec.vutbr.cz)



## Professors

Prof. Ing. Miloslav Filka, CSc.  
Prof. Ing. Jiří Mišurec, CSc.  
Prof. Ing. Zdeněk Smékal, CSc.  
Prof. Ing. Kamil Vrba, CSc.

## Associate Professors

Doc. Ing. Karel Burda, CSc.  
Doc. Ing. Radim Burget, Ph.D.  
Doc. Ing. Petr Číka, Ph.D.  
Doc. Ing. Jan Hajný, Ph.D.  
Doc. Ing. Norbert Herencsar, Ph.D.  
Doc. Ing. Jiří Hošek, Ph.D.  
Doc. Ing. Jan Jeřábek, Ph.D.  
Doc. Ing. Dan Komosný, Ph.D.  
Doc. Ing. Jaroslav Koton, Ph.D.  
Doc. Ing. Ivo Lattenberg, Ph.D.  
Doc. Ing. Petr Mlýnek, Ph.D.  
Doc. Ing. Vít Novotný, Ph.D.  
Doc. Mgr. Pavel Rajmic, Ph.D.  
Doc. Ing. Kamil Říha, Ph.D.  
Doc. Ing. Jiří Schimmel, Ph.D.  
Doc. Ing. Petr Sysel, Ph.D.  
Doc. Ing. Vladislav Škorpil, CSc.  
Doc. Ing. Václav Zeman, Ph.D.

## Lecturers

Ing. Miroslav Balík, Ph.D., Ing. Radim Číž, Ph.D., Mgr. Radka Koton, Ing. Pavel Hanák, Ph.D., Ing. Ondřej Krajsa, Ph.D., Ing. David Kubánek, Ph.D., Ing. Anna Kubánková, Ph.D., Ing. Lukáš Langhammer, Ph.D., Ing. Lukáš Malina, Ph.D., Ing. Zdeněk Martinásek, Ph.D., Ing. Jiří Mekyska, Ph.D., Ing. Jiří Přinosil, Ph.D., Ing. Pavel Šilhavý, Ph.D.

## Research Workers, Technical and Administrative Staff

Ing. Vlastimil Člupek, Ing. Jakub Frolka, Ing. Tomáš Horváth, Ing. Dominik Kováč, Ing. David Kurc, Magda Lounková, Hana Lukešová, Ing. Lukáš Malina, Ph.D., Ing. Jan Mašek, Ing. Pavel Mašek, Ing. Jiří Mekyska, Ph.D., Ing. Ľubomír Mráz, Ing. Petr Münster, Ph.D., Ing. Bohumil Novotný, Lukáš Pazdera, Robert Pernica, Jitka Šichová, Ing. Václav Uher, Ph.D., Ing. Vlastimil Člupek, Ph.D., Ing. Kateřina Zehlová

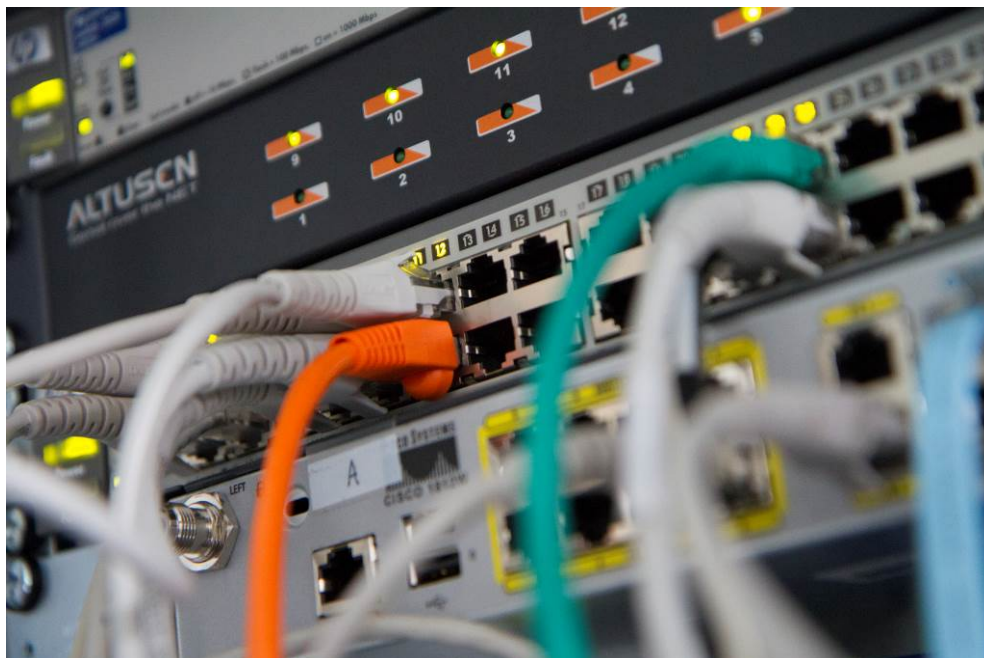
## Ph.D. Students

Ing. Petr Blažek, Ing. Rastislav Červeňák, Ing. Milan Čučka, Ing. Marie Mangová, Ing. Jan Dorazil, Ing. Petr Dzurenda, Ing. Jakub Frolka, Ing. Radek Fujdiak, Ing. Zoltán Galáž, Ing. Tomáš Gerlich, Ing. Pavol Harár, Ing. Tomáš Horváth, Ing. Petr Ilgner, Ing. Tomáš Kiska, Ing. Lukáš Kočí, Ing. Martin Kenyeres, Ing. Dominik Kováč, Ing. Martin Kolařík, Ing. Jan Krejčí, Ing. Petr Ležák, Ing. Tomáš Lieskovan, Ing. Zdeněk Mžourek, Ing. Pavel Mašek, Ing. Jan Mašek, Ing. Michaela Novosadová, Ing. Bohumil Novotný, Ing. Adam Olejář, Ing. Václav Oujezský, Ing. Ondřej Pavelka, Ing. Lukáš Povoda, Ing. Josef Polák, Ing. Marek Sikora, Ing. David Smékal, Ing. Pavel Šeda, Ing. Pavel Závíška, Ing. David Troják, Ing. František Urban, Ing. Lukáš Vlček, Ing. Kryštof Zeman, Ing. Vojtěch Burian, Ing. Jan Dvořák, Ing. David Grenar, Ing. Pavol Il'ko, Ing. Petr Kříž, Ing. Ján Mucha, Ing. Jiří Pokorný, Ing. Zuzana Polešáková, Ing. Martin Rajnoha, Ing. Ján Sláčik, Ing. Ondřej Sládok, Ing. Vojtěch Zvončák, Ing. Martin Štůsek

## Main Interests

The department has been developing the Bachelor study programme 'Teleinformatics' and Master programme 'Telecommunications and Information Technology'. We seek balance in education in all areas of communications, students are trained in all computing systems, computer networks, learn to develop network applications in various programming languages. They are instructed in the design of analog and digital circuits, microprocessors and signal processors and their applications. The students can specialise in multimedia informatics i.e. digital speech, music and image processing. There is a follow-up Ph.D. programme 'Teleinformatics'.

Another Bachelor study programme is 'Audio Engineering'. The programme has been provided in cooperation with Janáček Academy of Music and Performing Arts, Faculty of Music. The programme provides interdisciplinary Bachelor education in audio engineering and is focused on training of audio engineers with technical and artistic approach to the latest audio technology, audio signal processing, musical production and studio practice. The Master programme was accredited in 2015 when instruction in the study programme 'Information Safety' (IBEP) was launched. This interdisciplinary programme is focused on internet and network protection information and communication safety (ICT). The students learn how to configurate and maintain extensive computer infrastructures and test computer security by ethical hacking. The study programme offers interesting and attractive subjects in cryptography of programming or network operating systems, and also software law and economic aspects connected with safety issues. This interdisciplinary programme is provided in cooperation with Faculty of Law, Masaryk University in Brno and Faculty of Management, Brno University of Technology. The scope of training prepares students not only for technical positions, but also commercial or management positions and consultancy.



The department has its own LTE technology

## Main Interests

The department has been successful in obtaining funds from various education and research projects. In 2017 research and development teams conducted basic and applied research projects of 50 million CZK. A research

team has been engaged in providing up-to-date multimedia services via mobile and wireless networks. The department was involved in research and development for industry in the frame of MPO, TAČR, GAČR and Ministry of the Interior projects. We continued cooperation with GiTy a.s., Webnode s.r.o., 2N Telekomunikace, MegA, a.s. - Měřicí Energetické aparáty, TTC telekomunikace. We dealt with commercial projects for T-Mobile, Honeywell, Telekom Austria, E.ON Česká republika. The department's staff members are involved in operation of the regional centre SIX – 'Centre of Sensor, Information and Communication Systems'.

## Major Achievements

The main research interests of the department are converged information and communication systems focused on multimedia informatics, electronic systems for medical technology. In 2017 the department achieved very good results in:

Solution of cryptographic protection of communication and information systems of data networks, security of electronic archives.

Design and implementation of algorithms for digital processing of speech and music signals for telecommunication and multimedia applications, embedded systems for acoustic signal processing, and software for these systems.

Development of electronic devices for medical data transmission and processing, design and implementation of algorithms for processing and analysis of biomedical signals (NMR and CT tomography and ultrasound) and 3D modelling of parts of human body for diagnostics and surgery.

Research and development of telemetric systems, remote data collection systems, systems for wireless sensor networks, networks for industrial data collection and control (smart grids of power plants, waterworks, transportation, etc.).

Design and optimisation of algorithms for digital signal processing (digital filters, signal detection, spectral analysis, etc.), implementation of algorithms in signal processors and microcontrollers.

Research and design of systems of speech and image processing, security of multimedia systems archives, evaluation of emotions in speech and mimics via genetic programming.

Research and development of an intelligent system for power grid control and identification of threats in power grid infrastructure.

## Major Research Projects

### **Research of Cryptographic Primitives for Secure Authentication and Protection of Digital Identity – GAČR GP14-25298P**

Investigator: Jan Hajný

### **Research and Development of a Technology for Detection of Emotions in Unstructured Data – MPO FR-TI4/151**

Investigator: Zdeněk Smékal

### **Localisation and Classification of Vibrations Using an Optical Fiber Sensor over Large Distances – MPO FR-TI4/696**

Investigator: Vít Novotný

### **Detection of Safety Threats on Active Elements of Critical Infrastructures – VI2VS/428**

Investigator: Petr Münster

### **Systems Synthesis and Analysis – GA16-06175S**

Investigator: Jaroslav Koton

### **Active Elements with Differential Gates for Design of Original Non-Differential and Pseudo-Differential Function Blocks – GJ16-11460Y**

Investigator: Norbert Herencsár

### **Perfusion MR Imaging by Scan Compression – GA16-13830S**

Investigator: Pavel Rajmic

## Selected Publications

GERLICH, T.; BLAŽEK, P. Srovnání systémů Suricata a Snort pro detekci útoků cílených na odepření služeb. *Elektrorevue - Internetový časopis* (<http://www.elektrorevue.cz>), 2017, roč. 19, č. 6, s. 188-194. ISSN: 1213-1539.

RAJMIC, P.; NOVOSADOVÁ, M.; DAŇKOVÁ, M. Piecewise-polynomial Signal Segmentation Using Convex Optimization. *Kybernetika*, 2017, vol. 53, no. 6, p. 1131-1149. ISSN: 0023-5954.

ŠEDA, P.; MAŠEK, P.; HOŠEK, J. Autentizace IoT zařízení protokolem OAuth2 nebo HTTP(S) pro ukládání Big Data přes REST API. *Elektrorevue - Internetový časopis* (<http://www.elektrorevue.cz>), 2017, roč. 20, č. 4, s. 1-7. ISSN: 1213-1539.

- KENYERES, M.; KENYERES, J. Comparative Study of Distributed Estimation Precision by Average Consensus Weight Models. *Journal of Communications Software and Systems*, 2017, vol. 13, no. 4, p. 165-177. ISSN: 1845-6421.
- SLÁDOK, O.; KOTON, J.; HERENCŠÁR, N. Universal Pseudo-Differential Filter Using DDCC and DVCCs. *Elektronika Ir Elektrotechnika*, 2017, vol. 23, no. 6, p. 46-52. ISSN: 1392-1215.
- KOMOSNÝ, D.; MEHIC, M.; VOŽŇÁK, M. Macroscopic Geographical Speed of Data Transmission in European Internet. *Information Technology and Control*, 2017, vol. 46, no. 4, p. 521-529. ISSN: 1392-124X.
- GOMEZ-VILDA, P.; MEKYSKA, J.; GÓMEZ-RODELLAR, A.; PALACIOS-ALONSO, D.; RODELLAR BIARGE, M.; ÁLVAREZ-MARQUINA, A. Monitoring Parkinson Disease from speech articulation kinematics. *Loquens*, 2017, vol. 4, no. 1, p. 1-12. ISSN: 2386-2637.
- KENYERES, M.; KENYERES, J. Influence of random leader appointment on convergence rate of network size estimation. *UPB Scientific Bulletin, Series C: Electrical Engineering*, 2017, vol. 79, no. 4, p. 57-68. ISSN: 1454-234X.
- POŘÍZKA, P.; KLUS, J.; MAŠEK, J.; RAJNOHA, M.; PROCHAZKA, D.; MODLITBOVÁ, P.; NOVOTNÝ, J.; BURGET, R.; NOVOTNÝ, K.; KAISER, J. Multivariate classification of echellograms: a new perspective in Laser-Induced Breakdown Spectroscopy analysis. *Scientific Reports*, 2017, vol. 7, no. 3160, p. 1-12. ISSN: 2045-2322.
- BENEŠ, V.; NEUWIRT, K.; DOSTÁL, O. Identification Systems and Their Legitimacy in the New Legislation on the Protection of Personal Data. *International Journal of Advances in Telecommunications, Electrotechnics, Signals and Systems*, 2017, vol. 6, no. 3, p. 116-119. ISSN: 1805-5443.
- HORVÁTH, T.; MÜNSTER, P.; VOJTĚCH, J.; VELC, R.; OUJEZSKÝ, V. Simultaneous transmission of accurate time, stable frequency, data, and sensor system over one fiber with ITU 100?GHz grid. *Optical Fiber Technology*, 2017, vol. 40, no. 1, p. 139-143. ISSN: 1068-5200.
- HOŠEK, J.; MAŠEK, P.; ANDREEV, S.; GALININA, O.; OMETOV, A.; KRÖPFL, F.; WIEDERMANN, W.; KOUCHERYAVY, Y. A SyMPHOnY of Integrated IoT Businesses: Closing the Gap between Availability and Adoption. *IEEE COMMUNICATIONS MAGAZINE*, 2017, vol. 56, no. 12, p. 1-9. ISSN: 0163-6804.
- KOMOSNÝ, D.; BULÍN, M.; ILGNER, P. Internet Geography and Real Estate Market. *IEEE Access*, 2017, vol. 5, no. 1, p. 25750-25758. ISSN: 2169-3536.
- HORVÁTH, T.; MÜNSTER, P.; VOJTĚCH, J.; HAVLIŠ, O.; GALLO, M. Transmission Convergence Layer of NG-PON2 in VPIphotonics Tool. *Journal of Communications Software and Systems*, 2017, vol. 13, no. 3, p. 101-107. ISSN: 1845-6421.
- SMĚKAL, Z.; FANČAL, P. K čemu se dají použít spektra vyšších řádů?. *Sdělovací technika*, 2017, roč. 2017, č. 11, s. 26-30. ISSN: 0036-9942.
- BLAŽEK, P.; SMĚKAL, D.; MARTINÁSEK, Z. Porovnání technik směrování paketů pro adaptivní filtrační systém DDoS útoků. *Elektrorevue - Internetový časopis (<http://www.elektrorevue.cz>)*, 2017, roč. 19, č. 5, s. 1-8. ISSN: 1213-1539.
- ČERVENÁK, R. Bezpečnosť používania vysielateľov iBeacon. *Elektrorevue - Internetový časopis (<http://www.elektrorevue.cz>)*, 2017, roč. 20, č. 2, s. 1-5. ISSN: 1213-1539.
- FUJDIÁK, R.; DZURENDA, P.; MLÝNEK, P.; MIŠUREC, J.; ORGOŇ, M.; BEZZATEEV, S. Anomalous Behaviour of Cryptographic Elliptic Curves over Finite Field. *Elektronika Ir Elektrotechnika*, 2017, vol. 23, no. 5, p. 82-88. ISSN: 1392-1215.
- PANG, S.; KOMOSNÝ, D.; ZHU, L.; ZHANG, R.; SARRAFZADEH, A.; BAN, T.; INOUE, D. Malicious Events Grouping via Behavior Based Darknet Traffic Flow Analysis. *WIRELESS PERSONAL COMMUNICATIONS*, 2017, vol. 96, no. 4, p. 5335-5353. ISSN: 0929-6212.
- ALONSO-MARTINEZ, C.; FAÚNDEZ ZANUY, M.; MEKYSKA, J. A Comparative Study of In-Air Trajectories at Short and Long Distances in Online Handwriting. *Cognitive Computation*, 2017, vol. 9, no. 5, p. 712-720. ISSN: 1866-9956.
- LOPEZ-DE-IPINA, K.; CALVO, P.; FAÚNDEZ ZANUY, M.; CLAVÉ, P.; NASCIMENTO, W.; MARTINEZ DE LIZARDUY, U.; DANIEL, A.; VIRIDIANA, A.; ORTEGA, O.; MEKYSKA, J.; SANZ-CARTAGENA, M. Automatic voice analysis for dysphagia detection. *Speech, Language and Hearing*, 2017, vol. 1, no. 1, p. 1-4. ISSN: 2050-5728.
- KOMOSNÝ, D.; VOŽŇÁK, M.; REHMAN, S. Location Accuracy of Commercial IP Address Geolocation Databases. *Information Technology and Control*, 2017, vol. 46, no. 3, p. 333-344. ISSN: 1392-124X.
- POLEŠÁKOVÁ, Z.; JEŘÁBEK, J. Možnosti inovace struktury CMOS Miller OTA s využitím Teorie řešení inovačních zadání (TRIZ). *Elektrorevue - Internetový časopis (<http://www.elektrorevue.cz>)*, 2017, roč. 18, č. 10, s. 1-7. ISSN: 1213-1539.
- SIKORA, M.; BLAŽEK, P. Systém prevence průniku Slow HTTP DoS a DDoS útoků. *Elektrorevue - Internetový časopis (<http://www.elektrorevue.cz>)*, 2017, roč. 19, č. 4, s. 1-8. ISSN: 1213-1539.
- GALÁŽ, Z.; ZVONČÁK, V.; KISKA, T.; MUCHA, J.; SMĚKAL, Z. Objektivní hodnocení poruch chůze na základě akustické analýzy četby dlouhého textu u pacientů s idiopatickou Parkinsonovou nemocí. *Elektrorevue - Internetový časopis (<http://www.elektrorevue.cz>)*, 2017, roč. 19, č. 4, s. 1-7. ISSN: 1213-1539.

GOMEZ-VILDA, P.; MEKYSKA, J.; MANUEL FERRANDEZ, J.; PALACIOS-ALONSO, D.; GÓMEZ-RODELLAR, A.; RODELLAR BIARGE, M.; GALÁŽ, Z.; SMÉKAL, Z.; ELIÁŠOVÁ, I.; KOŠŤALOVÁ, M.; REKTOROVÁ, I. Parkinson Disease Detection from Speech Articulation Neuromechanics. *Frontiers in Neuroinformatics*, 2017, vol. 11, no. 56, p. 1-17. ISSN: 1662-5196.

MEHIC, M.; MAUHART, O.; RASS, S.; KOMOSNÝ, D.; ŘEZÁČ, F.; VOZŇÁK, M. Analysis of the Public Channel of Quantum Key Distribution Link. *IEEE JOURNAL OF QUANTUM ELECTRONICS*, 2017, vol. 53, no. 5, p. 1-8. ISSN: 0018-9197.

VYAS, G.; DUTTA, M.; PŘINOSIL, J. Improving the computational complexity and word recognition rate for dysarthria speech using robust frame selection algorithm. *International Journal of Signal and Imaging Systems Engineering*, 2017, vol. 10, no. 3, p. 136-145. ISSN: 1748-0698.

ŠOTNER, R.; HERENCŠÁR, N.; JEŘÁBEK, J.; LANGHAMMER, L.; POLÁK, J. On practical construction of electronically controllable compact current amplifier based on commercially available elements and its application. *AEU - International Journal of Electronics and Communications*, 2017, vol. 81, no. 11/2017, p. 56-66. ISSN: 1434-8411.

OUJEZSKÝ, V.; HORVÁTH, T. Traffic Analysis Using NetFlow and Python. *Informatyka, Automatyka, Pomíary w Gospodarce i Ochronie Środowiska*, 2017, no. 2, p. 5-7. ISSN: 2083-0157.

KENYERES, M.; KENYERES, J.; ŠKORPIL, V.; BURGET, R. Distributed Aggregate Function Estimation by Biphasically Configured Metropolis-Hasting Weight Model. *Radioengineering*, 2017, vol. 26, no. 2, p. 479-495. ISSN: 1210-2512.

KINTR L. Bezpečnostní opatření podle zákona o kybernetické bezpečnosti - 2. část - technická opatření. *Interní auditor*, 2017, roč. 21, č. 2, s. 30-34. ISSN: 1213-8274.

KHATEB, F.; JAIKLA, W.; KULEJ, T.; KUMNGERN, M.; KUBÁNEK, D. Shadow filters based on DDCC. *IET Circuits, Devices and Systems*, 2017, vol. 2017 (11), no. 6, IF: 1.092, p. 631-637. ISSN: 1751-858X.

LANGHAMMER, L.; DVOŘÁK, J.; ŠOTNER, R.; JEŘÁBEK, J. Electronically Tunable Fully-Differential Fractional-Order Low-Pass Filter. *Elektronika Ir Elektrotechnika*, 2017, vol. 23, no. 3, p. 47-54. ISSN: 1392-1215.

ŠOTNER, R.; JEŘÁBEK, J.; PETRŽELA, J.; DOMANSKÝ, O.; TSIRIMOKOU, G.; PSYCHALINOS, C. Synthesis and design of constant phase elements based on the multiplication of electronically controllable bilinear immittances in practice. *AEU - International Journal of Electronics and Communications*, 2017, vol. 78, no. 8/2017, p. 98-113. ISSN: 1434-8411.

KOMOSNÝ, D.; PANG, S.; MEHIC, M.; VOZŇÁK, M. Evaluation of Device-Independent Internet Spatial Location. *ISPRS International Journal of Geo-Information*, 2017, vol. 6, no. 6, p. 1-17. ISSN: 2220-9964.

TUNTRAKOOL, S.; KUMNGERN, M.; ŠOTNER, R.; HERENCŠÁR, N.; SUWANJAN, P.; JAIKLA, W. High input impedance voltage-mode universal filter and its modification as quadrature oscillator using VDDAs. *INDIAN JOURNAL OF PURE & APPLIED PHYSICS*, 2017, vol. 55, no. 5, p. 324-332. ISSN: 0019-5596.

GALÁŽ, Z.; KISKA, T.; ZVONČÁK, V.; MUCHA, J.; SMÉKAL, Z. Assessing Parkinson's disease using prosodic analysis of neutral, stress-modified and rhymed speech. *Elektrorevue - Internetový časopis (<http://www.elektrorevue.cz>)*, 2017, vol. 19, no. 2, p. 57-66. ISSN: 1213-1539.

MUCHA, J.; GALÁŽ, Z.; SMÉKAL, Z. Detekcia Parkinsonovej choroby pomocou akustickej analýzy prednesu básne. *Elektrorevue - Internetový časopis (<http://www.elektrorevue.cz>)*, 2017, roč. 19, č. 2, s. 1-7. ISSN: 1213-1539.

FROLKA, J.; HAJNÝ, J.; SMÉKAL, D. Generátor kybernetických útoků. *Elektrorevue - Internetový časopis (<http://www.elektrorevue.cz>)*, 2017, roč. 19, č. 2, s. 53-57. ISSN: 1213-1539.

KUBÁNEK, D.; FREEBORN, T. (1+?) Fractional-order transfer functions to approximate low-pass magnitude responses with arbitrary quality factor. *AEU - International Journal of Electronics and Communications*, 2017, vol. 2017 (78), no. , IF: 0.786, p. 1-10. ISSN: 1434-8411.

KOTON, J.; KUBÁNEK, D.; SLÁDOK, O.; VRBA, K.; SHADRIN, A.; USHAKOV, P. Fractional-Order Low- and High-Pass Filters Using UVCs. *JOURNAL OF CIRCUITS SYSTEMS AND COMPUTERS*, 2017, vol. 26, no. 12, p. 1-22. ISSN: 0218-1266.

ŠOTNER, R.; HERENCŠÁR, N.; JEŘÁBEK, J.; KARTCI, A.; KOTON, J.; DOSTÁL, T. Pseudo-Differential Filter Design Using Novel Adjustable Floating Inductance Simulator with Electronically Controllable Current Conveyors. *Elektronika Ir Elektrotechnika*, 2017, vol. 23, no. 2, p. 31-35. ISSN: 1392-1215.

PRŮŠA, Z.; RAJMÍČ, P. Toward High-Quality Real-Time Signal Reconstruction from STFT Magnitude. *IEEE SIGNAL PROCESSING LETTERS*, 2017, vol. 24, no. 6, p. 892-896. ISSN: 1070-9908.

BERTSIAS, P.; KHATEB, F.; KUBÁNEK, D.; KHANDAY, F.; PSYCHALINOS, C. Capacitorless Digitally Programmable Fractional-Order Filters. *AEU - International Journal of Electronics and Communications*, 2017, vol. 2017 (78), no. , IF: 1.147, p. 228-237. ISSN: 1434-8411.

HORVÁTH, T.; OUJEZSKÝ, V.; MÜNSTER, P.; VOJTĚCH, J.; HAVLIŠ, O.; SIKORA, P. Modified GIANT Dynamic Bandwidth Allocation Algorithm of NG-PON. *Journal of Communications Software and Systems*, 2017, vol. 13, no. 1, p. 15-22. ISSN: 1845-6421.

JEŘÁBEK, J.; ŠOTNER, R.; POLÁK, J.; LANGHAMMER, L.; HERENCŠÁR, N.; PROKOP, R.; VRBA, K. Resistorless Single-purpose or Reconfigurable Biquads Utilizing Single Z-Copy Controlled-Gain Voltage Differencing

- Current Conveyor. *JOURNAL OF CIRCUITS SYSTEMS AND COMPUTERS*, 2017, vol. 26, no. 3, p. 1-21. ISSN: 1793-6454.
- KONEČNÝ, M. Novela zákona o kybernetické bezpečnosti - část III. *Data Security Management*, 2017, roč. XX., č. 1/2017, s. 34-37. ISSN: 2336-6745.
- OUJEZSKÝ, V.; HORVÁTH, T.; ŠKORPIL, V. Botnet C&C Traffic and Flow Lifespans Using Survival Analysis. *International Journal of Advances in Telecommunications, Electrotechnics, Signals and Systems*, 2017, vol. 6, no. 1, p. 38-44. ISSN: 1805-5443.
- HERENCŠÁR, N.; KOTON, J.; HANÁK, P. Universal Voltage Conveyor and its Novel Dual-Output Fully-Cascadable VM APF Application. *Applied Sciences - Basel*, 2017, vol. 7, no. 3, p. 1-8. ISSN: 2076-3417.
- JERÁBEK, J.; ŠOTNER, R.; DVOŘÁK, J.; POLÁK, J.; KUBÁNEK, D.; HERENCŠÁR, N.; KOTON, J. Reconfigurable Fractional-Order Filter with Electronically Controllable Slope of Attenuation, Pole Frequency and Type of Approximation. *JOURNAL OF CIRCUITS SYSTEMS AND COMPUTERS*, 2017, vol. 26, no. 10, p. 1750157-1 (1750157-21 p.) ISSN: 1793-6454.
- KOMOSNÝ, D.; MRDOVIC, S.; ILKO, P.; GREJTÁK, M.; POSPÍCHAL, O. Testing Internet applications and services using PlanetLab. *Computer Standards & Interfaces*, 2017, vol. 53, no. 1, p. 33-38. ISSN: 0920-5489.
- BRABENEC, L.; MEKYSKA, J.; GALÁŽ, Z.; REKTOROVÁ, I. Speech disorders in Parkinson's disease: early diagnostics and effects of medication and brain stimulation. *JOURNAL OF NEURAL TRANSMISSION*, 2017, vol. 124, no. 3, p. 303-334. ISSN: 0300-9564.
- ŠTŮSEK, M.; MAŠEK, P. Identifikace webových prohlížečů s využitím metody Web Browser Fingerprinting. *Elektrorevue - Internetový časopis (<http://www.elektrorevue.cz>)*, 2017, roč. 19, č. 1, s. 1-8. ISSN: 1213-1539.
- POKORNÝ, J.; HOŠEK, J. Time Distribution within Industry 4.0 Platform: Controlling Slave Clocks via Master Clock HN50. *Elektrorevue - Internetový časopis (<http://www.elektrorevue.cz>)*, 2017, vol. 19, no. 1, p. 17-24. ISSN: 1213-1539.
- KALASOVÁ, D.; MAŠEK, J.; ZIKMUND, T.; SPURNÝ, P.; HALODA, J.; BURGET, R.; KAISER, J. Segmentation of multi-phase object applying trainable segmentation. *The e-Journal of Nondestructive Testing*, 2017, no. 2017, p. 1-6. ISSN: 1435-4934.
- VOJTĚCH, J.; ŠLAPÁK, M.; ŠKODA, P.; RADIL, J.; HAVLIŠ, O.; ALTMANN, M.; MÜNSTER, P.; VELC, R.; KUNDRÁT, J.; ALTMANNOVÁ, L.; VOHNOUT, R.; HORVÁTH, T.; HŮLA, M.; SMOTLACHA, V.; ČÍŽEK, M.; PRAVDOVÁ, L.; ŘEŘUCHA, Š.; HRABINA, J.; ČÍP, O. Joint accurate time and stable frequency distribution infrastructure sharing fiber footprint with research network. *Optical Engineering*, 2017, vol. 56, no. 2, p. 027101-1 (027101-7 p.) ISSN: 0091-3286.
- HORVÁTH, T.; KRKOŠ, R.; DUBRAVEC, L. Deep Data Analysis in GPON Networks. *Optica Applicata*, 2017, vol. 47, no. 1, p. 26-38. ISSN: 0078-5466.
- ŠOTNER, R.; JERÁBEK, J.; PROKOP, R.; KLEDROWETZ, V.; POLÁK, J. A CMOS Multiplied Input Differential Difference Amplifier: A New Active Device and Its Applications. *Applied Sciences - Basel*, 2017, vol. 7, no. 1, p. 1-13. ISSN: 2076-3417.
- MARTINÁSEK, Z.; IGLESIAS, F.; MALINA, L.; MARTINÁSEK, J. Crucial pitfall of DPA Contest V4.2 Implementation. *Security and Communication Networks (online)*, 2017, vol. 9, no. 18, p. 1-17. ISSN: 1939-0122.

## Bachelor 's Courses in Teleinformatics

Analog Technology

(prof. Ing. Kamil Vrba, CSc.)

Signals and Systems Analysis

(prof. Ing. Zdeněk Smékal, CSc.)

Network Architecture

(doc. Ing. Vít Novotný, Ph.D.)

CISCO Academy I

(doc. Ing. Dan Komosný, Ph.D.)

CISCO Academy II, V

(Ing. Milan Šimek, Ph.D.)

CISCO Academy III

(doc. Ing. Jan Jeřábek, Ph.D.)

CISCO Academy IV

(doc. Ing. Radim Burget, Ph.D.)

Digital Filters

(doc. Ing. Petr Sysel, Ph.D.)

Digital Signal Processing

(prof. Ing. Jiří Mišurec, CSc.)

Data Communication

(Ing. Pavel Šilhavý, Ph.D.)

Electroacoustics

(doc. Ing. Jiří Schimmel, Ph.D.)

Hardware of Computer Networks

(doc. Ing. Jaroslav Koton, Ph.D.)

Communication Technology

(doc. Ing. Jan Jeřábek, Ph.D.)

Design of Electronic Devices

(prof. Ing. Kamil Vrba, CSc.)

Object Oriented Programming

(doc. Ing. Ivo Lattenberg, Ph.D.)

Multimedia Services

(doc. Ing. Petr Číka, Ph.D.)

Computers and Programming 1  
(doc. Ing. Ivo Lattenberg, Ph.D.)  
Computers and Programming 2  
(Ing. Jiří Přinosil, Ph.D.)  
Practical Exercises in Information Networks  
(doc. Ing. Petr Číka, Ph.D.)  
Transmission Media  
(prof. Ing. Miloslav Filka, CSc.)  
Accesses and Transports Networks  
(doc. Ing. Vladislav Škorpil, CSc.)  
Network Operating Systems  
(doc. Ing. Dan Komosný, Ph.D.)

### **Bachelor's Courses in Audio Engineering**

Analog Technology  
(prof. Ing. Kamil Vrba, CSc.)  
Signals and Systems Analysis  
(prof. Ing. Zdeněk Smékal, CSc.)  
Audiotechnology in English  
(prof. Ing. Zdeněk Smékal, CSc.)  
Digital Signal Processing  
(prof. Ing. Jiří Mišurec, CSc.)  
Electroacoustics  
(doc. Ing. Jiří Schimmel, Ph.D.)  
Music Theory in English  
(prof. Ing. Zdeněk Smékal, CSc.)  
Design of Electronic Devices  
(prof. Ing. Kamil Vrba, CSc.)

### **Bachelor's Courses in Information Safety**

Základy kryptografie  
(doc. Ing. Jan Hajný, Ph.D.)  
Computers and Programming 1  
(doc. Ing. Ivo Lattenberg, Ph.D.)  
Computers and Programming 2  
(Ing. Jiří Přinosil, Ph.D.)  
Applied Cryptography  
(doc. Ing. Václav Zeman, Ph.D.)  
Communication Technology  
(doc. Ing. Jan Jeřábek, Ph.D.)  
Data Communication  
(doc. Ing. Pavel Šilhavý, Ph.D.)  
Network Operating Systems  
(doc. Ing. Dan Komosný, Ph.D.)  
Theoretical Informatics  
(doc. Ing. Radim Burget, Ph.D.)  
ICT Security 1  
(doc. Ing. Jan Hajný, Ph.D.)  
Multimedia Services  
(doc. Ing. Petr Číka, Ph.D.)  
ICT Security 2  
(prof. Ing. Jiří Mišurec, CSc.)

Studio and Music Electronics  
(doc. Ing. Jiří Schimmel, Ph.D.)  
Security Systems  
(doc. Ing. Karel Burda, CSc.)  
High-speed Communications Systems  
(doc. Ing. Vladislav Škorpil, CSc.)  
Foundations of Cryptography  
(doc. Ing. Jan Hajný, Ph.D.)  
Introduction to Computer Typography and Graphics  
(doc. Mgr. Pavel Rajmic, Ph.D.)

Design and Technology of Audio-electronic Devices  
(prof. Ing. Jiří Mišurec, CSc.)  
Computers and Programming 1  
(doc. Ing. Ivo Lattenberg, Ph.D.)  
Computers and Programming 2  
(Ing. Jiří Přinosil, Ph.D.)  
Object Oriented Programming  
(doc. Ing. Ivo Lattenberg, Ph.D.)  
Practical Exercises in Information Networks  
(doc. Ing. Petr Číka, Ph.D.)  
Studio and Music Electronics  
(doc. Ing. Jiří Schimmel, Ph.D.)  
Introduction to Computer Typography and Graphics  
(doc. Mgr. Pavel Rajmic, Ph.D.)

Cryptologic Protocol Theory  
(doc. Ing. Jan Hajný, Ph.D.)  
Introduction to Computer Typography and Graphics  
(doc. Mgr. Pavel Rajmic, Ph.D.)  
Security Systems  
(doc. Ing. Karel Burda, CSc.)  
Accesses and Transports Networks  
(doc. Ing. Vladislav Škorpil, CSc.)  
Network Architecture  
(doc. Ing. Vít Novotný, Ph.D.)  
Object Oriented Programming  
(doc. Ing. Ivo Lattenberg, Ph.D.)  
Transmission Media  
(prof. Ing. Miloslav Filka, CSc.)  
Hardware of Computer Networks  
(doc. Ing. Jaroslav Koton, Ph.D.)  
High-speed Communications Systems  
(doc. Ing. Vladislav Škorpil, CSc.)  
Practical Exercises in Information Networks  
(doc. Ing. Petr Číka, Ph.D.)  
CISCO Academy 1 – CCNA  
(doc. Ing. Dan Komosný, Ph.D.)

CISCO Academy 5 – CCNP  
(Ing. Milan Šimek, Ph.D.)  
CISCO Academy 3 – CCNP  
(doc. Ing. Jan Jeřábek, Ph.D.)

CISCO Academy 4 – CCNP  
(doc. Ing. Radim Burget, Ph.D.)  
CISCO Academy 2 – CCNA  
(Ing. Anna Kubánková, Ph.D.)

## Master's Courses in Telecommunications and Information Technology

Information System Security  
(doc. Ing. Karel Burda, CSc.)  
CISCO Academy I  
(doc. Ing. Dan Komosný, Ph.D.)  
CISCO Academy II, V  
(Ing. Milan Šimek, Ph.D.)  
CISCO Academy III  
(doc. Ing. Jan Jeřábek, Ph.D.)  
CISCO Academy IV  
(doc. Ing. Radim Burget, Ph.D.)  
Digital Audio Signal Processing  
(Ing. Miroslav Balík, Ph.D.)  
Digital Signal Processing  
(prof. Ing. Zdeněk Smékal, CSc.)  
Modern Computer Graphics  
(doc. Mgr. Pavel Rajmic, Ph.D.)  
Mobile Network Communication Systems  
(doc. Ing. Vít Novotný, Ph.D.)  
Cryptography  
(doc. Ing. Václav Zeman, Ph.D.)  
Modern Network Technologies  
(doc. Ing. Jaroslav Koton, Ph.D.)  
Multimedia  
(doc. Ing. Petr Číka, Ph.D.)  
Projecting, Administration and Security of Computer Networks  
(doc. Ing. Karel Burda, CSc.)  
Optical Networks  
(prof. Ing. Miloslav Filka, CSc.)

Computers and Peripheral Devices  
(Ing. Miroslav Balík, Ph.D.)  
Computer-Supported Solution of Engineering Problems  
(prof. Ing. Jiří Mišurec, CSc.)  
Modern Communication Techniques  
(doc. Ing. Jan Jeřábek, Ph.D.)  
Advanced Techniques of Image Processing  
(doc. Ing. Kamil Říha, Ph.D.)  
Wireless Sensor Networks  
(Ing. Milan Šimek, Ph.D.)  
Digital Signal Processors  
(doc. Ing. Petr Sysel, Ph.D.)  
Services of Telecommunication Networks  
(doc. Ing. Vladislav Škorpil, CSc.)  
Theoretical Informatics  
(doc. Ing. Radim Burget, Ph.D.)  
Theory of Communication  
(Ing. Radim Číž, Ph.D.)  
Advanced Data Transmission Technology  
(doc. Ing. Václav Zeman, Ph.D.)  
A/D and D/A Converters  
(prof. Ing. Kamil Vrba, CSc.)  
Security Systems  
(doc. Ing. Karel Burda, CSc.)  
Speech Processing  
(prof. Ing. Zdeněk Smékal, CSc.)  
Telecommunication and Information Systems  
(Ing. Pavel Šilhavý, Ph.D.)

## Ph.D. Courses

Applied Cryptography  
(doc. Ing. Karel Burda, CSc.)

Modern Network Technologies  
(doc. Ing. Vít Novotný, Ph.D.)

## Laboratories

**Laboratory of Circuit Technology** (research of analog current-mode circuits, Kamil Vrba)

**Laboratory of Converged Networks** (research and instruction in modern data communication networks and services, 2G - 4G mobile telecommunication networks and systems for data network provision of voice and multimedia services, Vít Novotný, Pavel Šilhavý)

**Laboratory of Digital Music Studio** (instruction and research in real-time multichannel audio signal processing on PCs and embedded systems, Jiří Schimmel)

**Laboratory of Electroacoustics and Studio Technology** (anechoic chamber, instruction and research in measurement of electroacoustic converters, identification and analysis of sound sources, space acoustics, analysis and synthesis of sound fields, Jiří Schimmel)

**Acoustic Laboratory** (research in sound effects, multichannel sound systems, 3D audio, conference audio systems, Jiří Schimmel)



**Laboratory of Grid Technology** (instruction in network technologies, research of switch and indicator management, analysis of stationary and wireless local computer networks operation, modelling of algorithms used in modern data networks, Jaroslav Koton)

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

**Laboratory of Data Transmission** (instruction in data communication and research in data transmission, modulation methods and error-protection codes, esp. for xDSL and PLC systems, modelling of access network and end device characteristics, Pavel Šilhavý)

**Laboratory of Design Systems** (instruction in programming languages, modelling of communication systems, telecommunication networks and electronic circuits, research on modern communication technologies, design of electronic devices, Radim Číž)

**Laboratory of Sensor Systems and Signals** (instruction and research in sensor networks based on the IEEE 802.15.4 standard, analysis of Zigbee and 6lowPAN protocols, sensor units configuration, data transmission and wireless network management, microcontrollers Atmel AVR, Ondřej Krajsa)

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

**Laboratory of Analog Circuits and Analog-Digital Conversion** (instruction and research of analog circuits and mutual analog-digital converters, David Kubánek)

**Laboratory of Communication Systems** (instruction and research in access and transportation networks, transportation and connection systems, converged telecommunication and computer networks, high-speed systems and telecommunication network services, Vladislav Škorpil)

**Laboratory of Transmission Networks** (research in FPGA and high-rate multimedia data transmission up to 100 Gb/s, Vladislav Škorpil)

**Laboratory of Acoustic Signal Processing** (design, optimisation and implementation of algorithms for speech and acoustic signal processing, optimisation of algorithms for multi-core computing systems, instruction in Digital Acoustic Signal Processing, computers and their peripherals, Miroslav Balík)

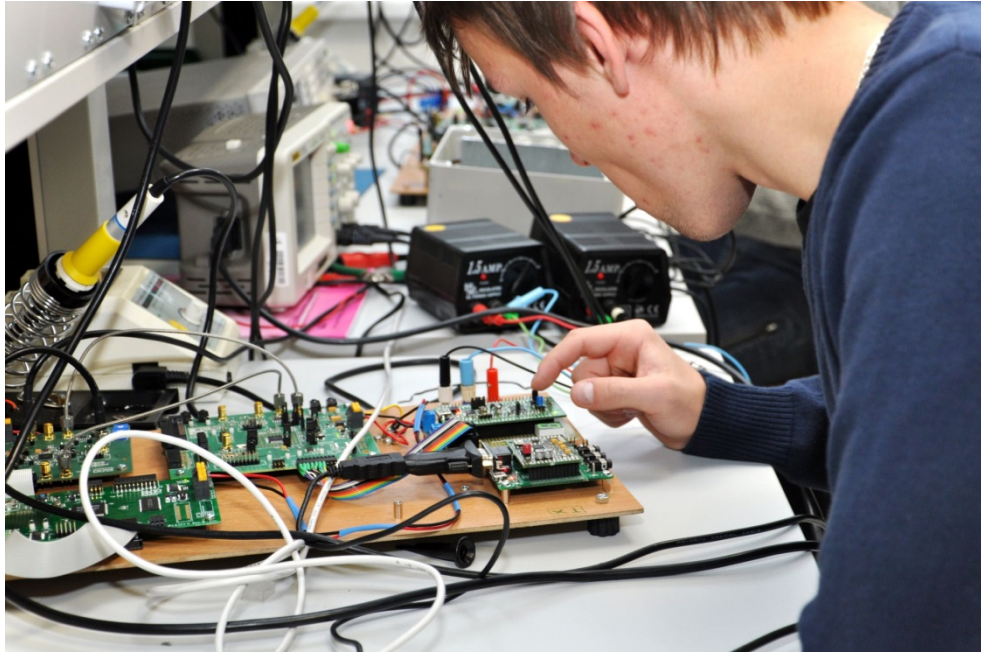
**Laboratory of Multimedia Signals** (research and development of multimedia embedded devices with ARM, Harvard architecture and VLIW architecture digital signal processors, optimization of algorithms for real-time digital signal processing, instruction in Signal Processors, Digital Filters and Digital Signal Processing, Petr Sysel)

**Research and Instruction Laboratory of Safety Systems** (research and development of cryptographic methods for communication and information systems, research and development of electronic protection systems, Karel Burda)

**Telepresence Studio** (research and development in videoconferencing and telepresenting services, Petr Číka)



Head and torso simulator with artificial ear and mouth for measurement of electroacoustic characteristics of telecommunication devices such as communicators, microphones and mobile phones



Student research laboratory

# Department of Theoretical and Experimental Electrical Engineering

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

Head

Technická 3082/12

61600 Brno

Tel.: 541 146 281

e-mail: [utee@feec.vutbr.cz](mailto:utee@feec.vutbr.cz)

## Professor Emeritus

Prof. Ing. Libor Dědek, CSc.

## Associate Professors

Doc. Ing. Petr Drexler, Ph.D.

Doc. Ing. Jan Mikulka, Ph.D.

Doc. Ing. Jiří Sedláček, CSc.

Doc. Ing. Miloslav Steinbauer, Ph.D.

## Professors

Prof. Ing. Karel Bartušek, DrSc.

Prof. Ing. Jarmila Dědková, CSc.

Prof. Ing. Pavel Fiala, Ph.D.

Prof. Ing. Eva Gescheidtová, CSc.

## Lecturers

Ing. Tibor Bachorec, Ph.D., Mgr. Přemysl Dohnal, Ing. Martin Friedl, Ph.D., Ing. Radim Kadlec, Ph.D., Ing. Tomáš Kříž, Ph.D., Ing. Petr Marcoň, Ph.D., Ing. Dušan Nešpor, Ph.D., Ing. Zdeněk Roubal, Ph.D., Ing. Zoltán Szabó, Ph.D.

## Ph.D. Students

Ing. Jan Dušek, Ing. Michal Hanzelka, MBA, Ing. David Hladký, Ing. Daniel Chalupa, Ing. Jiří Chytil, Ing. Jiří Janoušek, Ing. Ksenia Kořínková, Ph.D., Ing. Pavel Křepelka, Ing. Jaroslav Michalec, Ing. Rastislav Motúz, Ing. Jiří Sliž, Ing. Eliška Vlachová Hutová

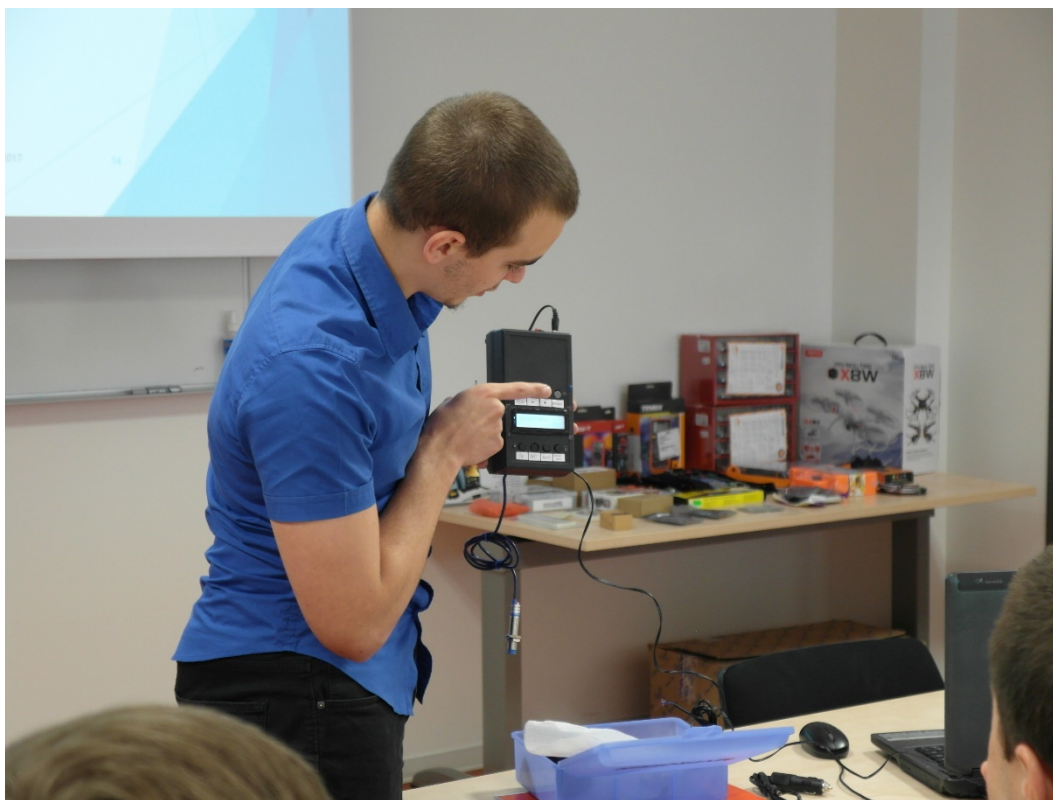
## Administrative and Technical Staff

Eva Cupáková, Ing. Martin Čáp, Ph.D., Alena Javůrková, Otáhalová Veronika

## Main Interests

The department provides instruction in Bachelor, Master and Ph.D. programmes targeted at education in the key areas of electrical engineering through understanding of the basic principles of electrical engineering, safety issues, measurement of electrical and non-electrical characteristics with focus on special applications and modelling of electromagnetic fields. Bachelor, Master and Ph.D. theses deal with topics of current and long-term research interests of the department. Instruction is provided in up-to-date equipped laboratories, computer laboratories and a research laboratory for students' work on their diploma theses.

Research is conducted in laboratories with the latest equipment for numerical modelling, magnetic measurements, light technology, low-level measurements, a pulse-sources laboratory, laboratory of microwave technology and research laboratory of electro optics and laser technology and laboratory of modelling and optimisation in electromechanical systems of FEEC. The department focused on numerical modelling of subatomic structures, wide-band signals, noise spectroscopy and specific designs of metamaterial and resonance structures for nuclear magnetic resonance and electron microscopy, optoelectronic measurements and metrology (GAČR), long-term research on analysis of numerical models of organic and anorganic systems associated with production technologies and design tests in the centre CEITEC, supported by GAČR. In cooperation with IMI International, s. r. o. - Norgren CZ, research on graphene-based nanostructures is being conducted for applications in nanosensors (GAČR). Another research issue is processing of images of magnetic resonance and electric impedance tomography. Research is also centred on MR and electric impedance tomography image processing, on the design of specific measuring methods, low-level and pulse signal processing and evaluation, and is supported by grant projects and contract cooperation with external partners and the industrial sector. Long-term safety research on the impact of electromagnetic fields on inanimate materials and living substance, pulse processes and wide-band detection methods has been pursued (GAČR projects, student theses).



'Microcontrollers are in 2017' – competition for 'bastlers' organised by the department every year

## Major Achievements

Basic research was focused on the design of progressive numerical methods, design of substance structures, modelling and analysis of EMG characteristics of nanostructures and periodical structures of organic and anorganic nature, wideband signal processing, NMR, NQR, noise spectroscopy, specific metamaterial structures for NMR and electron microscopy, optical and opto electronic measuring methods in EMG spectrum, processing and evaluation of NMR images and tests of novel imaging methods, upgrading and testing of the NQR system. Ph.D. students were engaged in measurements of a homogeneous group of students. The influence of changes in geomagnetic field on the characteristics of an individual with predictable impact in the society (GAČR) was studied.

In 2017 the department was awarded several patents on photonics. Contract research continues with TES, s.r.o. on detection, localisation and evaluation of failures of electric engines over 1 MW, design of special measuring exchanges for manufacturing of power tubes in TESLA Electron tubes, s.r.o. An operating sample was produced to supplement the submitted patent on non-destructive evaluation of the distribution of composite material fibres, and a number of measurements were executed on operating samples of composite materials. Research on generation and detection of isolated EMG pulses continued and student involvement in IET projects resulted in a number of minor operating devices. The long-term research of periodical systems and structures in infrared EMG waves was targeted at their utilisation as an information element or harvester. Another area of research in 2017 was low-frequency harvesting as well as a study of vibrations of mini- and microgenerators for fabrication of microstructures. Experimental laboratory measurements were made to evaluate the impact of the particular type of magnetic fields on anorganic, organic and living substance and the results were published (GAČR).

Work on the design of an operating sample of induction flow meter with measurement of average velocity up to 1 mm/s continued. Implementation of numerical modelling of the parameters of plasma formation in an atmospheric jet was supported by the design and testing of a device for power and harmonic signal generation in the radio frequency spectrum for plasma chamber.

Long-term cooperation with PROTOTYPA, a. s. In research on special measuring methods for single processes continued, and preparatory exterior work is going on for location of a passive optical radar at Brno airport and monitoring to secure the external perimeter. Joint research on microtechnology and design of structures with Technische Universität Wien continued.

The department is involved in centres SIX a CVVOZE. In 2017 we participated in the international project 'Interdisciplinary Research of Wireless Technologies' (INWITE).

## Major Research Projects

### Complex Artificial Electromagnetic Structures and Nanostructures – GAČR 17-00607S

Investigator: Pavel Fiala

### On-Chip Energy Storage for Autonomous Sensor Fields (CAPoC)- GAČR 17-27340S

Cooperation with Department of Microelectronics

### Long-Distance Identification of Small Reflectors Via Electromagnetic Waves – GAČR 15-08803S

Investigators: Petr Drexler

## Selected Publications

BARTUŠEK, K.; MARCOŇ, P.; FIALA, P.; MÁCA, J.; DOHNAL, P. The Effect of a Spiral Gradient Magnetic Field on the Ionic Conductivity of Water. *Water*, 2017, vol. 9, no. 9, p. 1-8. ISSN: 2073-4441.

MARCOŇ, P.; SZABÓ, Z.; VESELÝ, I.; ZEZULKA, F.; SAJDL, O.; ROUBAL, Z.; DOHNAL, P. A Real Model of a Micro-Grid to Improve Network Stability. *Applied Sciences - Basel*, 2017, no. 8, p. 1-16. ISSN: 2076-3417.

DREXLER, P.; KŘEPELKA, P.; PYTEL, R.; HYNŠTOVÁ, I.; PÉREZ-RODRÍGUEZ, F.; ROGER, J. Curve fitting in Fourier transform near infrared spectroscopy used for the analysis of bacterial cells. *JOURNAL OF NEAR INFRARED SPECTROSCOPY*, 2017, vol. 25, no. 3, p. 151-164. ISSN: 0967-0335.

HANZELKA, M.; DAN, J.; HOLCNER, V.; DOHNAL, P.; KADLEC, R. An Experiment to Prove the Effect of Low-Level Magnetic Fields Resulting from Ionospheric Changes on Humans. *Measurement Science Review*, 2017, vol. 2017, no. 17, p. 37-47. ISSN: 1335-8871.

KOŘÍNEK, R.; MIKULKA, J.; HRIB, J.; HUDEC, J.; HAVEL, L.; BARTUŠEK, K. Characterization of the Embryogenic Tissue of the Norway Spruce Including a Transition Layer between the Tissue and the Culture Medium by Magnetic Resonance Imaging. *Measurement Science Review*, 2017, vol. 17, no. 1, p. 19-26. ISSN: 1335-8871.

ROUBAL, Z.; BARTUŠEK, K.; SZABÓ, Z.; DREXLER, P.; ÜBERHUBEROVÁ, J. Measuring Light Air Ions in a Speleotherapeutic Cave. *Measurement Science Review*, 2017, vol. 17, no. 1, p. 27-36. ISSN: 1335-8871.

VLACHOVÁ HUTOVÁ, E.; BARTUŠEK, K.; DOHNAL, P.; FIALA, P. The Influence of a Static Magnetic Field on the Behavior of a Quantum Mechanical Model of Matter. *MEASUREMENT, Journal of the International Measurement Confederation (IMEKO)*, 2017, vol. 1, no. 96, p. 18-23. ISSN: 0263-2241.

## Bachelor's Courses

Safety in Electrical Engineering

(Ing. Radim Kadlec, Ph.D.)

Electrical Engineering Tutorial

(doc. Ing. Miloslav Steinbauer, Ph.D.)

Electrical Engineering

(Ing. Petr Marcoň, Ph.D.)

Electrical Engineering 1

(doc. Ing. Petr Drexler, Ph.D., prof. Ing. Jarmila Dědková, CSc.)

Electrical Engineering 2

(doc. Ing. Jiří Sedláček, CSc., doc. Ing. Miloslav Steinbauer, Ph.D.)

Electrical Engineering for Audio Engineering

(doc. Ing. Petr Drexler, Ph.D.)

Measurement in Electrical Engineering

(prof. Ing. Karel Bartušek, DrSc., doc. Ing. Jan Mikulka, Ph.D., prof. Ing. Eva Gescheidtová, CSc.)

Electrical Measurement for Audio Engineering

(prof. Ing. Karel Bartušek, DrSc.)

The C++ Programming Language

(prof. Ing. Pavel Fiala, Ph.D.)

Computer Modeling of Electrical Devices and Components

(prof. Ing. Pavel Fiala, Ph.D.)

Selected Topics of Electrical Engineering in English

(Ing. Petr Marcoň, Ph.D.)

## Master's Courses

Safety in Electrical Engineering

(Ing. Radim Kadlec, Ph.D.)

Safety of Electrical Devices

(doc. Ing. Miloslav Steinbauer, Ph.D.)

Electrical Installations

(Ing. Radim Kadlec, Ph.D.)

Electromagnetic Field Modeling

(Ing. Tibor Bachorec, Ph.D.)

## Ph.D. Courses

Numerical Computations with Partial Differential Equations (prof. Ing. Pavel Fiala, Ph.D.)

Special Measurement Methods (prof. Ing. Karel Bartušek, DrSc.)

## Laboratories

**Laboratory of Electrical Measurements** (instruction in Measurements in Electrical Engineering and Measurements in Electrical Engineering for Audio Engineering, Zoltán Szabó)

**Laboratory of Electrical Engineering** (instruction in Electrical Engineering 1,2 and Electrical Engineering for Audio Engineering, Martin Friedl)

**Laboratory of Electrical Engineering and Electrical Installations** (instruction laboratory for Electrical Installations, Electrotechnical Seminar and Electrical Engineering, Radim Kadlec)

**IET Laboratory** (instruction laboratory, Miloslav Steinbauer)

**Computer Laboratory of Electrical Engineering** (instruction in Electrical Engineering 1 and 2, Electrical Engineering for Audio Engineering, Miloslav Steinbauer)

**Computer Laboratory** (instruction in Electrotechnical Seminar, Modelling of Electromagnetic Fields, Computer Modelling of Electrical Devices and Components and Seminar C++, Miloslav Steinbauer)

**Seminar Laboratory** (Miloslav Steinbauer)

**Research Laboratory of Magnetic Measurement** (research laboratory of magnetic measurement, Zdeněk Roubal)

**Research Laboratory of Light Technology** (measurement of the parameters of light sources, Zdeněk Roubal)

**Restricted Access Laboratory** (basic and applied research of numerical methods, Pavel Fiala)

**Low-Level Measurement Laboratory** (Zdeněk Roubal)

**Research Laboratory for Student Theses** (research laboratory for students, Martin Friedl)

**Laboratory of Printed Circuit Boards** (development of printed circuit boards, Zoltán Szabó)

**Research Laboratory for Prototype Development** (research laboratory for Ph.D. students, Martin Friedl)

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

**Research Laboratory of Electro-Optics and Laser Technology** (optoelectronic measuring methods, Petr Drexler)



'Night of Scientists 2017'

# Department of Power Electrical and Electronic Engineering

## Doc. Ing. Ondřej Vítek, Ph.D.

Head

Technická 3082/12  
616 00 Brno  
Tel.: 541 146 704  
Fax: 541 146 705  
e-mail: [uvec@feec.vutbr.cz](mailto:uvec@feec.vutbr.cz)



## Professors

Prof. RNDr. Vladimír Aubrecht, CSc.  
Prof. Ing. Vítězslav Hájek, CSc.  
Prof. Ing. Jiří Skalický, CSc.

## Associate Professors

Doc. Ing. Bohuslav Bušov, CSc.  
Doc. Ing. Bohumil Klíma, Ph.D.  
Doc. Ing. Čestmír Ondrůšek, CSc.  
Doc. Dr. Ing. Miroslav Patočka,  
Doc. Ing. František Veselka, CSc.  
Doc. Ing. Ondřej Vítek, Ph.D.  
Doc. Ing. Pavel Vorel, Ph.D.

## Lecturers

Ing. Radoslav Cipín, Ph.D., Ing. Dalibor Červinka, Ph.D., Ing. Petr Huták, Ph.D., Ing. Rostislav Huzlík, Ph.D., Ing. Marcel Janda, Ph.D., Mgr. Petr Kloc, Ph.D., Ing. Jan Knobloch, Ph.D., Ing. Martin Mach, Ing. Ivo Pazdera, Ph.D., Ing. Petr Procházka, Ph.D., Ing. Jiří Valenta, Ph.D.

## Ph.D. Students

Ing. Jan Bárta, Ing. Jan Bulín, Ing. Jiří Ctibor, Ing. Lukáš Dostál, Ing. Martin Folprecht, Ielyzaveta Ishkova, Ing. Jiří Klíma, Ing. Ladislav Knebl, Ing. Jan Martiš, Ing. Jan Mikláš, Ing. Lukáš Mišinger, Ing. Veronika Novotná, Ing. Jan Pígl, Ing. Martin Prudík, Ing. Ondřej Rubeš, Ing. Josef Samek, Ing. David Šimek, Ing. Michal Šír, Ing. Petr Španěl, Ing. Marek Toman, Ing. Adam Vašíček, Ing. Eva Vítková, BA.

## Administrative and Technical Staff

Ing. Zdeněk Feiler, Ph.D., Zdeněk Liška, Josef Němec, Bc. Lucie Sobolová

## Main Interests

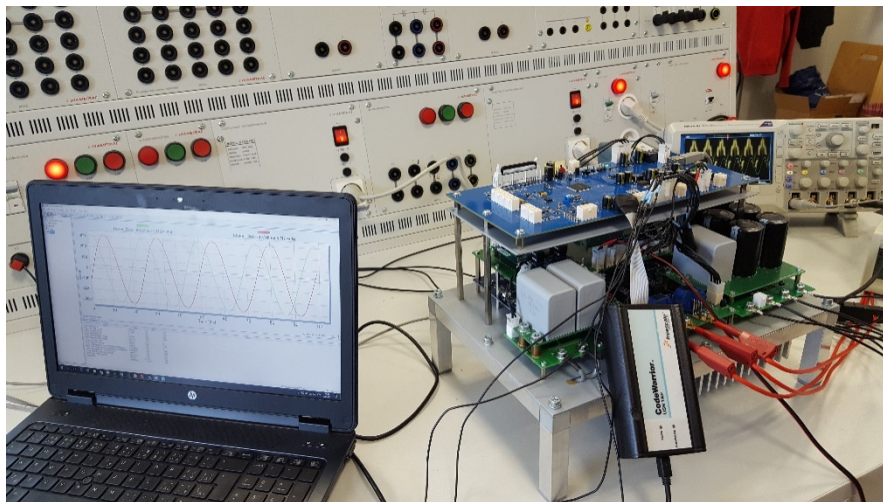
The department provides instruction in the study area 'Power Electrical and Electronic Engineering' in the Bachelor and Ph.D. programmes and in the study areas 'Power Electrical Engineering and Power Electronics' in the Master degree programme. Instruction is focused on the theory and construction of electrical machines and devices, CAD systems including solutions for electromagnetic and thermal fields and optimisation methods for

construction designs. The design, size, control and dynamics of electromechanical systems are the subject of instruction in electrical drives. Another area of interest is power electronics including DC/DC pulse converters (switching sources), DC/AC alternators, rectifiers etc. Attention is paid to the theory of regulation and digital control.

In basic research, the department deals with theoretical modelling of radiation energy transport in thermal plasma. Currently we are involved in basic research for medical purposes, in the development of a special high voltage pulse source for electroporation of cancer cells.

In applied research, electric machines, power electronics and electric drives and devices are in the focus of interest. Research is centered on low-voltage machines used in automotive industry, synchronous machines with permanent magnets, asynchronous and DC machines, and recently high-revolution asynchronous motors. The department's staff is experienced in the development of special machines such as starter generators, controlled magnetic bearings and magnetic levitation systems. They focused on power exploitation for electric arc extinction in low- and high-voltage devices, power converters of extreme parameters using up-to-date switching semiconductors SiC (silicon carbide and GaN (gallium nitride)). This area covers fast chargers for traction electromobile accumulators or devices for contactless (induction) energy transmission. Research on electric drives deals with optimal regulation of electrical drives, especially loss minimisation in traction drives, implementation of ultracapacitors, accumulators and fuel cells in the system of traction drives.

The department cooperates with a number of universities, e.g. SPGU St Petersburg, TU Pskov, TU Delft, TU Žilina, LUT Lappeenranta, Masaryk University Brno, and industrial companies and institutions, e.g. JSC Electrocontact (Kineshma-RF), Siemens Elektromotory Drásov, Siemens Elektromotory Mohelnice, OEZ Letohrad, ATAS Náchod, EMP Slavkov u Brna, JULI Motorenwerk Moravany, VUES Brno a.s., IVEP Brno, ŠLP Křtiny a.s., Tesla Blatná, Ingersoll Rand.



Workplace for development of electric drives and power electronics, sample of power converter to supply high-revolution asynchronous motor 6 kW, 120 000 min<sup>-1</sup>

## Major Achievements

In power electronics, the department focused on the development of a unique DC/DC converter with high volume density approx. 1 kW / 180 cm<sup>3</sup> For PBS Velké Bíteš, and a device for wireless energy transmission (on the principle of power coupled resonant circuits). This issue is currently in the focus of interest, and we have developed an operating sample 1500, which will be used for demonstration and educational purposes.

In cooperation with Mechanical Faculty we designed a drive for non-typical pump construction. It is an asynchronous motor with an external rotor where the pump's blades are positioned directly on the external rotor. A detailed analysis of iron losses in assisted reluctance motor 55 kW 3000 min<sup>-1</sup> was conducted in order to assess the impact of losses on the used permanent magnets.

In the framework of a TAČR project we cooperated with TES VSETÍN s.r.o. and designed a synchronous generator of apparent power 10 MVA to be utilised in water stations.

In cooperation with the centre ICRC FNUSA Brno the department developed a novel electroporation generator with AC output (Method H-FIRE). The device was tested at the Clinic of Swine Diseases, University of Veterinary and Pharmaceutical Sciences in Brno. In the frame of contract research for COMPEX Brno, a high-frequency power source 3,9 MHz for plastic surgery and cosmetics was designed.

A short circuit laboratory was set in operation as a result of contract research on international level (Eaton - Austria, Techna International – Great Britain). Measurements of Li-ion accumulators 4,2 V with discharging current 400A and charging current 200 A were conducted in the framework of contract research.



The department's staff were offered placements at Lappeenranta University of Technology (LUT) and in the company SpinDrive in Finland.

## Major Reserch Projects

### Energy in Conditions of Sustainable Development (EN-PUR) – LO1210

Investigator: Vladimír Aubrecht

### Study of Thermodynamic and Electromagnetic Processes in Low-Voltage Switching Devices – GA15-14829S

Investigator: Vladimír Aubrecht

### Resolvers - Modern Position Sensors – FV10195

Investigator: Vítězslav Hájek

### Synchronous Machines Optimisation for Operating Parameters Enhancement and Mass Reduction – TH02010348.

Investigator: Čestmír Ondrůšek

### Research and Development of Assisted Reluctance Motors up to 55kW –TH02010074.

Investigator: Čestmír Ondrůšek

### Transport Tractor Set with Hybrid Drive –TH02010115.

Investigator: Ondřej Vítek

### Research and Development of Asynchronous Motors with Novel Rotors – FV20335.

Investigator: Vítězslav Hájek

## Selected Publications

MACH, M.; ONDRŮŠEK, Č. Motor pro hybridní čerpací systém. *Elektrorevue - Internetový časopis* (<http://www.elektrorevue.cz>), 2017, roč. 19, č. 6, s. 173-180. ISSN: 1213-1539.

CIPÍN, R.; TOMAN, M.; KNOBLOCH, J. Estimation of Alkaline Battery Parameters. *ECS Transactions*, 2017, vol. 81, no. 1, p. 1-6. ISSN: 1938-5862.

TOMAN, M.; VOREL, P.; CIPÍN, R. Thermal Calculation of Li-Ion Battery Pack. *ECS Transactions*, 2017, vol. 81, no. 1, p. 1-6. ISSN: 1938-5862.

PROCHÁZKA, P.; PAZDERA, I.; HUTÁK, P.; KNOBLOCH, J.; LAZEK, T. Battery Powered Wheelbarrow. *ECS Transactions*, 2017, no. 1, p. 1-5. ISSN: 1938-5862.

PROCHÁZKA, P.; PAZDERA, I.; VÍTEK, O.; HUTÁK, P. Forwarder Trailer with Auxiliary Electric Drive Unit. *ECS Transactions*, 2017, no. 1, p. 1-6. ISSN: 1938-5862.

VOREL, P.; MARTIŠ, J.; ČERVINKA, D. LiFePO<sub>4</sub> Powered Arc Welder. *ECS Transactions*, 2017, no. 1, p. 10-17. ISSN: 1938-5862.

KLOC, P.; AUBRECHT, V.; BARTLOVÁ, M. Objective function for numerical mean absorption bands optimization. *Plasma Physics and Technology*, 2017, vol. 4, no. 3, p. 269-272. ISSN: 2336-2626.

VALENTA, J.; SAMOHEJL, M.; FENDRYCH, M.; KLOC, P.; DOSTÁL, L. Diagnostics of Various Phenomena in LV Devices Under Real Switching Conditions. *Plasma Physics and Technology*, 2017, vol. 4, no. 3, p. 257-260. ISSN: 2336-2626.

ŠIMEK, D.; PĚČEK, D. EXPERIMENTAL TEMPERATURE MEASUREMENTS IN MINIATURE CIRCUIT BREAKER. *Plasma Physics and Technology*, 2017, vol. 4, no. 3, p. 265-268. ISSN: 2336-2626.

BOGATYREVA, N.; BARTLOVÁ, M.; AUBRECHT, V.; KLOC, P. Radiation Transfer in Arc Plasmas. *Plasma Physics and Technology*, 2017, vol. 4, no. 3, p. 253-256. ISSN: 2336-2626.

KLOC, P.; AUBRECHT, V.; BARTLOVÁ, M. Numerically optimized band boundaries of Planck mean absorption coefficients in air plasma. *Journal of Physics D: Applied Physics*, 2017, vol. 50, no. 30, p. 1-10. ISSN: 0022-3727.

VESELKA, F. Stejnoseměrné elektrické stroje s permanentními magnety. Komutace a možnosti inovace kluzného kontaktu. *Electro*, 2017, roč. 27, č. 6, s. 10-13. ISSN: 1210-0889.

UZHEGOV, N.; BÁRTA, J.; KURFÜRST, J.; ONDRŮŠEK, Č.; PYRHÖNEN, J. Comparison of High-Speed Electrical Motors for a Turbo Circulator Application. *IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS*, 2017, no. 99, p. 1-10. ISSN: 0093-9994.

VESELKA, F. Inovace komponent kluzného kontaktu. *Electro*, 2017, roč. 27, č. 4-12, s. 1-8. ISSN: 1210-0889.

BULÍN, T.; ONDRŮŠEK, Č.; HAPLA, M.; SCHNEEWEISS, O.; ŠVÁBENSKÁ, E. Magnetic Properties and Structure of Non-Oriented Electrical Steel Sheets after Different Shape Processing. *ACTA PHYSICA POLONICA A*, 2017, vol. 131, no. 4, p. 819-821. ISSN: 1898-794X.

## Bachelor's Courses

Computers and Programming 1  
(prof. RNDr. Vladimír Aubrecht, CSc.)  
Computer Science in High Power Engineering  
(Ing. Marcel Janda, Ph.D.)  
Power Electronics  
(doc. Dr. Ing. Miroslav Patočka)  
Electrical Apparatus  
(doc. Ing. Bohuslav Bušov, CSc.)  
Electrical Machines  
(doc. Ing. Čestmír Ondrůšek, CSc.)  
Control Theory  
(Ing. Petr Huták, Ph.D.)  
Electrical Drives  
(Ing. Dalibor Červinka, Ph.D.)

Automobile Electric and Electronic Systems  
(prof. Ing. Vítězslav Hájek, CSc.)  
Control Electronics  
(doc. Dr. Ing. Miroslav Patočka)  
Electrical Machines 2  
(doc. Ing. Ondřej Vítek, Ph.D.)  
Electrotechnical Inspection and Supervision  
(doc. Ing. František Veselka, CSc.)  
Microprocessor Technics for Drives  
(Ing. Ivo Pazdera, Ph.D.)  
Computer Aided Design  
(Ing. Marcel Janda, Ph.D.)

## Master's Courses

Electromechanical System Dynamics  
(doc. Ing. Čestmír Ondrůšek, CSc.)  
Technika výkonových měničů  
(doc. Dr. Ing. Miroslav Patočka)  
Computer Modelling in Power Electrical Engineering  
(Ing. Marcel Janda, Ph.D.)  
Control of Dynamic Systems  
(Ing. Petr Huták, Ph.D.)  
Laboratory of Electrical Machines and Apparatus  
(Ing. Marcel Janda, Ph.D.)  
Industrial Electronics  
(doc. Ing. Pavel Vorel, Ph.D.)  
AC Drives  
(Ing. Ivo Pazdera, Ph.D.)  
Electrical Microdrives  
(doc. Ing. Ondřej Vítek, Ph.D.)

Electrical Controlled Drives  
(Ing. Dalibor Červinka, Ph.D.)  
Power Converter Design  
(doc. Dr. Ing. Miroslav Patočka)  
Adaptive and Optimal Control of Drives  
(Ing. Petr Huták, Ph.D.)  
Diagnostics and Electrical Equipments Protections  
(Ing. Jiří Valenta, Ph.D.)  
Project Management of Innovation  
(doc. Ing. Bohuslav Bušov, CSc.)  
Control Elements in Electrical Drives  
(doc. Ing. Pavel Vorel, Ph.D.)  
Construction and Production of Electrical Equipments  
(doc. Ing. Bohuslav Bušov, CSc.)  
Microcomputer Control of Electrical Drives  
(Ing. Ivo Pazdera, Ph.D.)

## Ph.D. Courses

Topical Issues of Electrical Machines and Apparatus  
(doc. Ing. Čestmír Ondrůšek, CSc.)

Selected Problems from Power Electronics and Electrical Drives  
(prof. Ing. Jiří Skalický, CSc.)

## Laboratories

**Laboratory of Electrical Machines** (research on commutation of electrical machines, measurement of medium-power output, magnetic bearings, automated measurements, Ondřej Vítek)

**Laboratory of Mechatronics** (Ondřej Vítek)

**Laboratory of Electrical Devices** (switching devices, Bohuslav Bušov)

**Laboratory of Holographic Interferometry** (optical stand for holographic interferometry, e.g. diagnostics of rotating machine vibrations, Marcel Janda)

**Laboratory of Electrical Drives** (electrical drives with focus on independent traction, Dalibor Červinka)

**Laboratory of Power Electronics** (research in pulse converters of different outputs, Petr Procházka)

**Laboratory of High-Current Electronics** (research on DC/DC converters, alternators and low-voltage brushless drives, Dalibor Červinka)

**Laboratory of Dynamic Properties of Electrical Machines** (experimental analysis of transient performances in electrical machines, Ondřej Vítek)

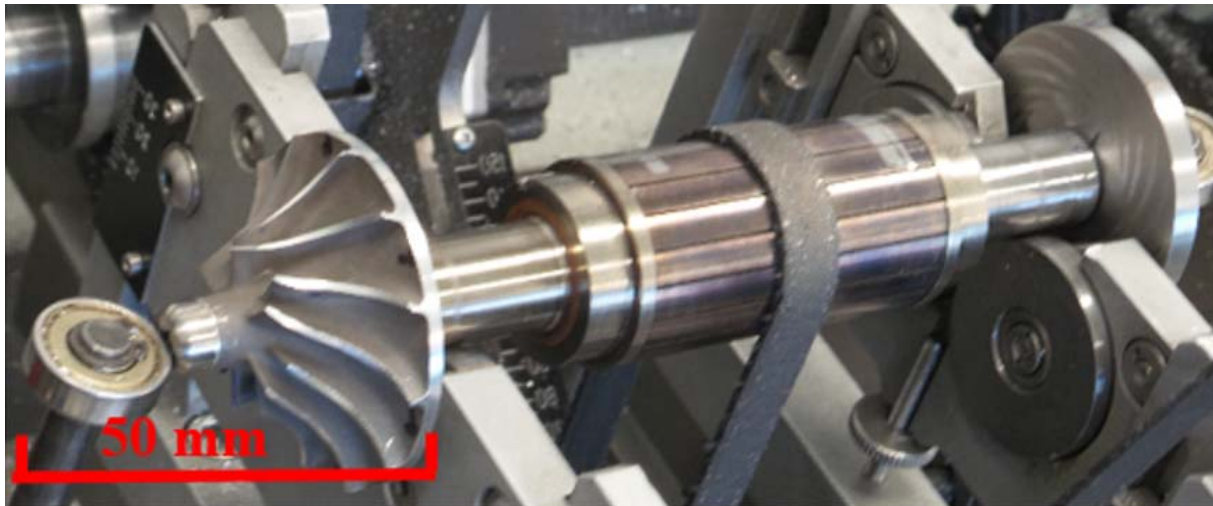
**Laboratory of Control Electronics** (Pavel Vorel)

**Laboratory of Microprocessor Technology** (Bohumil Klíma)

**Laboratory of Microelectromechanical Systems** (Radoslav Cipín)

**Laboratory of Power Electronics 2** (Pavel Vorel)

**Research and Development Laboratory** (Petr Procházka)



Rotor of high-revolution asynchronous motor 6 kW, 120 000 min<sup>-1</sup>