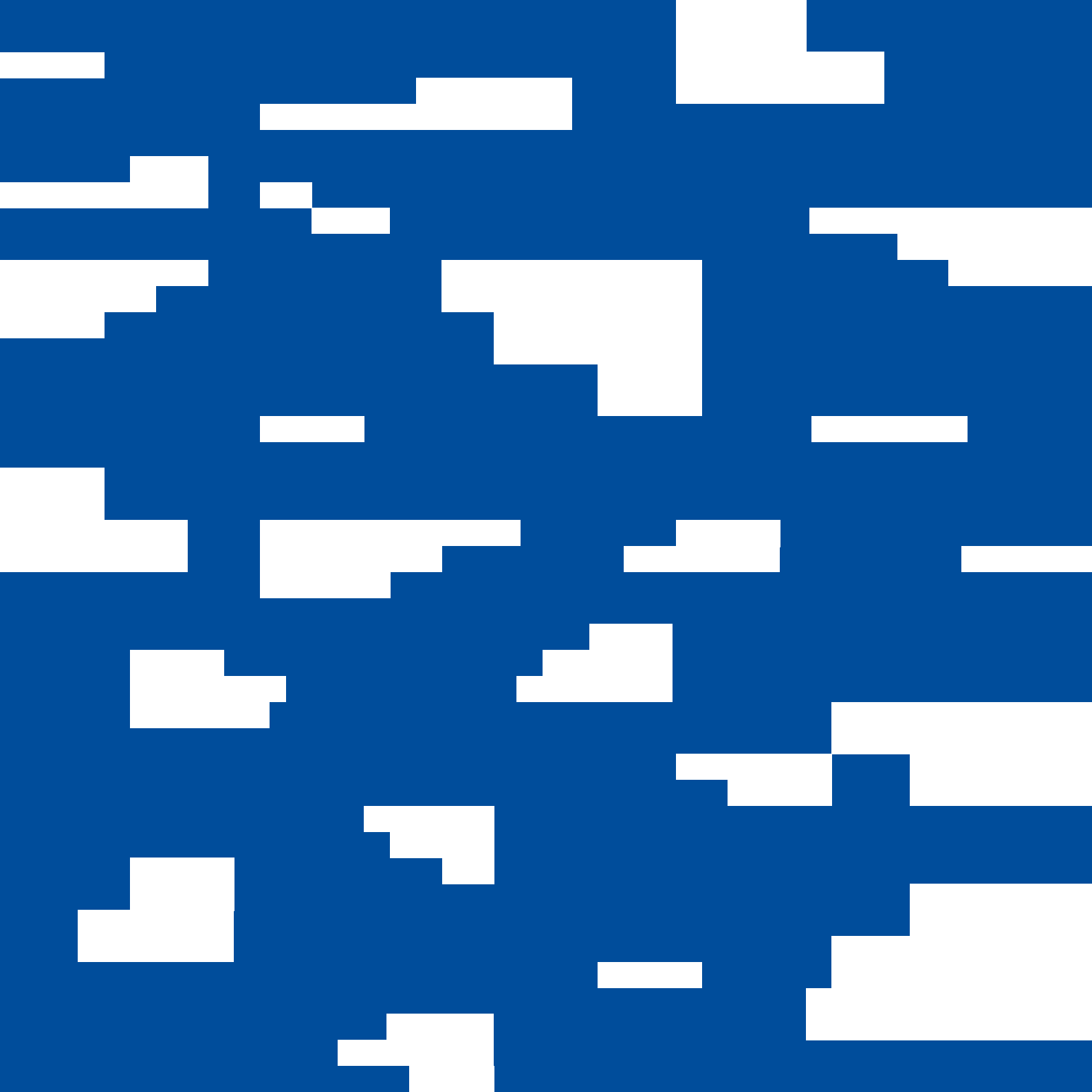
BRNO UNIVERSITY OF TECHNOLOGY
FACULTY OF ELECTRICAL ENGINEERING AND COMMUNICATION

ANNUAL REPORT 2019



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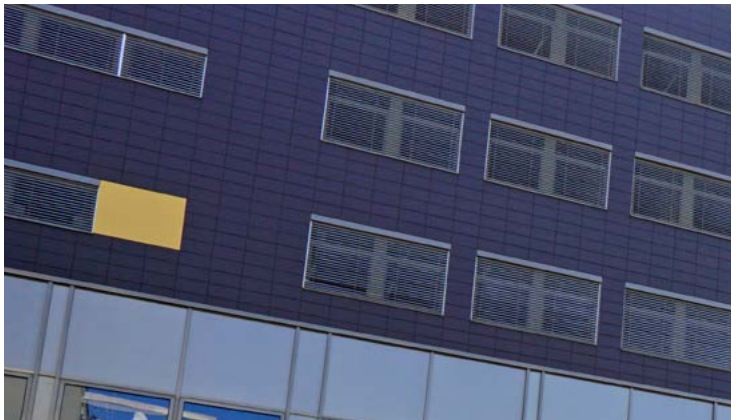

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OPENING WORD OF THE DEAN

Dear readers,

you are browsing one of the strategic faculty documents, the Annual Report of the Faculty of Electrical Engineering and Communication, Brno University of Technology, of 2019. This year we have decided to change both its format and content in order to make it a comprehensive as well as enjoyable document on faculty activities which will be useful both for internal and external report of past events.

The year 2019 was an anniversary year. Apart from the 30th Velvet Revolution Anniversary we also celebrated 60 years from the foundation of our faculty. 60 years ago the former Faculty of Energy split into two separate faculties, the Faculty of Mechanical Engineering and the Faculty of Electrical Engineering. Throughout 2019 there were many activities related to this event. In Technická 12, posters on faculty history were exhibited, in Prof. Brauner Lecture Hall "Golden promotions" of the 1969 electrical, mechanical and civil engineering alumni took place and a faculty external session was organized for the faculty management, department and deputy heads. A theatrical performance Viva "Lalala" republika held in the City Theatre Brno only for faculty staff and their guests highlighted the celebrations.

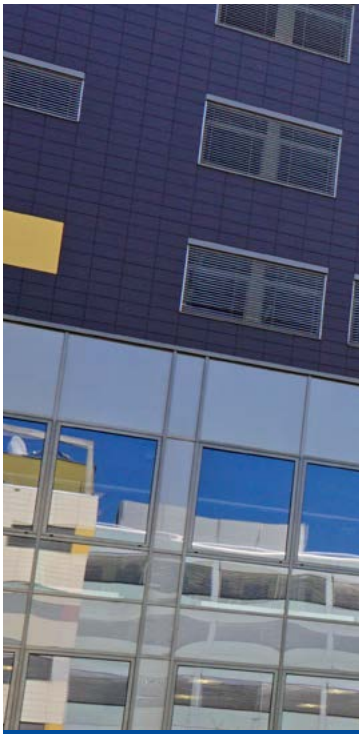
One of the 2019 memorable events is definitely a completion of all study programmes transformation into new ones as required by the National Accreditation Bureau. Now, the faculty can offer a complete portfolio of newly accredited study programmes including all fields of electronics, electrotechnics, communication technologies and related interdisciplinary fields. We also helped significantly to an accreditation of a new study programme Sports Technology in which many subjects will be covered by our faculty employees. In research activities we managed to raise significantly the number of publications in prestigious scientific journals. In applied research we also won several awards such as 'Golden Amper' and our researchers from Laboratory of Light and Illumination Technology (UEEN) were awarded for luminiscence distribution analyser LDA-LumiDISP as one of the most useful exhibits of the AMPER 2019 fair.

We also advanced in our public presentation. Our activities were presented by social media such as Facebook, Instagram and many articles on our employees' and students' successes were published in various newspapers and magazines. The faculty launched new webpages reflecting the BUT visual style including the English version.

Nowadays, the Faculty of Electrical Engineering and Communication, Brno University of Technology, with its offer of study programmes, laboratory equipment and scientific research results ranks to excellent educational institutions exceeding the borders of the Czech Republic. However, its continuous development is conditioned and supported by ceaseless effort of the faculty staff. I hereby thank to all faculty employees and students for their working results in 2019.

Prof. RNDr. Vladimír Aubrecht, CSc.
Dean

Photo: Igor Šefr



MISSION, VISION AND STRATEGIC GOALS OF THE FACULTY

The faculty mission is to educate knowledgeable experts with advanced skills and abilities gained from the accredited study programmes, to conduct scientific research in both national and international environment and to produce research results highly relevant for the society.

Photo: Jakub Rozboud

F

Faculty

is an excellent educational institution preparing graduates ready to participate in the dynamical development of advanced technologies. Thanks to close faculty cooperation with the industry a vast majority of students finds their job even before the study completion.

E

Excellent

scientific research is conducted not only at individual faculty departments, but also at two regional research centres SIX and CVVOZE. The faculty also takes part in the activities of the CEITEC BUT scientific research centre of excellence. Our scientific research is focused on vast range of projects affecting not only everyday life, but forming also our future, such as the development of Parkinson disease early diagnosis tool, secure cyberspace or the Smart Cities project.

K

(K) Campus

of the Faculty of Electrical Engineering and Communication is situated in Brno-Královo Pole. The construction of the modern educational and research complex was completed in 2013 and after more than 50 years of faculty existence it enabled to unite all faculty workplaces into one place located Pod Palackého vrchem.

T

Traditions

of the faculty can be traced to the first half of the last century. For sixty years the faculty has been developping educational and research activities in electrotechnics, electronics and related fields. It was founded in 1959 by the governmental Act no. 59 dividing the Faculty of Energy into Faculty of Mechanical Engineering and Faculty of Electrical Engineering. Since 12 August 1959 the faculty has been acting independently.

2019 FEEC Facts in Numbers

2,998
students

1,034
courses

190+
running projects

681
papers

64
prototypes, software and functioning samples

4
successfully completed habilitations

539
faculty employees

7
international conferences held by the faculty

PEOPLE AT THE FEEC

Management of the Faculty of Electrical Engineering and Communication (FEEC)

Dean
Prof. RNDr. Vladimír Aubrecht, CSc.

Vice-Dean for Study Affairs, statutary representative of the Dean
Prof. Ing. Jarmila Dědková, CSc.

Vice-Dean for Development and Strategic Planning
doc. Ing. Petr Fiedler, Ph.D.

Vice-Dean for International and Public Relations
doc. Ing. Jiří Háze, Ph.D.

Vice-Dean for Research and PhD study
prof. Ing. Jaroslav Koton, Ph.D.

Financial officer
Ing. Miloslav Morda

Organisational Structure

DEAN'S OFFICE

- Organising Department
  - Library
- Student Affairs Department
- Department of Science and International relations
- Personnel and Legal Department
- Accounting and Finance Department
- Information Systems Administration Department
- Branch Facilities Management: Technická

ACADEMIC SENATE

Chairman

- doc. Ing. Miloslav Steinbauer, Ph.D.

ACADEMIC STAFF CHAMBER OF THE SENATE

Chairman of Chamber

- Ing. Ivana Jakubová

STUDENTS' CHAMBER OF THE SENATE

Chairman of the Chamber

- Ing. Daniel Janík

SCIENTIFIC BOARD

Chairman of Scientific Board

- Prof. RNDr. Vladimír Aubrecht, CSc.

STUDY PROGRAMME BOARD

Chairman

- Prof. Ing. Jarmila Dědková, CSc.

DISCIPLINARY COMMITTEE

Chairman

- Ing. Helena Polsterová, CSc.

ETHICS COMMITTEE

Chairman

- doc. Ing. Jana Kolářová, Ph.D.

DEPARTMENTS AND RESEARCH CENTRES

- Department of Control and Instrumentation (UAMT)
- Department of Biomedical Engineering (UBMI)
- Department of Electrical Power Engineering (UEEN)
- Department of Electrical and Electronic Technology (UETE)
- Department of Physics (UFYZ)
- Department of Foreign Languages (UJAZ)
- Department of Mathematics (UMAT)
- Department of Microelectronics (UMEL)
- Department of Radioengineering (UREL)
- Department of Telecommunications (UTKO)
- Department of Theoretical and Experimental Electrical Engineering (UTEE)
- Department of Power Electrical and Electronic Enginering (UVEE)
- Centre of Research and Utilisation of Renewable Energy Sources (CVVOZE)
- Cenre of Sensor, Information and Communication Systems (SIX)

OTHER UNITS

- Trade Unions-ZO 2698
- Club 'Elektron'
- Faculty interactive playroom 'Elektrikárium'
- Multifunctional room for students 'Studentárium'

Habilitations and Appointments to Professorship

New associate professors at the FEEC appointed by the BUT rector in 2019

ELECTRONICS AND COMMUNICATIONS

→ doc. Ing. Jiří Blumenstein, Ph.D.

THEORETICAL ELECTRICAL ENGINNEERING

→ doc. Ing. Petr Marcoň, Ph.D.

ELECTRICAL AND ELECTRONIC TECHNOLOGY

→ doc. Ing. Jan Pekárek, Ph.D.

TELEINFORMATICS

→ doc. Ing. Lukáš Malina, Ph.D.

Number of faculty employees in 2019

Number of faculty employees:	539 (429.23 recalculated number)
Number of academic and scientific staff:	270 (233.20 recalculated number)
Average age of FEEC employees:	42.10 years
Ratio of women employees at FEEC:	22%

Important Awards and Prizes

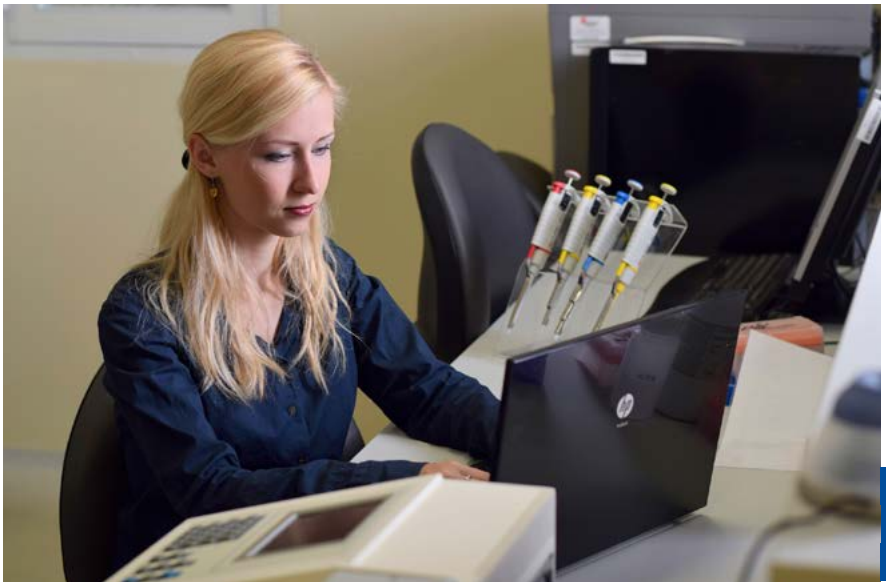


Photo: Oto Jaroušek

Experiments using computer modelling instead of laboratory experiments developped by Jana Musilová, significantly reduce the research price and time demand. The suggested methods can thus accelerate substantially the biotechnological industry.

Ph.D. Talent Award

A Ph.D. student Jana Musilová impressed the Brno Ph.D. Talent scientific committee with her research into the potential of new methods effectively describing regulation mechanisms of non-model organisms. So far, non-model organisms stood aside scientific focus as their properties (e.g. long reproduction time or inability to reproduce in laboratory conditions) made their thorough research either impossible, too difficult or too expensive to conduct. This is also the case of the Clostridium beijerinckii organism which is Jana Musilova's object of research. The aim of her research is to understand its metabolic buthanol production which could be used for fossil fuels replacement.

Czechitas Award for the best woman's Bachelor thesis

Kateřina Kočendová won the Czechitas Award prize with her Bachelor thesis named Gait and step counting using smartphone.

Photo: FEEC archive

Petr Baxant (the first from the left) and Jan Škoda (the third from the left) have been working on the development of luminiscence distribution analyser LDA-Lumi DISP for more than 20 years.

'GOLDEN AMPER' 2019 Award

The researchers from the Laboratory of Light and Illumination Technology (UEEN) were awarded with a GOLDEN AMPER prize and a prize for one of the most useful exhibits at the AMPER exhibition where they presented a luminiscence distribution analyser LDA-LumiDISP. This measuring tool based on digital camera with a special evaluating software is able to measure luminiscence and its distribution in any environment. The analyser measures the luminiscence distribution by an internationally approved methodology UGR (U|nified Glare Rating), which very few tools in the world can. A great advantage is that it uses a commercially affordable camera for professional measuring purposes. In addition, this tool enables extremely precise measurement compared to low construction costs, which makes it unique with respect to other similar products constructed with the same aim.

Photo: FEEC archive

Luminiscence distribution analyser based on the principle of an affordable camera.

Zdena Rábová Prize

On 20 September 2019 a biomedical engineering student Veronika Kamenská and her colleagues from the Faculty of Information Technology BUT Tomáš Chlubna and Aleš Řezáč were awarded with the Zdena Rábová Prize by Pavel Zemčík, the dean of the Faculty of Information Technology. This prize is intended for outstanding students' performance in research and development. The students created a mobile application No panic! which can immediately help people with panic attacks or suicide intentions. Their creative work included cooperation with both hospital and private psychiatrists and psychologists. The application contains five modules which its user chooses according to his or her current emotional state. The modules include quick aid for depression, anxiety and panic, self-harm and suicide intentions. The last module offers professional help.

Photo: Oto Jandušek

No panic! application offers an immediate psychological help.

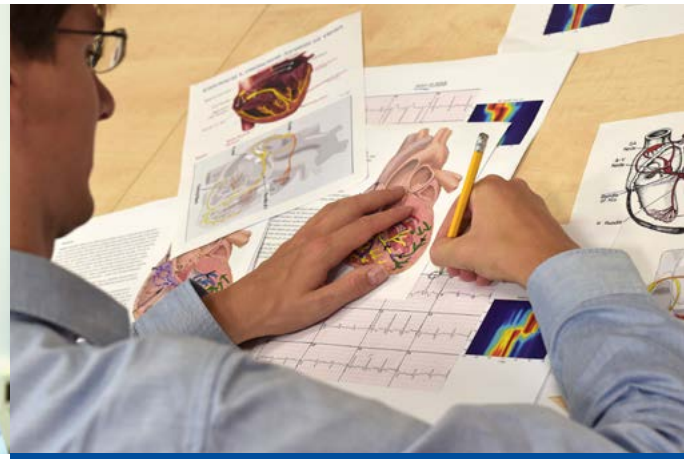


Photo: Oto Janoušek

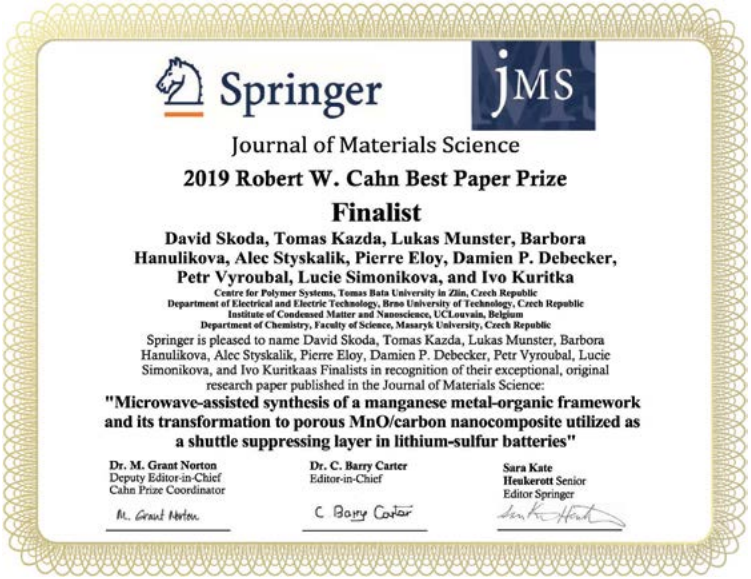
Radovan Smíšek has been continuously analysing cardiosignals.

Josef Hlávka Prize for outstanding students

On 17 November 2019 at the Lužany u Přeštic chateau medals were handed over to meritorious scientists for their lifelong effort and talented students were awarded with prizes from the 'Nadání Josefa, Marie a Zdeňky Hlávkových' Foundation. That year the five awarded BUT students also included our faculty student Pavla Šabacká and a Ph.D. student Radovan Smíšek who both conduct research and development activities. Pavla Šabacká was awarded for her longterm cooperation with the Department of Electrical and Electronic Technology of the FEEC BUT and the Institute of Scientific Instruments of the Czech Academy of Sciences where she had participated in the research in mapping vaccuum chambers in an electronic microscope since her secondary school studies. Radovan Smíšek has been continuously analysing cardiosignals. At the Department of Biomedical Engineering he focuses on the development of software tools for detection and classification of cardiopathologies.

Best Publication Prize

Tomáš Kazda was awarded with Best Publication of November 2019 Prize by the Journal of Material Science for a paper called Microwave-assisted synthesis of a manganese metal-organic framework and its transformation to porous MnO/carbon nanocomposite utilized as a shuttle suppressing layer in lithium-sulfur batteries. The paper was written in cooperation with the Polymer Systems Centre, UTB Zlín and it was also nominated for the Robert W. Cahn Best Paper Prize.



Springer

JMS

Journal of Materials Science

2019 Robert W. Cahn Best Paper Prize

Finalist

David Skoda, Tomas Kazda, Lukas Munster, Barbora Hanulikova, Alec Styskalik, Pierre Eloy, Damien P. Debecker, Petr Vyroubal, Lucie Simonikova, and Ivo Kuritka

Centre for Polymer Systems, Tomas Bata University in Zlin, Czech Republic
Department of Electrical and Electric Technology, Brno University of Technology, Czech Republic
Institute of Condensed Matter and Nanoscience, UCLouvain, Belgium
Department of Chemistry, Faculty of Science, Masaryk University, Czech Republic

Springer is pleased to name David Skoda, Tomas Kazda, Lukas Munster, Barbora Hanulikova, Alec Styskalik, Pierre Eloy, Damien P. Debecker, Petr Vyroubal, Lucie Simonikova, and Ivo Kuritkaas Finalists in recognition of their exceptional, original research paper published in the Journal of Materials Science:

"Microwave-assisted synthesis of a manganese metal-organic framework and its transformation to porous MnO/carbon nanocomposite utilized as a shuttle suppressing layer in lithium-sulfur batteries"

Dr. M. Grant Norton
Deputy Editor-in-Chief
Cahn Prize Coordinator

Dr. C. Barry Carter
Editor-in-Chief

Sara Kate Heukerott Senior Editor Springer

Invited lecture in the Research Laboratory of Electronics, Massachusetts Institute of Technology (MIT)

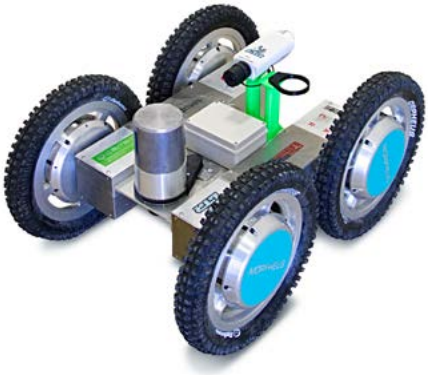
On 1 September 2019 Jiří Mekyska presented a summary of a 10-years' research in Brain Diseases Analysis Laboratory (BDALab) focusing on quantitative analysis of hypokinetic dysartry (HD) in his invited lecture in the Research Laboratory of Electronics, Massachusetts Institute of Technology (MIT) at the 1st Automatic Assessment of Parkinsonian Speech Workshop (AAPS 2019). The workshop on HD acoustic analysis hosted participants from the most prestigious universities in the world (Harvard University, Johns Hopkins University, etc.) and Jiří Mekyska not only presented the BUT research but also prepared ground for establishing a joint research of these universities in monitoring the Parkinson disease and finding new advanced diagnostic methods.

Well-known Figures

"We are creating robots from the first draft to the last screw. We don't want to research for 20 years into something which turns out to be useless," says Luděk Žalud

Photo: Luděk Žalud archive

Luděk Žalud and his team are creating a semi-automatic robotic platform called Ateros which can be operated by a single person.



Professor Luděk Žalud has been focusing on robotics for 18 years. His success at the international competition of rescue robots (Robocup Rescue League) made ground for his future passion for this field and nowadays he leads a team of 12 specialists at the Laboratory of Telepresence and Robotics at the FEEC BUT, where he focuses on robotic platforms for the army and medical use. In his opinion robotics has changed dramatically over the last 20 years and that will change even more with the AI implementation. The biggest challenge for Prof. Žalud and his team, however, is not a technical one, in his opinion. It is their desire to keep common sense and joy to work despite an intensive working strain and an increasing workload of projects and contracts.

At the International Engineering Fair in October 2019 Luděk Žalud and his colleagues presented three projects: terrestrial robots Orpheus and Morpheus and a Uranus drone. "Orpheus is a robotic platform we have been developping since 2003 with over 14 different types," said Prof. Žalud. Orhpeus is produced in two versions, civilian and army one. "Army

type is intended for the so-called CBRN recognoissance, i.e. chemical, biological and radiation-nuclear threats. Now we are working on a third generation of these devices which will be used by the Chemical Unit of the Czech Army," said Prof. Žalud, explaining that by 2022 40 robots would be delivered to the Czech Army.

The civilian version of Orpheus is intended for research. "We use it for example for exploration of algorithms of mobile robots exact self-localisation. We also work on the development of multispectre 3D mapping and environmental mapping.", explained Luděk Žalud, adding that civilian versions are always intended for testing new technologies which might be then used for the army version. "Now we focus mainly on environmental radiation measuring. We cooperate for example with the National Radiation Protection Institute (SÚRO) responsible for civil nuclear security in the Czech Republic," said Luděk Žalud.

Morpheus is, according to Prof. Žalud, a simplified version of Orpheus in a certain sense, using also a part of his name. "We added only 'M', as the device can change its form. And I admit we were also influenced by the Matrix movie." Morpheus is cheaper than robots intended for the army. It is also better equipped for environmental measuring. "In the centre of the robot's body there is a space for a radiation sensor which is rather huge. We saved the space by locating the main engines into the wheels," described Prof. Žalud. The device can localize the radiation source and detect it. Now he and his team are developping a new type which will be equipped with a manipulator that will enable to grab the radiation source and relocate it. Morpheus can also be used for measuring temperature and harmful substances or land quality testing.

Firefighters use a similar-type robot which instead of radiation detects the condition of electromobile batteries after a car crash. "After an electromobile crash there is a substantial danger of igniting lithium-polymere or lithium-ion batteries which emit high heat and are difficult to extinguish. Therefore, the electromobile is first accessed by a robot to detect a possible danger, and only then firemen and rescuers can approach it," explained Prof. Žalud.

Even though in the laboratory he and his team are already working on fully autonomous devices, in Prof. Žalud's opinion it will still take a long time to create robots that could work in rescue and exploration missions without human control. "Nowadays devices

Photo: Luděk Žalud archive

Morpheus robot is intended for environmental measuring, especially for locating radiation sources.

Photo: Luděk Žalud archive

Civilian version, Orpheus, is used for testing new technologies that will be then applied to army devices.

are not equipped with sufficient AI to solve such demanding missions such as searching for things or people in a difficult terrain," he said. So far, they are able to work as a prolonged human hand. "They are controlled remotely and the intelligence source is human. Nevertheless, they can save lives, as they can be used in dangerous situations instead of a human," added Prof. Žalud.

The third exhibit at the International Engineering Fair was a drone used for mapping locations. "The drone itself is the least interesting part. More remarkable is the appliance carried beneath. Thanks to that it can create an extremely detailed 3D digital map of the location it flies above. We are perhaps the first in the world to create such a precise map just with the help of a small drone. Thanks to the combination of a good quality camera, an exact GPS localiser and inertial navigation the drone can shoot from different angles and from various places. However, it still keeps track of the exact location and the camera angle. Using such information a software can calculate a detailed 3D map," explains Prof. Žalud.

Robots and drones from the Laboratory of Telepresence and Robotics at the FEEC BUT represent the ATEROS system, i.e. autonomously telepresent robotic system. "Our goal is to have a range of robots with different qualities which can be operated by a single person who controls them. Our devices, nevertheless, are partially autonomous and they can explore locations on their own. They immediately inform the operator whenever they find something suspicious. The operator can control all of them by a VR helmet which enables to have an immediate real-life like experience," described Prof. Žalud. Apart from the army and environmental measuring the robots could thus be used for e.g. guarding strategic objects. "It is well-known that BUT is a university oriented on real life impact. That was one of the reasons we chose these appliances because they are practical and can be successfully sold in the market. We do not want to research for 20 years into something that turns out to be useless," said Prof. Žalud. Their research proved to be successful, as the BUT together with a spin-off LTR company have managed to sell more than 10 robots so far.

"I wouldn't like to sit at the computer and do the programming. I like to communicate with patients," says David Pospíšil, the author of a unique catheter and a heart electrophysiology specialist

Combining electrical engineering and medicine proved to be a successful choice for David Pospíšil. During his studies of biomedical engineering at the FEEC BUT he developped a liking for heart and the study of cardiology. Today, he meets his patients at the operating halls of Internal Cardiology Clinic of the University Hospital Brno, where he, being attested as a clinical engineer, manages a team of 8 other engineers. In addition, he focuses on popularisation of technical cardiology, he is about to defend his doctoral thesis in cardiology and during his internship in the United States he participated at the development of a catheter which could influence substantially the ablation cure for heart arrhythmias.

Patients with heart defects and various circulation system diseases meet biomedical engineers in hospitals more and more often. In the University Hospital Brno there is a growing team of specialists who can help to choose the right stimulator, defibrillator or other supporting technology. They also cooperate at invasive procedures during which they manage the right device operation and its setting.

It is David Pospíšil's task to manage the team of biomedical engineers. "Originally, I studied electrical engineering because my father works in that field. During my bachelor studies, however, I took some optional courses from the Department of Biomedical Engineering. I enjoyed the combination of electrical engineering and medicine very much. It was too late for me to start studying medicine though, and that is why biomedical engineering proved to be a most interesting choice," described his origins David Pospíšil. In his diploma thesis he focused on EKG, that is why he started to cooperate with the University Hospital Brno and finally he continued on his Ph.D. studies there.

This year, after seven years spent at the Internal Cardiology Clinic, he became the manager of the biomedical team. "Cardiology is the field where biomedical engineers are most needed, as there is a lot of technical equipment. Moreover, it is mostly working with the electric signals. We cooperate closely with doctors and take an active part in operations. Recently, we have started to develop a field of echocardiography or outpatient checkups," said David Pospíšil. In the future the patients in surgeries will thus meet engineers more often, as they will be focusing on function and performance of the operated-in devices. "During the 7 years I have spent working at the

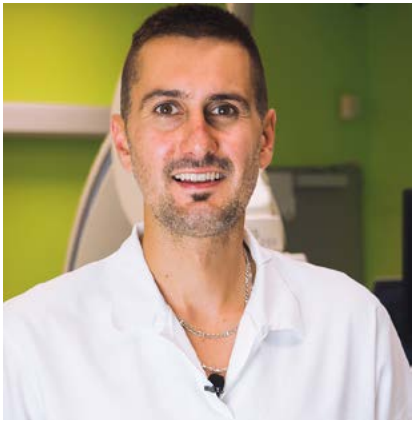


Photo: David Pospíšil archive

Biomedical engineer David Pospíšil now manages a specialist team in the University Hospital Brno.

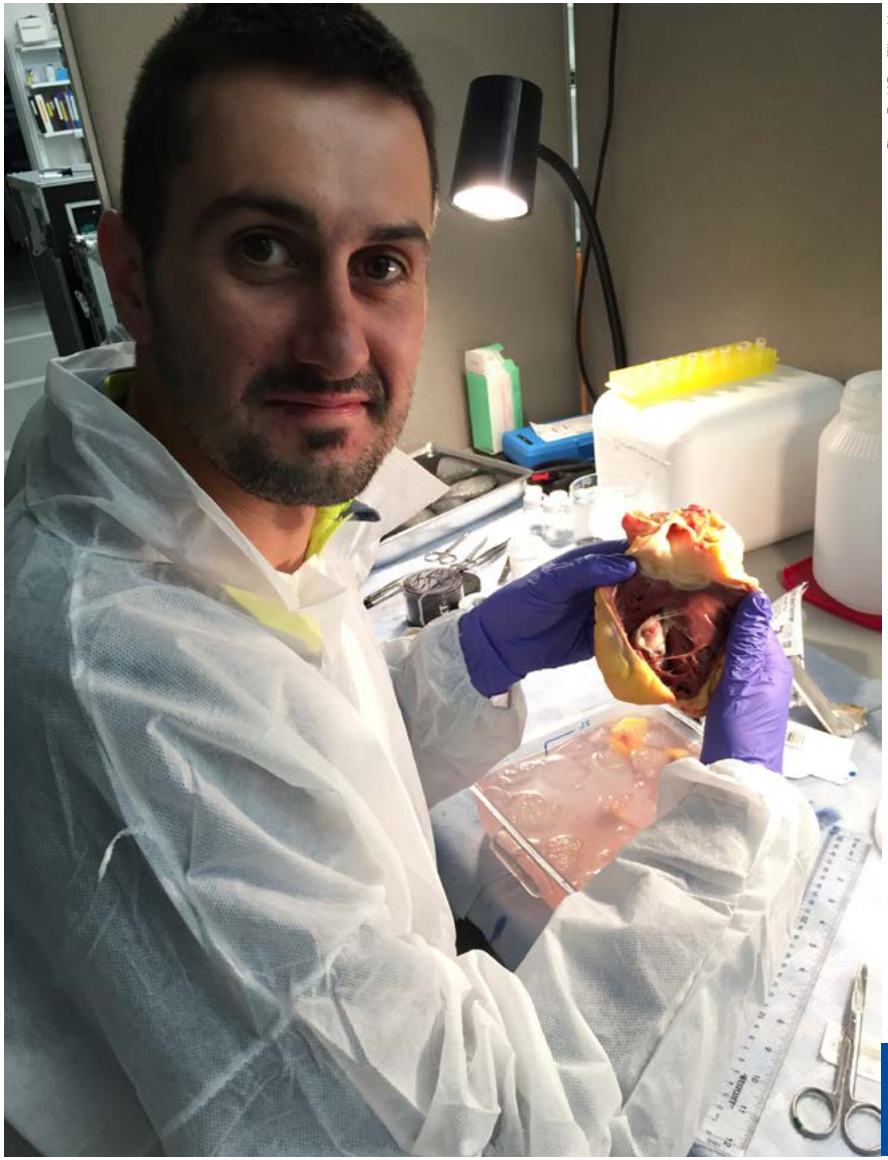


Photo: David Pospíšil archive

In David Pospíšil's opinion electrical engineering is very close to cardiology.

hospital I have noticed the dynamic development of the field. What is more, our current superintendent is a true visionary in his field in the Czech Republic and he has managed to establish a real interventional cardiology centre here, so the facilities are progressive indeed," he added.

What David Pospíšil likes about the field is a combination of technology and medicine and its impact on real people. "I am happy I don't have to sit at the computer and do some programming. I can meet patients, help them and push the limits of medicine forward," he said. A catheter David Pospíšil helped to develop during his recent internship at The George Washington University in the USA could have a radical impact on patients' treatment.

There, under the world-renown specialist Igor Efimov's supervision, he worked on the catheter for diagnostics and therapy of heart arrhythmia. He developped a solution which the university decided to patent. "Professor Efimov noticed my work during another common project in which I worked at the Invasive and Intervention Electrophysiology of the Internal Cardiological Clinic (IKK) at the University Hospital Brno (FN Brno) and I focused on technical details of research in low-energy heart chambers stimulation. He found out that in my Ph.D. thesis I research the electrophysiology of heart chambers, and so he finally invited me for an internship to his laboratory," he explained.

The catheter he developped in the USA can rapidly shorten the operation time. After its implementation signals from the concerned areas are gathered during a couple of heart contractions. If the doctors discover the reason of arrhythmia, they can immediately remove it by directed radiofrequence. "The problem is that in the chamber there is only one blood discharge which cannot be obstacled, otherwise we would block the circulation. The new catheter type fastens the whole operation. Moreover, it unfolds in the chamber and sticks to the walls, but it is hollow, so the blood can still circulate in," David Pospíšil explained the main advantages.

Nevertheless, there are still many unanswered questions in the heart resynchronising treatment. "We have a small percentage of patients who do not react to the treatment and we don't know if it is the question of the device setting, timing or locating the electrode. Or perhaps there are any other influences we do not know yet," he said.

In addition, David Pospíšil tries to popularize the whole field and the image of biomedical engineers in the medical community. "I would like to show more what we are doing because I believe that the field of study should be renowned not only by our colleagues from hospitals, but also by other doctors in general," he said. He also tries to find his followers and he works as an external lector at the Department of Biomedical Engineering at the FEEC BUT. "It is good to see that if you prepare your lectures thoroughly and you dedicate your time to students, you can see how interested they are in that topic," David Pospíšil says and he also believes that there are many potential colleagues in his lectures.

Photo: Jakub Rozboud

RESEARCH AND DEVELOPMENT AT THE FEEC

Photo: Jakub Rozboud

Projects

Faculty of Electrical Engineering and Communication ranks to the top both in the basic and the applied research in all fields of electrical engineering, electronics and related fields. Our research teams solve many projects independently, but most projects are based on cooperation with other research centres, universities and renowned companies. The faculty is successful in achieving both national and international grants from other subjects.

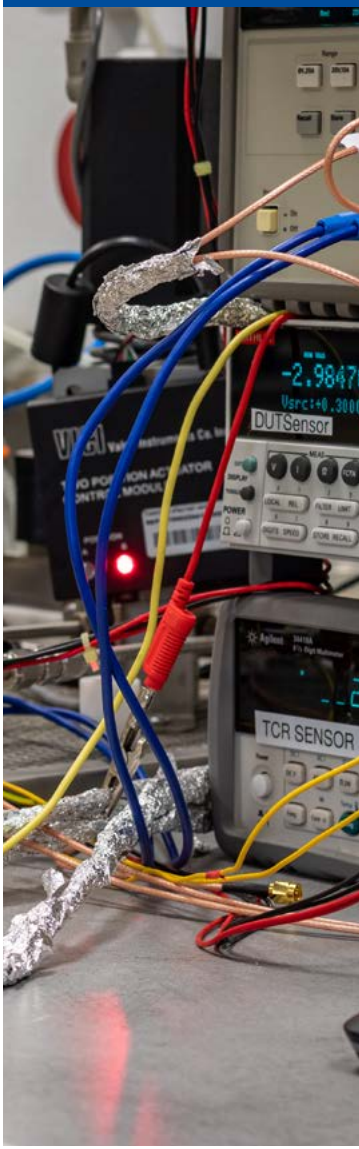
Research Fields

Our faculty obtains remarkable results in various fields of study, not just in electrical engineering. In each field there are many research teams able to participate at the research and development of joint projects with industrial partners as well as in contractual research.

Research Teams:

- AUTOMATION, ROBOTICS AND SENSORS
- MICRO- AND NANOELECTRONICS
- BIOMEDICAL ENGINEERING AND SIGNAL PROCESSING
- RADIOELECTRONICS AND COMMUNICATION TECHNOLOGIES
- ELECTRICAL TECHNOLOGY
- TELECOMMUNICATION AND INFORMATION SYSTEMS
- INFORMATION AND CYBERNETIC SECURITY
- POWER ELECTRONICS AND ELECTRIC POWER

Photo: Jakub Rozboud

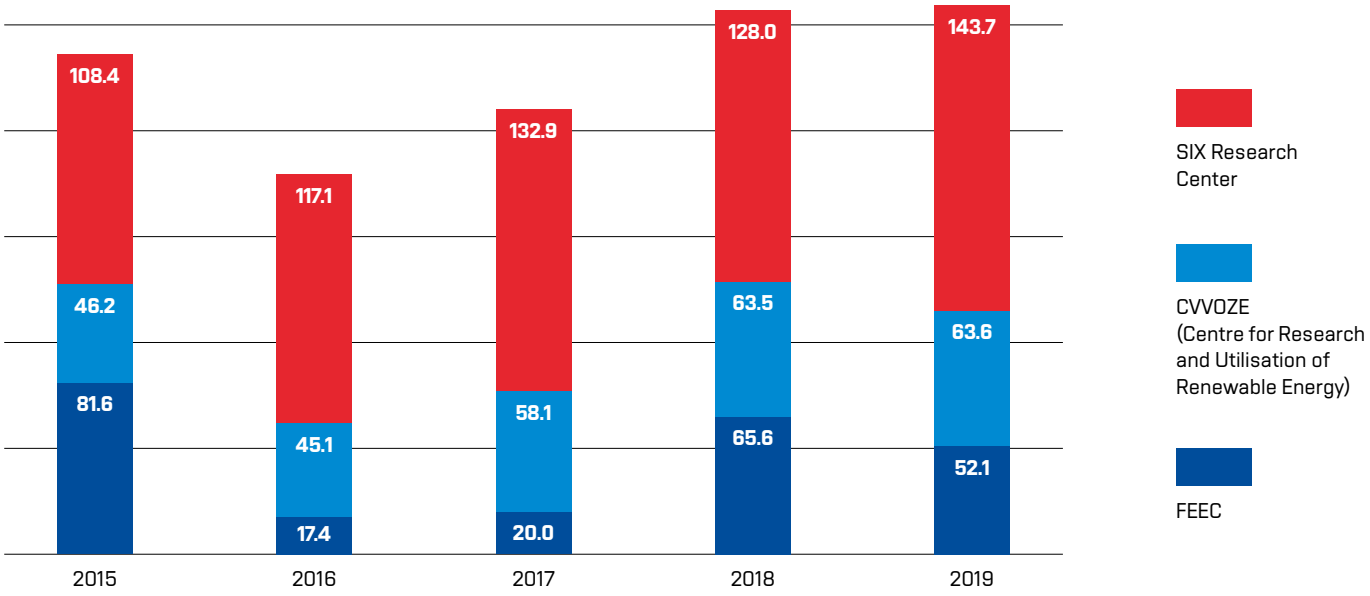


Research and Development in 2019

In 2019 the researchers from the FEEC solved more than 190 projects with industrial as well as foreign partners and the overall financial aid exceeded 250 million CZK. The main financial aid providers for basic and applied research are Technology Agency of the Czech Republic (TA ČR), Ministry of the Interior of the Czech Republic (MV ČR), Ministry of Education, Youth and Sports (MŠMT) and Czech Science Foundation (GA ČR). The biggest FEEC grant projects include research into diagnostic tools of portable electronics, development of sensors that will explore the atmosphere composition and the concentration of particles absorbed in there, or e.g. cryptographic mechanisms for privacy protection within European Union cybernetic security framework.

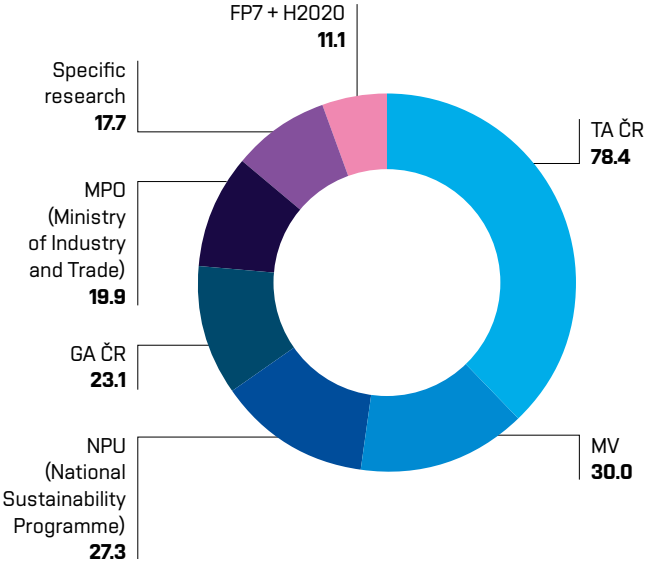
Research centres and faculty departments participation at the R&D financial aid

(mil. CZK)



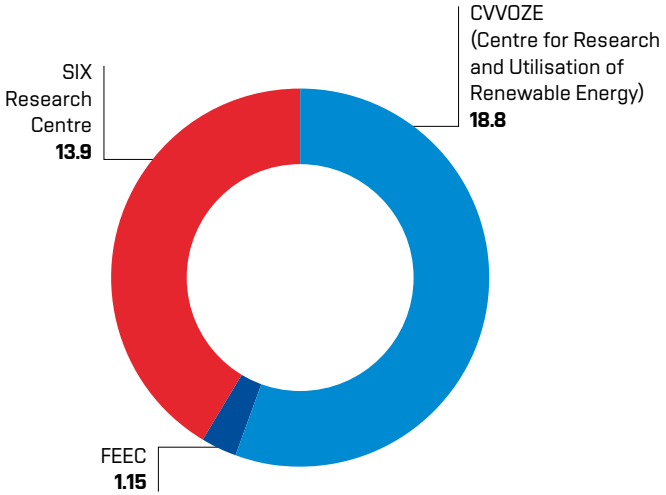
Main providers of R&D financial support in 2019

(mil. CZK)



Commercial contract research at the FEEC in 2019

(mil. CZK)



Commercial Contracts Research

Financial revenues from commercial contracts in 2019 were almost 34 mil. CZK, including regional research centres CVVOZE and SIX. The research was based on both direct business contracts and students' diploma and dissertation theses.

Numbers of final works with a topic related to industry in 2019:

Bachelor theses:	28
Diploma theses:	38

Important Projects

SPARTA (UTKO)

The SPARTA project (Special projects for advanced research and technology in Europe, https://www.sparta.eu), which falls under the European programme Horizon 2020, focuses on the field of cybernetic security. Within a couple of years the European Commission plans to establish a European centre of competence which should unite excellent experts and workplaces on cybernetic security in Europe. 44 partners from all Europe participate at the SPARTA project, aiming at the development of the competence net, identifying topics for future research and creating innovative strategies for the European protection from cybernetic threats. The Department of Telecommunication, FEEC BUT, focuses on two key activities in the SPARTA framework. The first is training and raising awareness in cybernetic security. This activity, closely tied to teaching, focuses on creating the so-called "best practice", i.e. identifying what a study programme on cybernetic security should look like and what knowledge and skills it should deliver to its students. Many years of teaching experience in the popular study programme called Information Security taught at the Department of Telecommunications will be beneficial also for the SPARTA project. Almost five years of experience with designing, accreditation and providing the study programme will help universities that do not have such a programme yet and they are thinking of starting it. The outcome of the project will be a set of recommendations for teaching courses and programmes aimed at cybernetic security at other EU universities.
The second project activity involves research in modern cryptography and the Internet of Things (IoT). It is mainly focused on digital identity protection, privacy protection and personal data misuse.

Provider:	H2020
Principal investigator:	doc. Ing. Jan Hajný, Ph.D.
Start date:	1. 2. 2019
End date:	31. 1. 2022
Total funding:	€ 15,999,913, of which BUT € 452,140

Photo: David Konečný, UTKO archive

Digital device representation as an AAS for IT production (UAMT)

In industry production following the Industry 4.0 Standards individual production appliances, newly created appliances and other components communicate with each other without any intermediaries or superordinate control devices. Thus, they need to have a so-called digital shell, i.e. Asset Administration Shell (AAS). A digital AAS is an active virtual component representation and it also represents an interface between a physical, software, economic or other production component, i.e. Asset and its digital representation. According to Industry 4.0 standards each production component needs to have an AAS. The above-mentioned project focused on the creation of methodology for automatized shell design following the Industry 4.0 standards. The result is a set of user-friendly software units for component configuration and testing.

For their testing a virtual production line with 3D printers, robots and components and product warehouses was designed which followed the European electrical engineering standards in Industry 4.0. Modern communication devices, such as OPC UA, MQTT, knowledge discovery, mapping methods and others were used for that.

The suggested automatized solution effectiveness was far higher than the manual AAS model designs and the project results in digital production components counterparts exceed highly the usual standard solutions common in the Czech Republic.

Provider:	TA ČR
Principal investigator:	Prof. Ing. František Zezulka, CSc.
Start date:	1. 1. 2018
End date:	31. 12. 2019
Total funding:	36,985,360 CZK

Dynamics of systems with focus on their algebraic and topological structure (UMAT)

Mathematical models of the issues of manageability and controllability of dynamical systems are often represented by delayed differential and difference systems. Issues important for describing their behaviour include their solvability, stability and periodical and oscillatory properties. The project aimed at identifying optimal criteria providing the above mentioned qualitative properties of solution, and finding suitable mathematical models. Sufficient conditions of asymptotic stability of feedback systems and of relative controllability of discrete systems of higher orders were established. In the case of a mathematical model of underwater wireless sensor networks, EL-hyperstructures and ordered hypergroups were used. All results were original ones and were published in renowned impact factor journals.

Provider:	Brno University of Technology
Principal investigator:	doc. RNDr. Zdeněk Šmarda, CSc.
Start date:	31. 1. 2017
End date:	31. 12. 2019
Total funding:	2,778,000 CZK

Lukáš Smital and his colleagues manage research activities in

Photo: Oto Janoušek

automatized annotation of ECG record quality.

Photo: Jakub Rozboud

Health and activity monitoring by wearables in extreme conditions (UBMI)

The project focuses on the software development for biological signal analysis recorded by wearable devices for professionals, such as soldiers, fire-fighters, etc. These devices allow for monitoring vital signs of persons under extreme conditions (e.g. electric activity of the heart, brain or muscles) together with tracking the persons' motion. The aim of the project is to measure the negative extreme conditions influence on biological signals and evaluate the reduced data quality influence on their diagnostic usage.

For this purpose new mathematical procedures for setting the biological signal quality and their diagnostics will be created. Computational algorithms will be designed in such a way that they will be able to work in real time reflecting the professionals in action' activities. The software will be used in a compact wearable device developped in cooperation with the Mayo Clinic and financially supported by the United States Office of Naval Research Global. The project results will prevent health damage or sudden death in service.

Provider:	The Office of Naval Research (ONR)
Principal investigator:	Ing. Lukáš Smital, Ph.D.
Start date:	1. 1. 2019
End date:	31. 12. 2021
Total funding:	218,075 USD (4,980,833 CZK)

Development of new electrochemical power storage: accumulators (UETE)

During 2019, the Department of Electrical and Electronic Technology was supported by a grant for quality Czech research development. The main aim is to research new materials for Na-ion and Li-S accumulators. Their advantage is a lower price and an easy accessibility of the materials used, which could offer similar, or much higher capacity and lower price compared to the original Li-ion accumulators.

Provider:	MŠMT, INTER-EXCELLENCE
Principal investigator:	Ing. Tomáš Kazda, Ph.D.
Start date:	31. 3. 2019
End date:	31. 12. 2022
Total funding:	12,600,000 CZK

Intelligent power grids (UEEN)

The aim of the project is to develop fast, precise and easy-to-use tools for control and protection of power grid and shortening the time of fault recovery by using secure ICT, as well as implementation of adequate protection and control algorithms.

An inherent part of the project is a local distribution network of 22kV supplying BUT buildings located in Pod Palackého vrchem campus. In individual consumption sites current and voltage sensor measurements are installed. The measured data can be used in real time for analysing the current grid state and its possible faults. They can also be used for testing the newly created protection algorithms and see how the grid reacts in the long term. The research in secure technologies for data transmission and processing is another part of the project. This is the reason why the intelligent power grid is also used for testing different communication technologies and newly created applications for cybernetic security. The main aim is thus creating a secure and reliable communication network for industry and power applications.

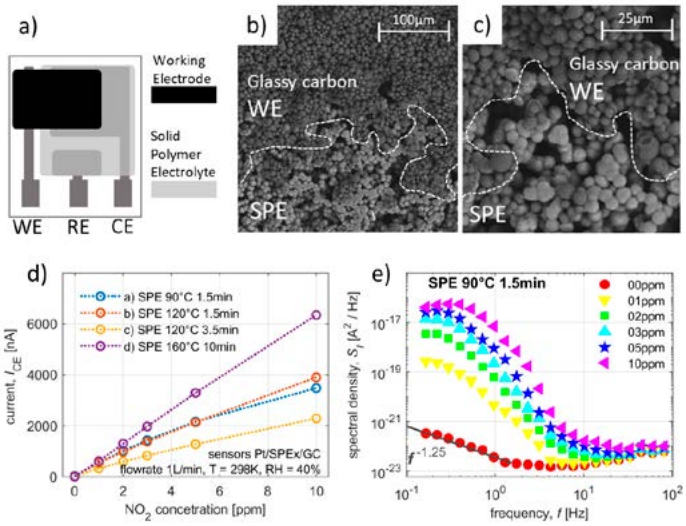
Provider:	TA ČR
Principal investigator:	doc. Ing. Jaroslava Orságová, Ph.D.
Start date:	1. 9. 2018
End date:	31. 8. 2023
Total funding:	35,500,000 CZK

Photo: UEEN archive

Influence of polymer electrolyte crystallinity and carbon electrode morphology on charge transportation and its fluctuation in electrochemical gas sensors (UFYZ)

The project is an experimental study on the influence of polymer electrolyte crystallinity and carbon electrode morphology on charge transportation between the electrode and electrolyte interface from the perspective of physical and functional properties of electrochemical gas sensors. The main project asset and originality lies in the analysis and unique evaluation of the electric charge transportation fluctuation through diverse morphology of the electrode/electrolyte interface. The charge transportation fluctuation, i.e. Bernamont noise, is well-known as an unwanted and disturbing additive element carrying no information. However, many works show that it can be used for finding information on chemical and physical processes at active chemical sensors interfaces in order to improve their selectivity and sensitivity.

Provider:	GA ČR
Principal investigator:	doc. Ing. Petr Sedlák, Ph.D.
Start date:	1. 1. 2018
End date:	31. 12. 2020
Total funding:	5,548,000 CZK



a) sensor topology, b–c) morphology of glassy carbon/polymer electrolyte interface, d) dependence of the current on concentration for four polymer electrolytes with different crystallinity, e) spectral density of current fluctuations for growing concentrations of a detected substance

Design of a FWC control unit in 3MI instrument for MetOp satellites of the second generation (UMEL)

The Department of Microelectronics cooperates in this project with the European Space Agency (ESA) and the RUAG company. The European contribution in the Earth's atmosphere research and meteorological observations from the polar orbit started with the first generation of meteorological satellites (MetOp) launched in 2006 and it followed with launching two more satellites MetOp-B and MetOp-C in 2012 and 2018. The MetOp-SG satellite second generation's task is to monitor the Earth's atmosphere from the polar orbit for the following 8.5 years of its supposed lifespan. The first of the MetOp-SG-A satellite series with the planned launch in 2021 will carry 8 of all these instruments in total, including a set of 3MI sensors (Multi-view, Multi-channel, Multi-polarization Imager), which will help to explore the content and concentration of particles in the atmosphere.

Provider:	ESA
Principal investigator:	doc. Ing. Lukáš Fujcik, Ph.D.
Start date:	1. 1. 2017
End date:	31. 12. 2020
Total funding:	approx. 12,000,000 CZK

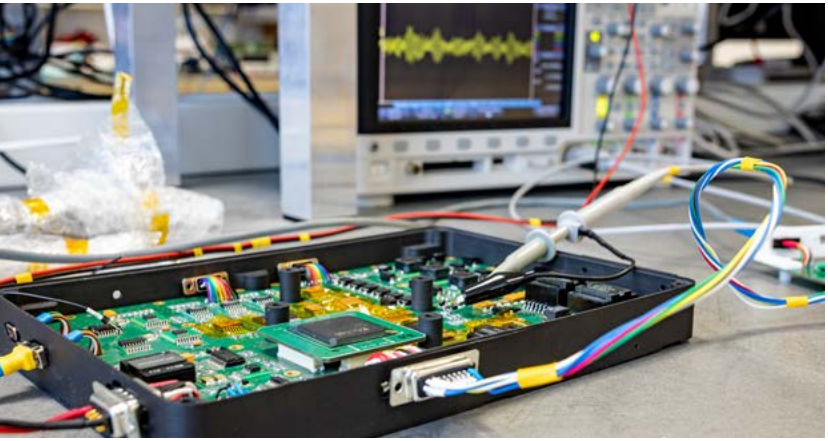
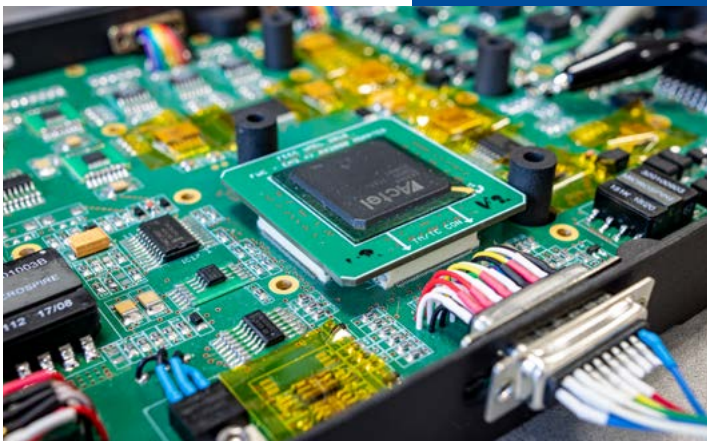


Photo: Jakub Rozboud



Automatized barrier tracking for pedestrians and physically disabled (UREL)

Photo: UREL archive

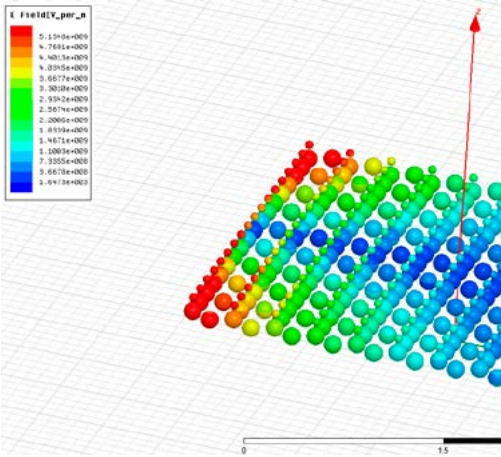
Mapping vehicle scans data from pavements and trails inaccessible for mapping cars.

The appliance for planning the easiest path for a pram or a wheelchair was developped at the Department of Radioelectronics under the supervision of Tomáš Götthans. A unique three-wheel vehicle scans data from pavements and trails inaccessible for mapping cars. It can find and recognise a barrier or rough surface. Using the appliance disabled people will be able to find the easiest way to a shop or an office. The idea of a mapping vehicle that could reach the locations inaccessible by car originated from the CEDA Maps company which focuses on mapping data creation for Google or for their own applications. The company asked the Department of Radioelectronics to develop a vehicle which could map pedestrian trails. The tricycle is powered by electrical engine to reach a longer distance. With the vehicle an operator can map from forty to seventy kilometres of trails a day. Apart from the ability to detect a slope the vehicle can scan the locations using neural network and it enables street view, thanks to which a person can see the trail in 3D or classify objects, i.e. find out whether there is a pavement, a kerb, a wall or a traffic sign. The vehicle can measure the pavement width and height as well as detect rough surface. So far, the vehicle is being tested and the authors are still improving the algorithms and minor construction details.

Photo: Jakub Rozhoud

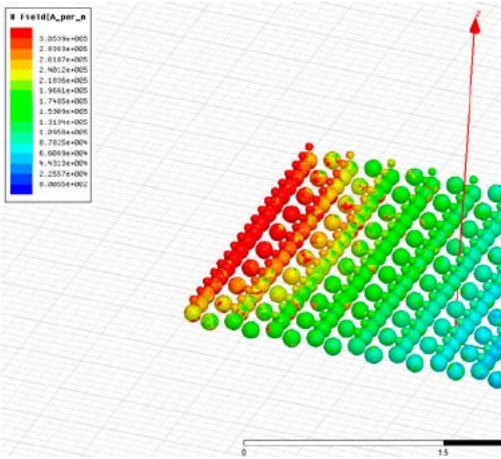
Provider:	TA ČR
Principal investigator:	doc. Ing. Tomáš Götthans, Ph.D.
Start date:	1. 1. 2017
End date:	31. 12. 2019
Total funding:	2,852,105 CZK

Photo: Jakub Rozboud



Complex artificial electromagnetic structures and nanostructures (UTEE)

The project aimed at exploring and describing complex artificial structures and their reaction to the high-frequency electromagnetic field. These structures display an unusual reaction not commonly seen in natural structures. The research was focused on theoretical properties description and analysis. To verify the hypothesis testing samples were created to explore their behaviour. The project also researched the methods for graphen preparation. The created samples can be used for improvement of emitters, sensors and other system properties. A special attention was dedicated to the development of numerical and circumferential models of periodical systems including a carbon nanotube (nanofibre) and graphen. In the project measuring and imaging methods including magnetic resonance were also researched and improved. An electron microscope and selected analytical methods were used for exploring internal processes.



Electric and magnetic field parametric analysis of an organic periodical system

Provider:	GA ČR
Principal investigator:	Prof. Ing. Pavel Fiala, Ph.D.
Start date:	1. 1. 2017
End date:	31. 12. 2019
Total funding:	9,555,000 CZK (FEEC: 2,939,000 CZK)

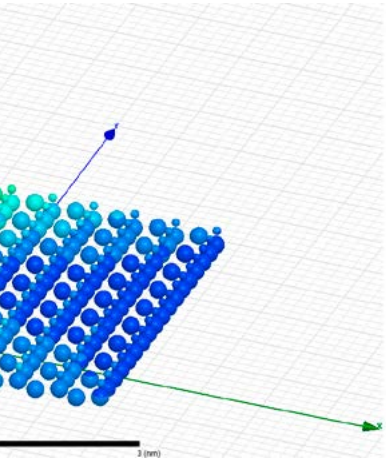
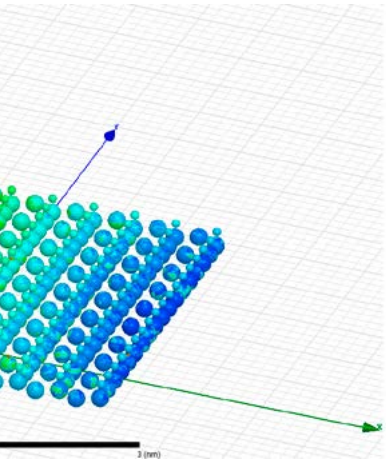


Illustration: Petr Fiala archive



High-revolution systems technology for termonuclear fusions (UVEE)

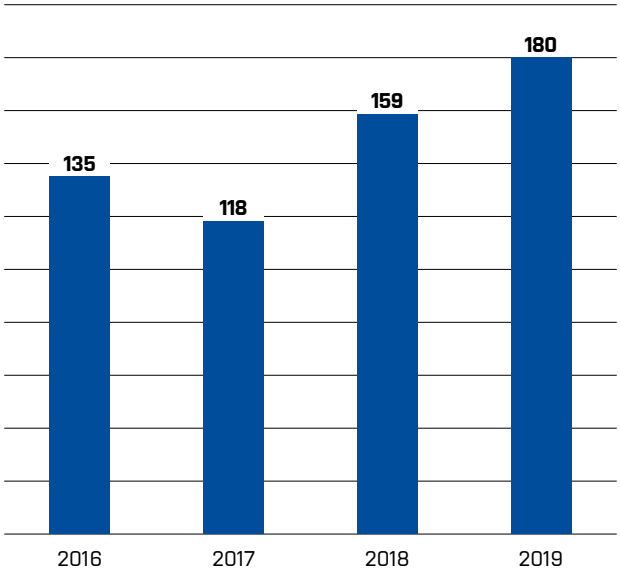
The project aims at research and development of high-revolution technology for helium primary heat transfer system (PHTS) of a fusion reactor. The necessary technology elements to be researched and developped are: working stage of in-built high-revolution electric engine and magnetic bearings including their control and frequency switch security. The developped high-revolution technology should have the minimum parameters of 10.5 MW, 8,000 min^{-1}, 6 kV. To reduce the project economic cost the technology will be delivered in full technical documentation, but its technological key features will be verified at a test sample with parameters of 350 kW, 6 kV.

Provider:	TA ČR
Principal investigator:	doc. Ing. Ondřej Vítek, Ph.D.
Start date:	1. 8. 2019
End date:	31. 12. 2025
Total funding by BUT/project:	approx. 31,000,000 CZK / 69,000,000 CZK

PUBLICATIONS

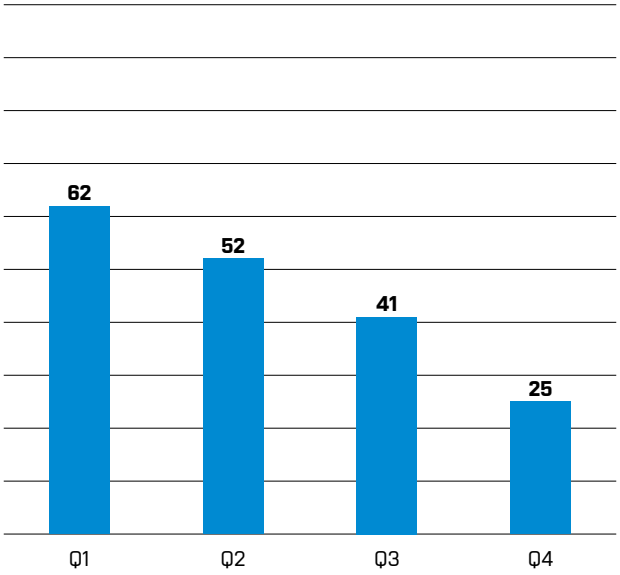
Number of WoS journal publications

(without quartile specification)



FEEC publication profile in 2019

(Number of WoS journal papers)



8
books or book chapters

203
papers in Web of Science Core Collection (WoS)

307
conference proceedings registered in WoS or Scopus

64
prototypes, software or functioning sample

6 utility models or industrial designs

→ Communication test environment for the transmission and distribution network

→ Stress tester ICT

→ Template for creating spherical solder outlets on BGA bushings

→ Electroporation generator for heart tissue ablation

→ Nuclear fuel with innovative neutron absorber – Nuclear fuel, fuel pellet containing this fuel and fuel rod containing at least one of this pellet

→ Nuclear fuel with decreased central temperature – Nuclear fuel, fuel pellet containing this fuel and fuel rod containing at least one of this pellet

2 Czech patents

THERAPEUTIC-DIAGNOSTIC UNIT FOR MEASURING AND TREATING POSTURAL STABILITY DISORDERS

Document no:	308067
Authors:	Chromý, A.; Žalud, L.
Patent owner:	BUT (100%)

ELECTRIC MACHINE FAN

Document no:	307822
Author:	Veselka, F.
Patent owner:	BUT (100%)

FEEC DEPARTMENTS AND RESEARCH CENTRES

Photo: Oto Jenoušek

Photo: UAMT archive

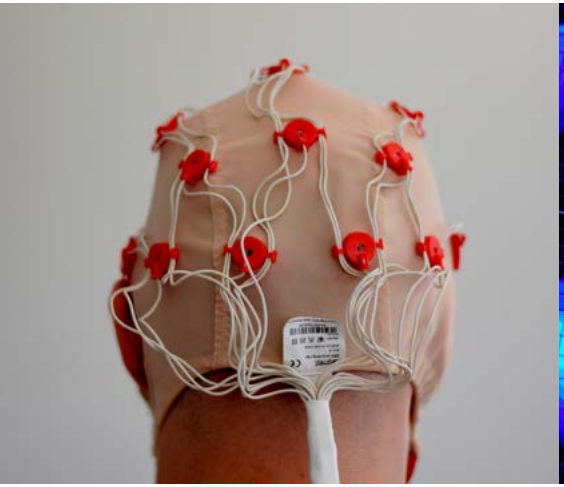
Department of Control and Instrumentation (UAMT)

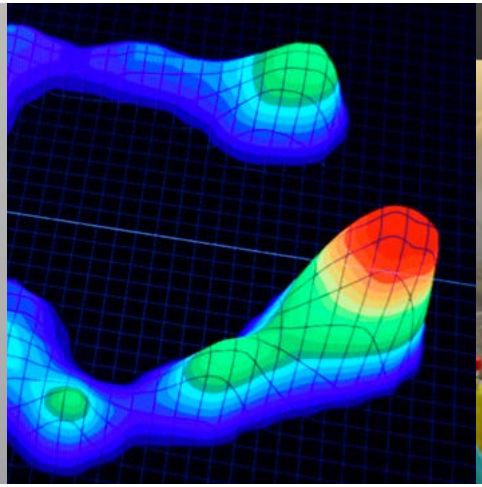
In 2019 the Department of Control and Instrumentation provided instruction in the fields of control, measurement, industry automatization, artificial intelligence, robotics and computer vision.

In control measurement the department focused mainly on robust and predictive electric drive control. The instruction in instrumentation was oriented at electric and electronic measurement, virtual measurement in LabVIEW as well as at non-electric quantities measurement and evaluation methods. Research activities focused mainly on vibrodiagnostics, thermodiagnostics and acoustic emissions. Industry automatization activities were aimed at Industry 4.0, in-built real time systems, wireless communication systems and industrial Ethernet, including system security against internal and external failures and attacks. In AI and robotics the department continued its research in mobile robotics service, mobile robots control in difficult terrain, self-localisation inside and outside buildings, land and aerial robotic systems intended for extreme conditions and usage of advanced optic scanning elements and VR/ER in biomedicine.

In computer vision the applied research focused on research and development of industrial, transportation and experimental visual systems.

Head:	doc. Ing. Václav Jirsík, CSc.
Number of research teams:	5
Number of employees (recalculated):	26.24
Average age of employees:	44.30 years
Ratio of women employees:	8%





Department of Biomedical Engineering (UBMI)

The Department of Biomedical Engineering helps to prepare experts in modern technologies aiming at improving the quality of life. Students and scientists develop advanced algorithms and medical instruments for diagnostics of grave illnesses as well as methods for genetic code and cell systems analysis. Students can make use of specialised laboratories being constantly innovated. Laboratory infrastructure is equipped with imaging systems, optic microscopes and devices for cell or molecular biology. In 2019 a new Master study programme Bioengineering was opened and the Biomedical Engineering and Bioinformatics Master study programme was modernised and a brand new Bachelor study programme Sports Technology was opened. With this perspective new courses were prepared together with laboratory tasks for laboratories newly equipped with modern instruments financially supported by MŠMT.

Head:	Prof. Ing. Ivo Provazník, Ph.D.
Number of research teams:	4
Number of employees (recalculated):	29.81
Average age of employees:	36.80 years
Ratio of women employees:	34%

Photo: UETE archive

Department of Electrical Power Engineering (UEEN)

The Department of Electrical Power Engineering provides instruction in Bachelor study programme Power Electrical and Electronic Engineering, in Master study programme Electrical Power Engineering and Doctoral study programme Power Systems and Power Electronics. In 2019 a new interdisciplinary Master study programme Electrical Power Engineering and Communication Technologies was opened.

In research the department focuses on production, transmission, distribution and usage of electric power. In 2019 the most important research activities were the integration of diffused sources including current inverter properties and their parametrization to support the grid, security of the power network during failures, accumulation hybrid systems design and optimization, luminiscence distribution analysis and the negative influence of lightning, and controlled nuclear reactor accelerators.

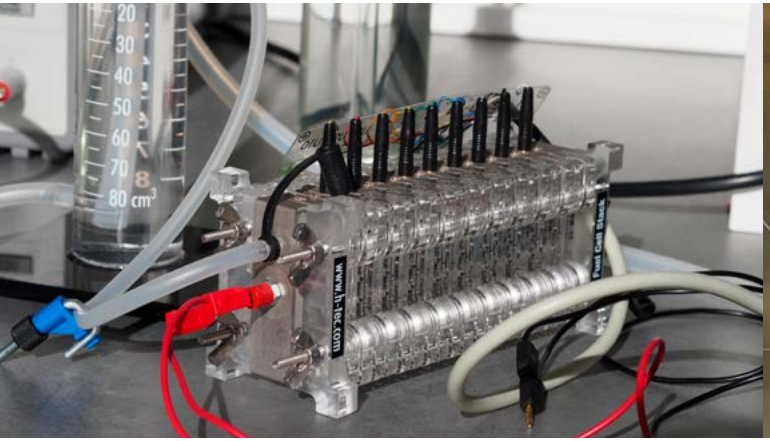
Photo: UETE archive

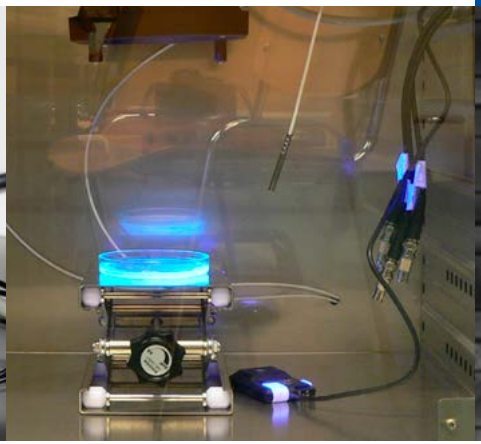
Head:	doc. Ing. Petr Toman, Ph.D.
Number of research teams:	5
Number of employees (recalculated):	34
Average age of employees:	38.2 years
Ratio of women employees:	16%

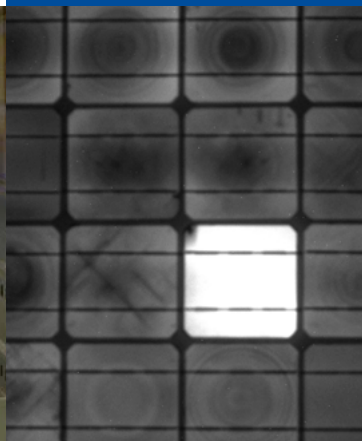
Department of Electrical and Electronic Technology (UETE)

Department of Electrical and Electronic Technology provides instruction in courses related to electrotechnical materials, their manufacturing processes, diagnostics, testing engineering, management and quality control. Apart from courses related to materials, the department provides instruction in courses on alternative sources of energy and ecology. The research areas of the department focus on electron microscopy or photovoltaics. In electrochemical sources the department continued its design and development of new materials in Li-Ion bateries, electrocatalysts and ionchange membranes for fuel elements. Regarding photovoltaic systems the department studied the issue of non-destructive diagnostics of defects and quality, reliability and service life of solar cells. The department was developping a system of detection of signal electrons and methods of environmental rastering electron microscopy and microscopy of atomic powers for the use in electron microscopy.

Head:	doc. Ing. Petr Bača, Ph.D.
Number of research teams:	6
Number of employees (recalculated):	24.73
Average age of employees:	42.70 years
Ratio of women employees:	21%







Department of Physics (UFYZ)

In its educational activities the department provides instruction of basic courses in physics in Bachelor and follow-up Master studies. The Department of Physics guarantees instruction in courses 'Nanotechnology', 'Modern Physics', 'Solid State Physics', 'Non-Destructive Diagnostics and Physics of Dielectrics' and 'Physical Optics'. In Doctoral studies it provides instruction in courses 'Junctions and nanostructures', 'Spectroscopic methods for non-destructive diagnostics' (for FEEC) and 'Optics' (for FIT).
In research, the department focused on basic and applied research of physical parameters of semiconductor and dielectrical materials and components and on nanosensorics. The main areas included noise spectroscopy, local characterization with nanoresolution, measuring nonlinearities, dielectrical spectroscopy and designing indicators of quality and reliability of components. The department obtained several results in research of properties of sensors of acoustic and electromagnetic emission.

Head:	Prof. Ing. Lubomír Grmela, CSc.
Number of research teams:	3
Number of employees (recalculated):	21.25
Average age of employees:	43.60 years
Ratio of women employees:	22%

Photo: UJAZ archive

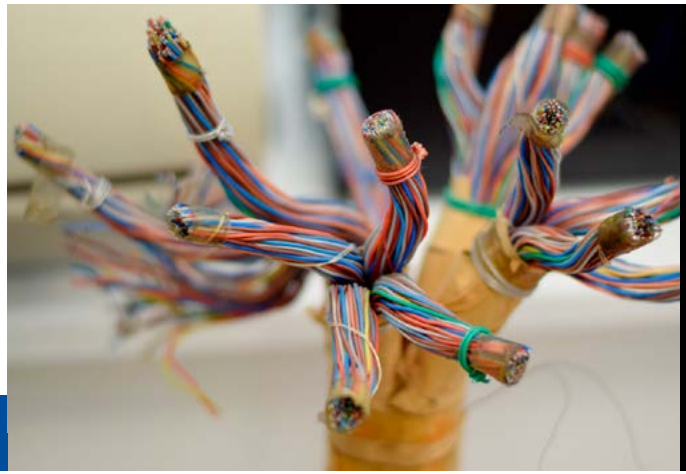
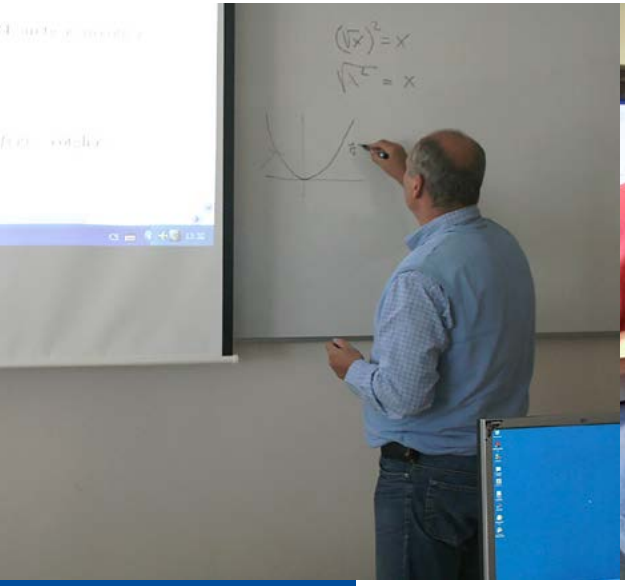


Photo: Oto Janoušek

Department of Languages (UJAZ)

Department of Languages provides and guarantees linguistic and popular sciences courses at the bachelor, follow-up master and doctoral levels at three faculties of BUT: the Faculty of Electrical Engineering and Communications, the Faculty of Business and Management and the Faculty of Information Technology. Apart from these the department guarantees its own study programme English in Electrical Engineering and Information Technology, which provides its graduates with skills and competences useful for experts in numerous specializations of electrical engineering and information technology. The department continued to offer optional courses in law or economics or accredited supplementary pedagogical study enabling its graduates to perform pedagogical activities at all secondary schools in the Czech Republic. In the area of research, the department continues to study English for professional purposes and to implement its findings into teaching materials of its courses.

Head:	Ing. Martin Jílek
Number of research teams:	3
Number of employees (recalculated):	19.30
Average age of employees:	49.30 years
Ratio of women employees:	70%



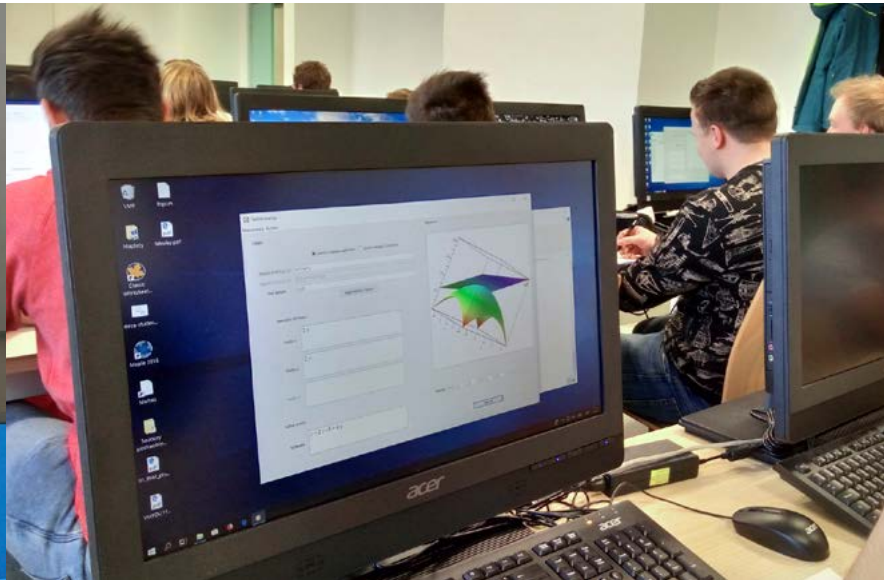


Photo: UMAT archive

Department of Mathematics (UMAT)

Department of Mathematics provides instruction in mathematical courses in Bachelor and Master study programmes in both attended and combined forms, in Doctoral courses and in courses of mathematics in Bachelor study programmes at the Faculty of Information Technology and at the Institute of Forensic Engineering. In its research, the department cooperates on a basis of bilateral agreements with Kiev State University and Kiev State University of Economics. It focuses on the study of qualitative properties of dynamical systems, theories of algebraic and topological structures and statistical processing of data sets.

Head:	doc. RNDr. Zdeněk Šmarda, CSc.
Number of research teams:	3
Number of employees (recalculated):	12.19
Average age of employees:	52.70 years
Ratio of women employees:	27%

Department of Microelectronics (UMEL)

Department of Microelectronics provides instruction in bachelor and follow-up master courses in electronic components and electronic circuits and specialized courses in the area of designing integrated circuits and microelectronic technologies. In research, 2019 saw the department focusing especially on applied research in integrated circuits, specialized electronic systems, sensors and microelectronic technologies. Main areas of research included methods of designing circuits in voltage, current and mixed modes, systems for space applications or complex Smart systems, MEMS and NEMS structures, methods for evaluating signals from sensors, advanced technology for components, surfaces and sensors, reliability of connecting systems of 3D and lead-free solders, methods of connecting and encasement of semiconductor chips or non-conventional application of thick layers (scanning converters, attenuators, antenna shielding, etc.).

Head:	doc. Ing. Jiří Háze, Ph.D.
Number of research teams:	4
Number of employees (recalculated):	29.08
Average age of employees:	45 years
Ratio of women employees:	13%

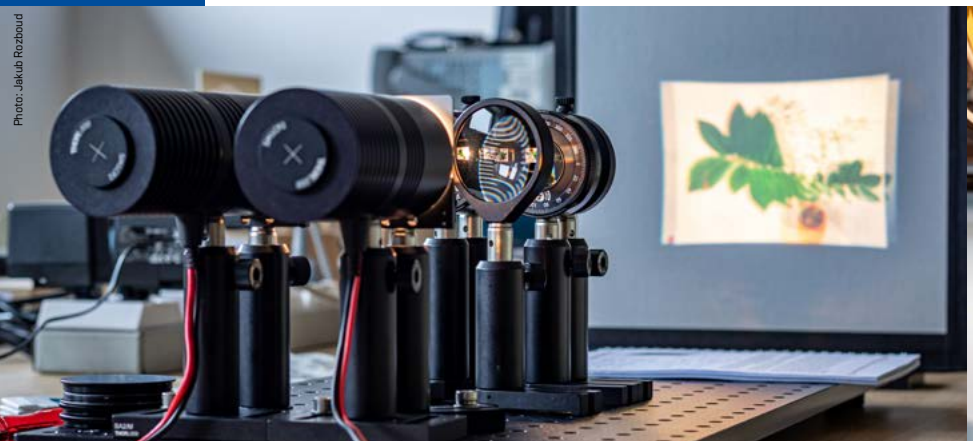
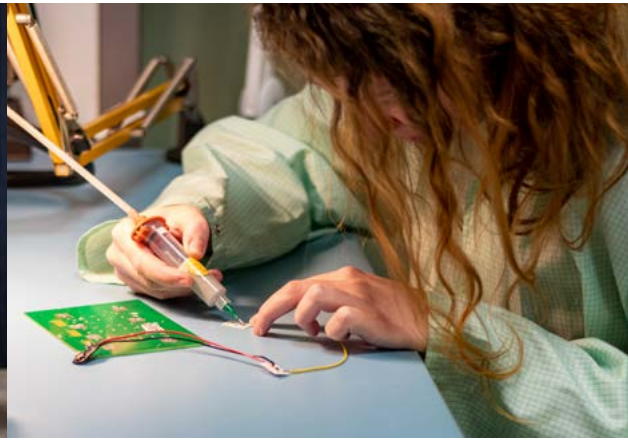


Photo: Jakub Rozboud



Department of Radioelectronics (UREL)

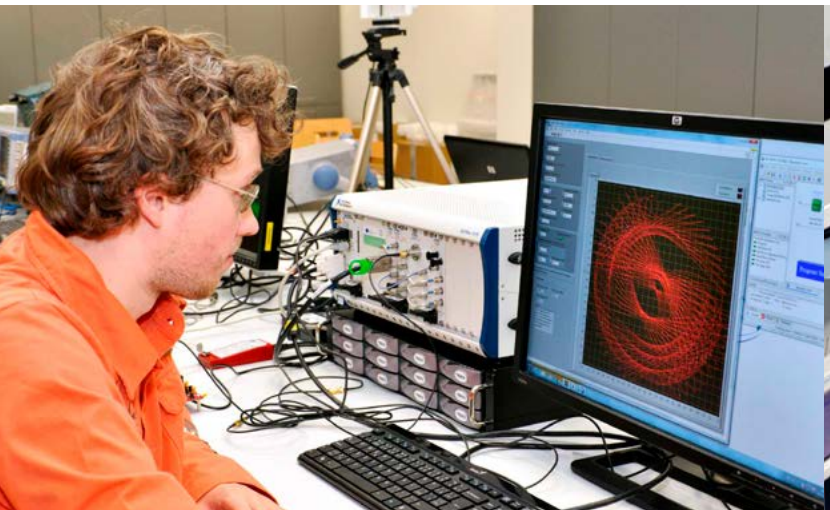
Department of Radioelectronics specializes in instruction, research and development in modern electronic circuits, new methods of signal processing, wireless, mobile, optical and satellite communication, digital radio and TV broadcasting and solutions in microwave circuits and antennas. In the area of instruction it provides courses in the study programme 'Electronics and Communication Technologies' in all its stages – bachelor, master and doctoral ones.

In 2019, the research activities of the department continued to be focused in the area of design of future generations of wireless communication systems, their specific microwave technologies, electronics for the range of millimetre waves, and design of new function blocks and algorithms for such systems in projects at the national and international level and in bilateral international cooperation.

Moreover, the department continuously cooperates with professional and amateur organizations both in the Czech Republic and abroad. In 2019, the department organized the fourth year of the faculty student competition 'Golden transistor 2019', in which student teams contested in the best technical implementation of their projects.

Photo: UTKO archive

Head:	Prof. Ing. Tomáš Kratochvíl, Ph.D.
Number of research teams:	5
Number of employees (recalculated):	47.13
Average age of employees:	41.80 years
Ratio of women employees:	16%



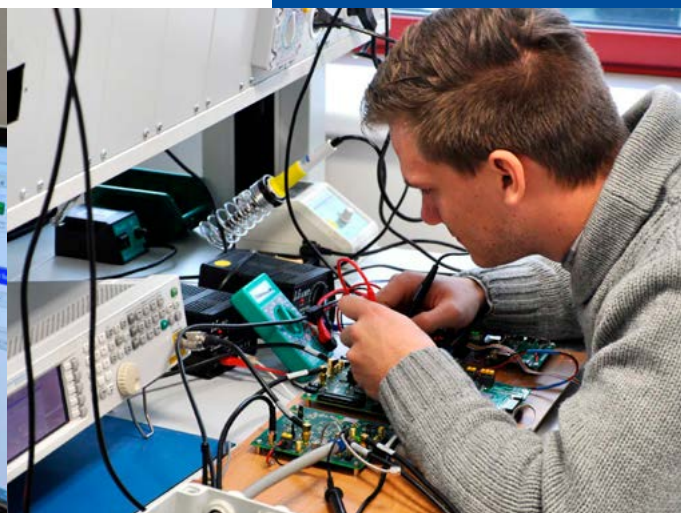


Photo: UREL archive

Department of Telecommunications (UTKO)

Department of Telecommunications specializes in instruction and research especially in information and communication technologies, cybernetic safety, processing of visual and speech signals, big data processing and hardware development. In instruction it guarantees 3 Master, 3 Bachelor and 2 Doctoral study programmes. In research it is an important partner of national and global enterprises including AT & T, AVAST, CESNET, NÚKIB, Konica-Minolta, Paolo Alto, Vodafone, etc.

In 2019, the Department of Communications, jointly with AT & T launched a new laboratory in innovations which specializes in sensors, IoT network communications and Industry 4.0, it constructed a relax zone for its PhD staff students and initiated the construction of a cybernetic polygon.

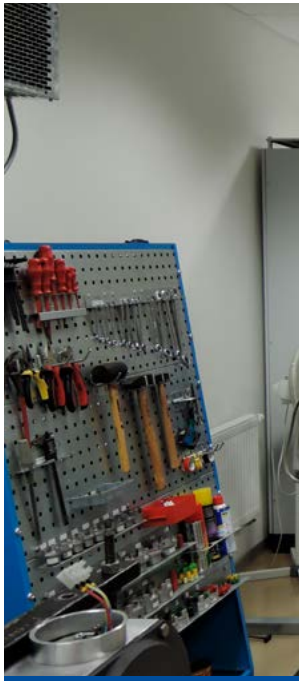
Head:	Prof. Ing. Jiří Mišurec, CSc.
Number of research teams:	8
Number of employees (recalculated):	81.76
Average age of employees:	36.80 years
Ratio of women employees:	11%

Department of Theoretical and Experimental Electrical Engineering (UTEE)

The research conducted by the department covers mainly the following three areas:

- Use of numerical methods for modelling physical fields
- Research into special measurement methods making use of techniques of nuclear magnetic resonance (NMR) and nuclear quadrupole resonance (NQR)
- Research area of experimental and applied electrical engineering and electronics focusing on detection of short, high power electromagnetic impulses (up to 10 GW), fast repeated as well as single processes (in ns) and non-standard sources of electric energy

In 2019 the department extended its cooperation with ENBRA, a.s. in development of a device for remote data transmission, and prepared a project for further research. Other research projects were conducted in cooperation with the University Hospital Brno and Eaton Elektrotechnika, s.r.o. Furthermore, the department provided expert opinions in the area of electrical engineering and electronics. In the area of instruction, new subjects 'Design of Electronic circuits' and 'Design Systems and Electronic Circuits Practice' were implemented.



Head:	Prof. Ing. Pavel Fiala, Ph.D.
Number of research teams:	6
Number of employees (recalculated):	18.43
Average age of employees:	43.70 years
Ratio of women employees:	19%

Photo: UVEE archive

Department of Power Electrical and Electronic Engineering (UVEE)

The department provides instruction in bachelor, master and doctoral study programmes in electrical machines and devices, electric drives and power electronics.

In 2019, the Department of Power Electrical and Electronic Engineering participated in development of hybrid drives of working machines and brakes cylinders for a unique device for testing car emissions. The department continued its development of artificial network with performance up to 75 kVA used for testing commercial switch for solar power stations, and initiated its research of a BMS system and battery charger for commercial purposes.

In the area of electrical machines, the department initiated its development of an engine for turbocompressor 3 kW, 180.000 min^{-1}, development of a high-speed engine with magnetic support and of a switch with a planned use of removing heat from a fission reactor. The department continued its cooperation with the biggest European short-circuit testing stations in the area of electric arc diagnostics. Moreover, in cooperation with E.ON, the department performed tests of efficiency of protective tools for workers working under high voltage.

Head:	doc. Ing. Ondřej Vítek, Ph.D.
Number of research teams:	4
Number of employees (recalculated):	31.70
Average age of employees:	39.60 years
Ratio of women employees:	11%

Photo: Igor Šefr

Centre for Research and Utilization of Renewable Energy Sources (CVVOZE)

The CVVOZE centre completed its first year without financial support of National Sustainability Program. Even despite this interruption in the process of financing the centre, a wide range of projects of applied research was investigated in cooperation with industrial partners. The centre continued to generate significant financial outcomes in commercial contracts. Research workers of the centre achieved a row of remarkable results which are being used in industry as well as in daily life. A great success of the centre is its inclusion in LIFE 2018 GRID, a project whose principal investigator is the Lyon branch of General Electric.

The centre focuses on 5 main research areas:

- Optimizing electromechanical conversion
- Chemical and photovoltaic sources
- Generation, transfer, distribution and use of electrical power
- Automation and sensor technologies
- Switch-off processes in switchgear

The above activities are significantly supported by strategic laboratories CVVOZE PowerLab in the premises of Professor List Technology Park.

Photo: Igor Šefr

Head:	Prof. RNDr. Vladimír Aubrecht, CSc.

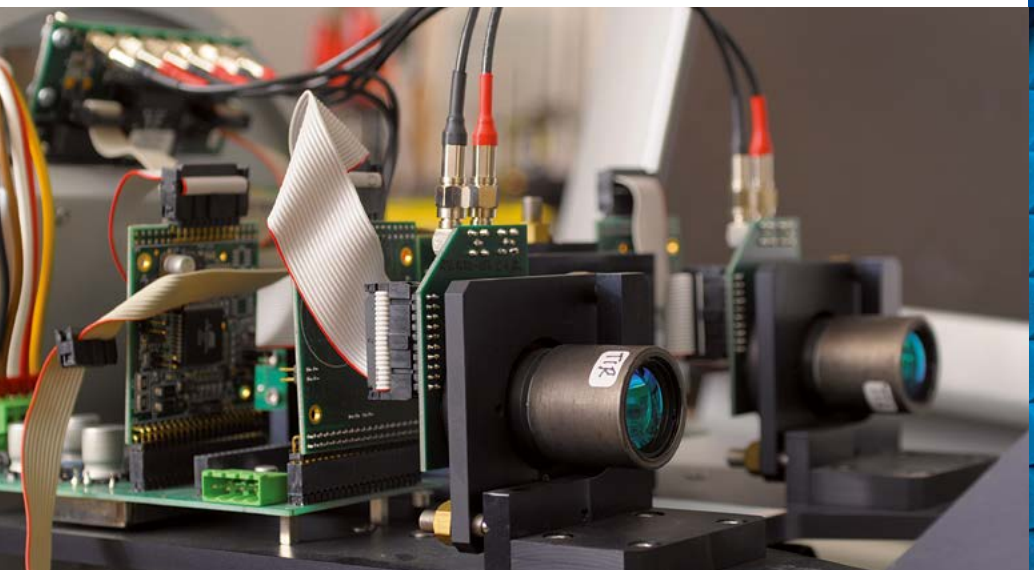
Centre of Sensor, Information and Communication Systems (SIX)

In 2019, the regional research centre SIX successfully completed investigation of 'Interdisciplinary Research of Wireless Technologies' (INWITE), a National Sustainability Program project. This project significantly helped the centre to establish itself in research and development into an important research institution exceeding the regional borders. The centre successfully completed a wide range of projects in basic and applied research in particular, and commercial contracts with an increasing trend of financial assets of projects. The centre investigated several projects funded by the European Commission with significant outcomes and international impact.

The centre focuses on 6 main research areas:

- Sensors, nanotechnology and integrated circuits
- Signals, their transmission, processing and machine learning
- Radio-frequency systems
- Mobile communication systems
- Antennas and high-frequency circuits
- Advanced cybersecurity

Head:	doc. Ing. Martin Slanina, Ph.D.



STUDY AT FEEC

Our faculty is the only in the Czech Republic offering the widest range of study programmes focusing on electrical engineering and all related areas ranging from microelectronics to telecommunications, cybernetics and power electrical engineering, as well as biomedicine, in 16 three-year long Bachelor study programmes, 22 two-year long follow-up Master study programmes and 29 four-year long Doctoral study programmes.

Top background

Since 2013, the Faculty of Electrical Engineering and Communication has been based in modern buildings of the campus 'Pod Palackého vrchem'. After more than fifty years all the facilities, equipment and background are concentrated in premises equipped with the latest technologies, laboratories, lecture halls, canteens, libraries as well as places for relaxation.

Photo: Igor Šefr

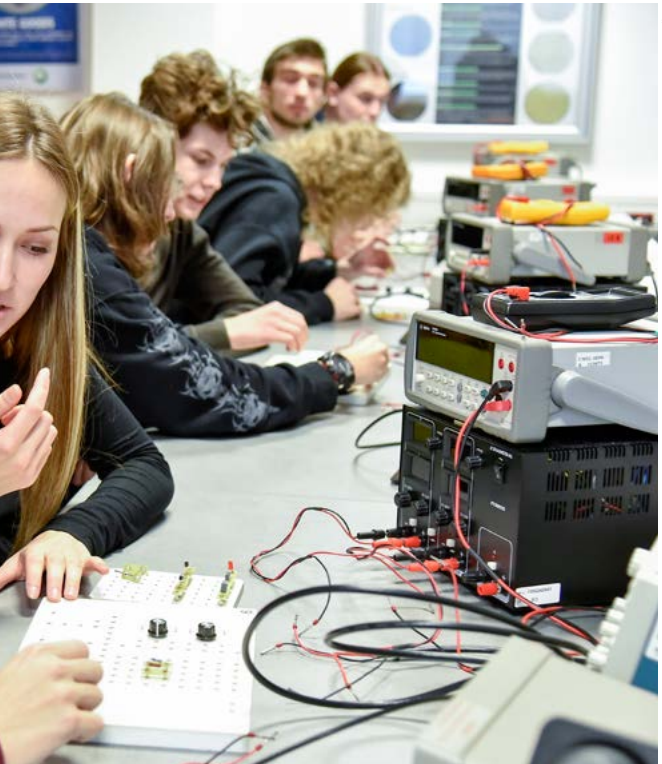


Photo: Igor Šefr

Links to the practice

Thanks to many cooperation links between the faculty and commercial subjects and industrial partners, our students can receive not only good quality theoretical training but also practice which plays key role in their future careers. Thus, in 77% cases, students can arrange their job positions before they successfully complete their studies. This makes our graduates the fastest to be employed out of the whole BUT.

FEEC graduates earn one of the highest starting salaries out of BUT

Our graduates are not only sought after at the job market, but their starting salaries also rank among the highest out of all BUT graduates.

Instruction with emphasis on innovation of study programmes

Content of instruction as well as our offer of study programmes are being constantly innovated. We respond to trends in industry so that our students could be fully competitive at the job market. This can become true also thanks to the expertise of our colleagues from research projects who transfer their findings into their courses. In 2019 we completed the transformation of our study programmes in all forms of study into new study programmes as required by the National Accreditation Bureau. The faculty offers a complete portfolio of newly accredited study programmes.

Study Programmes

Bachelor studies

Attended form:

- English in Electrical Engineering and Information Technology (CZ)
- Audio engineering – Acoustics and Audiovisual Technology (CZ)
- Audio engineering – Sound Production and Recording (CZ)
- Automation and Measurement (CZ)
- Biomedical Technology and Bioinformatics (CZ)
- Electronics and Communication Technologies (CZ)
- Information Security (CZ)
- Microelectronics and Technology (CZ)
- Power Electrical and Electronic Engineering (CZ)
- Telecommunication and Information Systems (CZ)
- Electrical Engineering – Electronics and Communication Technologies (EN)
- Electrical Engineering – Power Systems and Automation (EN)

Combined form:

- Electronics and Communication Technologies (CZ)
- Microelectronics and Technology (CZ)
- Power Electrical and Electronic Engineering (CZ)
- Telecommunication and Information Systems (CZ)

Master studies

Attended form:

- Audio engineering – Acoustics and Audiovisual Technology (CZ)
- Audio engineering – Sound Production and Recording (CZ)
- Bioengineering (CZ)
- Biomedical Engineering and Bioinformatics (CZ)
- Electrical Power Engineering (CZ)
- Electronics and Communication Technologies (CZ)
- Electrotechnical Manufacturing and Management (CZ)
- Information Security (CZ)
- Cybernetics, Control and Management (CZ)
- Microelectronics (CZ)
- Power Electrical Engineering and Electronics (CZ)
- Telecommunications and Information Technology (CZ)
- Communications and Networking (EN)
- Electrical Power Engineering (EN)
- Power Systems and Communication Technology (EN)
- Telecommunications (EN)

Combined form:

- Electrical Power Engineering (CZ)
- Electronics and Communication Technologies (CZ)
- Electrotechnical Manufacturing and Management (CZ)
- Power Electrical Engineering and Electronics (CZ)
- Telecommunications and Information Technology (CZ)

Doctoral studies

Attended form:

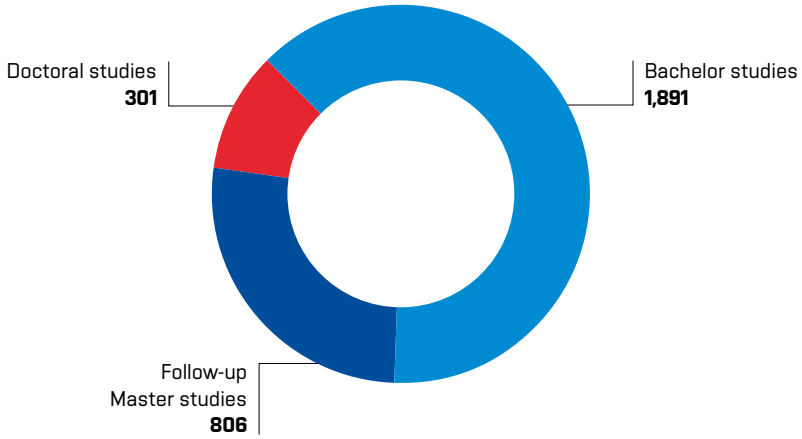
- Electronics and Communications (CZ)
- Information Security (CZ)
- Cybernetics, Control and Management (CZ)
- Microelectronics and Technology (CZ)
- Power Systems and Power Electronics (CZ)
- Teleinformatics (CZ)
- Theoretical Electrical Engineering (CZ)
- Biomedical Technology and Bioinformatics (CZ)
- Cybernetics, Control and Measurements (EN)
- Electronics and Communication Technologies (EN)
- Electronics and Information Technologies (EN)
- Microelectronics and Technology (EN)
- Power Systems and Power Electronics (EN)
- Teleinformatics (EN)
- Theoretical Electrical Engineering (EN)

Combined form:

- Electronics and Communication Technologies (CZ)
- Information Security (CZ)
- Cybernetics, Control and Measurement (CZ)
- Microelectronics and Technology (CZ)
- Power Systems and Power Electronics (CZ)
- Teleinformatics (CZ)
- Theoretical Electrical Engineering (CZ)
- Biomedical Engineering and Bioinformatics (CZ)
- Cybernetics, Control and Measurements (EN)
- Electronics and Communication Technologies (EN)
- Microelectronics and Technology (EN)
- Power Systems and Power Electronics (EN)
- Teleinformatics (EN)
- Theoretical Electrical Engineering (EN)

Number of students

(sum total 2,998)



Interest in study

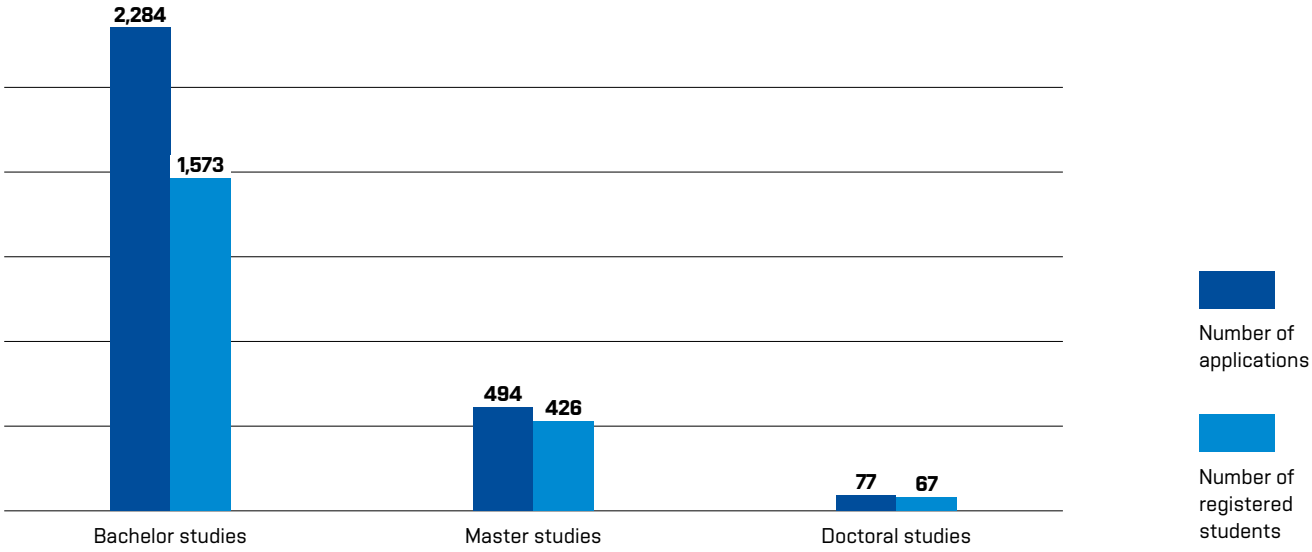


Photo: 'Students for Students' club archive

'Students for Students' Club

'Students for Students' is an organization of volunteers, which has worked at FEEC for 14 years now. Its main aim is to help new students to adapt at the faculty, organize events for students and help with organization of faculty events. Twice per semester the club publishes E-FEKT, a bulletin for students full of interesting facts from behind the scene of FEEC and BUT.

Selected event organized by the 'Students for Students' club:

- PerFEECT Start
- Music from FEEC (Hudba z FEKTu)
- Drop of FEEC and FIT blood
- Run to 53
- Tabletop Days

Well-known Students

A BUT student proposed a system for detection of vehicles driving in the opposite direction

Ondřej Vacek, a student of the Faculty of Electrical Engineering and Communication, proposed a system which could autonomously detect vehicles driving in the opposite direction on highways and speedways. This could reduce the number of car accidents and increase road safety. At the same time, the system would automatically send a warning to the National Traffic Information Center. Existing cameras installed on toll gates could be used for detection.

Ondřej Vacek, a student of Automation and Measurement, recently attracted

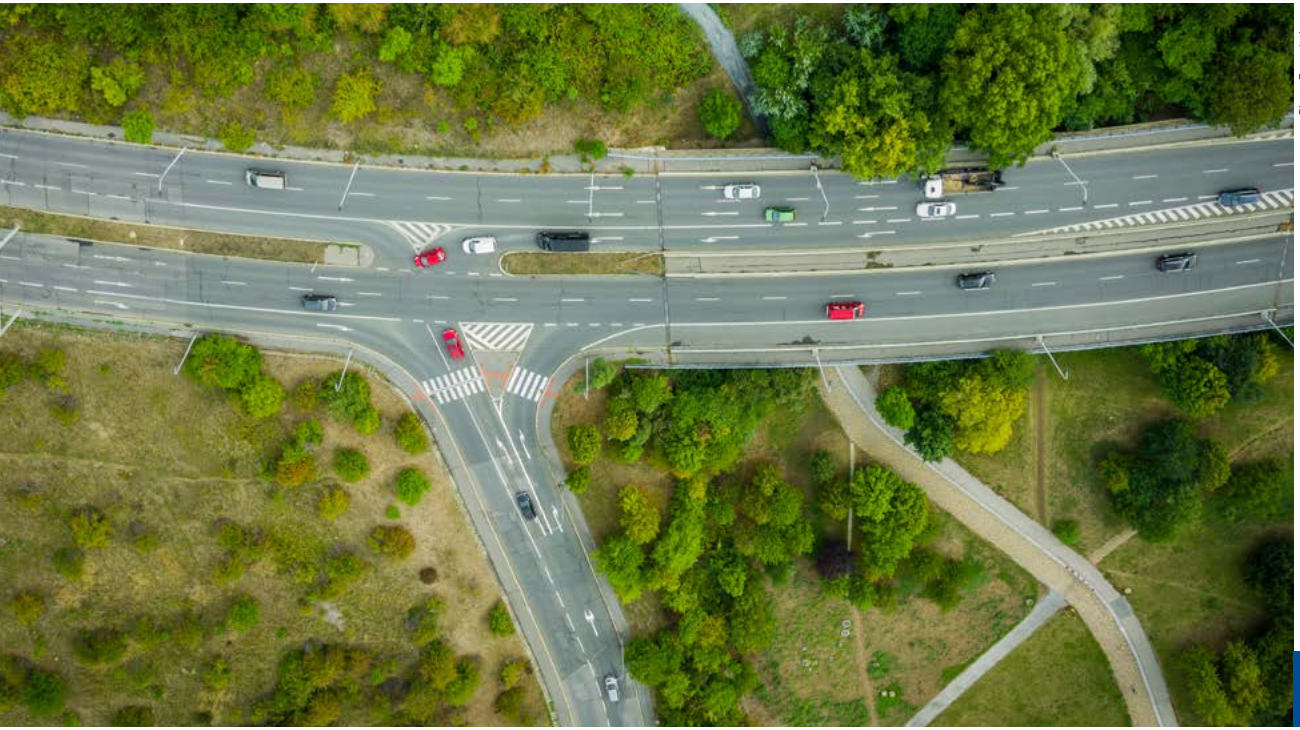


Photo: Depositphotos

attention in contest 'My Vision Zero', where he made his way to the finals. "These days, there is almost one car per day driving in the opposite direction on highways or speedways. Statistics of the Police of the Czech Republic state that in the Czech Republic there are about 320 cases a year, when drivers drive on highways or speedways in the opposite direction," Ondřej Vacek explains his motivation. He took a 'free course' guaranteed by Institute of Forensic Engineering, BUT to extend his education in the area of traffic. It was there that he started to work on his project.

"The system is meant to autonomously detect vehicles which entered e.g. a highway in the opposite direction. Subsequently, using smart traffic or information signs, it autonomously places a warning or uses light signals to inform cars driving in the correct direction or it can even stop them in order to minimize the risk of possible front collision of vehicles," Ondřej Vacek continues. He claims that existing strategy of distribution of traffic signs need not be sufficient. His proposal takes into account financial means as well. It makes use of existing cameras, which are already installed at toll gates yet are not being used for this purpose. Already existing information signs on highways and speedways could be used as well. "I would like to deal with this topic further on. At the moment I am considering choosing it for my bachelor thesis. The next step would be designing appropriate software, which is what I would like to focus on," the FEEC student states.

Driving in the opposite direction can happen quite easily. Sometimes, a sudden health problem, tiredness or absent-mindedness is to be blamed. However, the situation can also be a result of confusing traffic signs or the wrong navigation. Ondřej Vacek took part in the traffic safety contest 'My Vision Zero', where his work won him a place in the finals. The jury awarded it with the 4th position.

'Beware of tricks', a cybersecurity educational application for children

Photo: Patrik Škunda

Who can I add to my Facebook friends? Is this web page safe? Such are questions that children answer during a playful test in the mobile app 'Beware of tricks'. Patrik Škunda, from the Faculty of Electrical Engineering and Communication, BUT, developped it for the police of the South Moravian region with the aim to educate elementary school pupils in cybersecurity. However, their parents and teachers can test themselves too.

The mobile app emerged as a part of the project called 'Safely in Cyberspace', which warns against tricks related to communication in the virtual world. Children can, in a playful way, learn about the most frequent internet tricks and traps. "The whole test consists of five rounds. Players answer different questions in each round such as whether clicking on selected links is safe/We thought of different variations

Photo: Depositphotos

on existing commonly known web pages such as 'sezna.m.cz' or asked which of the email addresses is a fake," Patrik Škunda, a FEEC BUT graduate, who was developping the app for South Moravian police for half a year as a part of his bachelor thesis, explains.

The application touches also the issue of social networks. It focuses not only on types of information safe to share but also on whom to share it with. "On Facebook, children can naively add unknown people who asked them for friendship. Therefore, we prepared several variations on friendship requests in the test. These include completely unknown people who have Chinese characters in their names or concrete people who share many friends with the given person," Patrik Škunda adds and explains that he focused also on which information is safe to be shared publicly and which only with friends.

The test has a form of a game. After every round, players get feedback with explanations why their answers are correct or not. At the end of the game, the app calculates the final score and those who are not satisfied can play the game again. The application is designed in such a way that the questions do not repeat. Even though it is elementary school pupils that are the target group of the app, anyone can test their knowledge. The application can be downloaded for free from Google Play.

"During our discussions at elementary schools we try to pass information on safe internet behaviour not only to children but also to their parents and teachers. Adults have tested our application as well and we have received positive feedback from them," Zdeňka Procházková, prevention coordinator from the Regional police headquarters of the South Moravian region, states. However, the author can see ways of enhancing his application. "What we have is the first beta version. It would certainly be useful to work on the graphic design or to better tailor it for uses with various versions of Android, or to develop its iOS version," Patrik Škunda sums up. Mrs Procházková agrees and says that they plan to work on the application and to prepare a similar concept for adults as well. The project 'Safely in Cyberspace' is coordinated by the South Moravian region and the Regional police headquarters of the South Moravian region. It aims not only at informing public about guidelines of safe internet behaviour but it also instructs head teachers and teachers in suitable techniques when facing cyberbullying. The project was awarded by the Ministry of Interior when it won the second place in the national round of European prize of crime prevention.

Tomáš Repčík, a student of FEEC BUT, developped a mobile app for pensioners. It helps them when they fall down

More than 37 million people in the world hurt themselves when falling down, with more than 640 thousand dying as a result of the fall. According to World Health Organization, the age group of 65+ is the most vulnerable one. It was for them that Tomáš Repčík, a student of Biomedicine of the Faculty of Electrical Engineering and Communication developped a mobile app with AI features. The app finds out that the owner of the phone fell down and automatically dials for help. Tomáš Repčík developped his application for his Bachelor thesis and it won him the student contest EEICT this year.

After a person falls down, the app installed in the phone immediately recognizes potential danger. It waits for thirty seconds for the owner of the phone to start moving. If the person is still lying on the same place, a loud alarm goes off in order to attract potential passers-by or neighbours. The application immediately unlocks the phone and offers the option to dial emergency. In the case of false alarm, the phone owner can easily switch off the alarm sound. In the opposite case the application sends an SMS and email with location data of the phone owner to a pre-defined family member.

"The application is intended for pensioners, people for whom consequences of falling down can be fatal. It does not require any management – one only registers and fills in an emergency contact of a family member or a friend. The application then runs on background and it is impossible to switch it off or delete by accident," Tomáš Repčík, a FEEC student, who had been aided by rescuers in the process of development, explains.

In order to develop his app, he used neural networks. First, he had to teach it how to distinguish falling from other human movements. "I started with collecting data from various studies to find out parameters specific for falling down in order to be able to describe the signal of the fall," explains the student who used more than twenty people and almost three thousand different measurements to train the neural network. "My friends looked rather unhappy when I asked them to fall down in various ways – stumble or slip – just because of my work. Naturally, they fell down on soft surfaces," the student jokes.

The mobile app makes use of standard mobile phones sensors including GPS. The most important of these is the accelerometer because after the phone accelerates rapidly, the application starts to find out whether its owner has just fallen down. However, if the person just throws the phone away on the bed or the phone falls down on the floor, the application finds out that the situation poses no danger. "Mobile phones have also sensors for measuring distances. They can find out whether they are in a closed environment on the body such as a pocket or hand. The app measures acceleration only in moments when you have the phone with you," Tomáš Repčík explains.

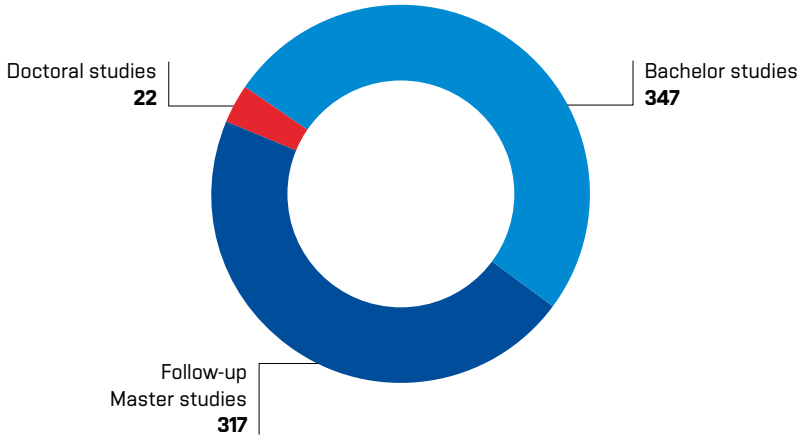
At the moment, the app is able to detect falls with 80% success rate. Before launching the app, Tomáš Repčík therefore wants to work on increasing its precision. Launching the app is scheduled for the end of the year – first for Android, later also for iOS.

Photo: Tomáš Repčík

Graduates

Number of 2019 graduates

(sum total: 686)



FEEC graduates find their positions as experts in technical or management positions in various areas of light and heavy current electrical and electrotechnical engineering, robotics and applied informatics, in production, management and maintenance of medical equipment, in institutions of cybersecurity, environment diagnostics and protection, and as engineers – experts in electronics.

Well-known Graduates

‘Záchranka’ App (by Filip Maleňák) expanded to Hungary

The application, in which pressing one button on a mobile phone dials emergency line 155, sends location data of the caller, with precision of several meters, to the nearest regional emergency station has been programmed by Filip Maleňák, a FEEC graduate. He prepared its first version as a student of biomedical engineering at the Faculty of Electrical Engineering and Communication when he was looking for the topic of his bachelor thesis. Since he was in contact with emergency service at that time and knew that caller localization is the biggest challenge they were facing, he decided to develop an app to make localization easier.

Photo: Depositphotos

The app, named ‘Záchranka’ (Emergency), launched in 2016, not only expanded to many other countries but has also been substantially extended. New features include first aid manual or sending an alarm signal to mountain rescue service. The app made Filip Maleňák a member of a prestigious selection ’30 under 30’, a list of talented figures under 30 years of age made by Czech mutation of Forbes. ‘Záchranka’, with more than 1,150,000 downloads operates not only in the Czech Republic, Austria or in the Slovak mountains, bu in 2019 it expanded to Hungary as well.

LIFE AT FEEC

History

Faculty of Electrical Engineering and Communication Technologies is, and has always been, an integral part of Brno University of Technology, founded on 24 January 1849, when the Moravian Diet approved foundation of a technical school. The school was bilingual with languages of instruction being Czech and German. Its students could study technical, agricultural and commercial areas. Brno University of Technology, then consisting of three faculties: Faculty of Construction Engineering (FCE), Faculty of Architecture and Building Construction (FABC) and Faculty of Energy (FE), was founded on 24th July 1956. The Government Act No 58 of 12 August 1959 divided the Faculty of Energy into Faculty of Mechanical Engineering and Faculty of Electrical Engineering. This is the beginning of an independent electrical engineering faculty in Brno. In 2002 an independent Faculty of Information Technology (FIT) was established and the original Faculty of Electrical Engineering and Information Technology was transformed into the current Faculty of Electrical Engineering and Communication (FEEC) on 1 January 2002.

Photo: Igor Šefr

Photo: Lukáš Němeček

Photo: FEEC archive

FEEC Trademark

An unmistakable symbol of lightning has been connected with the faculty since 1961. In that year, the student organization held a contest for the best FEEC logo. Soon, proposals began to appear at the student notice board in the mezzanine at Antonínská 1, where the faculty had been located at that time. One of them was a logo resembling a profile of Wankel engine, which was simple and elegant. Supporting comments began to fill the notice board and the proposal won the final evaluation decisively. It took many years to find out its author – Ing. Mirko Deml, the 1962 graduate of Measurement and Control study programme.

Photo: Igor Šefr

FEEC BUT campus 'Pod Palackého vrchem'

In 2013, the faculty reached an important milestone of completing its new buildings. After more than fifty years of its existence, all faculty buildings were concentrated into one location – BUT campus 'Pod Palackého vrchem'. In two new buildings on Technická Street one can find high-tech laboratories, lecture rooms as well as places for relaxation. In this way, the faculty continues to pursue its vision of being a modern institution of education, research and development for the 21st century.

5,368 m²
area of lecture rooms

12,085 m²
area of laboratories

25,850 m²
other areas: corridors and elevator hatchways

PerFEECT year 2019

Faculty life is not only education, research or development. Throughout the year conferences, student contests, events for faculty staff members or public and festivities such as student bands contests are organized or co-organized.

JANUARY

23

Ceremonial launching of Innovation Laboratory

Photo: AT & T (Jindřich Špaček)

Department of Telecommunications FEEC BUT, in cooperation with the American Company AT & T, launched its Innovation Laboratory, a place for students to propose, design and construct their own project from the stage of designing printed circuit boards and components positioning to printing mechanical parts on a 3D printer. The laboratory includes smart measurement systems, demo versions of smart household components or an autonomous drone. The laboratory focuses on developing autonomous drones and smart technologies for the Internet of Things.

25

The 52nd Grand Ball and the 18th joint FEEC – FIT Faculty ball 2019

Photo: Martin Stříška

The ball took place in Voroněž hotel. Guests were entertained by musical band KOLOREZ and Jaroslav Čech cimbalom band. The events were moderated by Marek Kolář – member of Brno City Theatre.

29

6th year of Merkur perFEKT Challenge Superfinals

Photo: Oto Janoušek

The superfinals of perFEKT Challenge, construction and programming

competition which uses the Merkur construction kit, was held in the faculty premises. Secondary school students, who made their way through the autumn round, contested for the title of the absolute winner, which eventually went to the team named 'Ajťáci' from Střední škola informatiky, elektrotechniky a řemesel, Rožnov pod Radhoštěm.

30

'Open doors day' at FEEC for prospective students

Photo: Jakub Rozboud

During the January 'open doors day', 350 prospective FEEC students learned important information about entrance exams and study programmes offered by the faculty. After an opening presentation of faculty study options, secondary school students had the opportunity to see the high-tech laboratories of faculty departments. Traditionally, there are three 'open doors days' with an attendance of about one thousand.

FEBRUARY

26

Tabletop Studentárium

Sixty board games were available for FEEC students at a whole-day event organized by SPS at 'Studentárium' at Technická 12.

MARCH

16

AMPER 2019 Fair

Amper 2019, an international fair of electrical engineering, power electrical engineering, automation, communication and safeguarding was held at the Brno Trade Fair Centre. Faculty of Electrical Engineering and Communication presented on its stalls 11 technological devices designed with the help of FEEC researchers. The main award, GOLDEN AMPER 2019 went to the team of Petr Baxant for luminiscence distribution analyzer LDA – LumiDISP. For details regarding this success see p. 14.

4

Exhibition celebrating the 60th anniversary of the faculty

Photo: Igor Šefr

In order to recall the 60th anniversary of the faculty, a panel exhibition, presenting historic moments and changes of the faculty in past decades, was organized in the foyer of Technická 12.

7

EBEC 2019, the biggest technology competition at FEEC

Photo: Igor Šefr

At the beginning of March, FEEC hosted a local round of EBEC (European BEST Engineering Competition), known as the biggest international technology competition for European university

students. Teams of four compete in categories 'Team Design' and 'Case study'.

14

FEEC hosted a lecture of Dana Drábová

Photo: FEEC archive

Department of Power Electrical Enginering, FEEC BUT, organized a lecture delivered by Dana Drábová, head of State Office for Nuclear Safety. In a completely full lecture hall of Prof. Brauner, both students and employees had the opportunity to find out many interesting facts about energetic needs of our civilization and future trends and limitations of current technology.

27–28

External session of the extended dean's college

Members of the extended dean's college, joined by department bursars and heads of dean's office departments met at an inspiring external session of the college at hotel Kurdějov.

APRIL

16–18

Conference: Microwave and Radio Electronics Week MAREW 2019, Pardubice, Czech Republic

Traditional meeting of researchers, academics, students and enterprises MAREW is a joint event of two respected international conferences: Radioelectronics (in 2019 already in its 29th year) and a conference on microwave technology. Radioelectronics originated at FEEC and is currently organized in turns by Czech and Slovak scientific community. Each year, the conference venues are placed at different Czech or Slovak universities, yet the conference is always attended by a significant number of FEEC staff members and students presenting and discussing latest trends in electronics, signal processing or information technologies.

17

'Run to 53'

Photo: Jakub Rozboud

Sporting fun event for both students and faculty management of catching bus No. 53.

18

The Mayor of Brno visited the Department of Telecommunications

Photo: FEEC archive

In mid April Markéta Vaňková, the Mayor of Brno, paid visit to the Faculty of Electrical Engineering and Communication. At the Department of Telecommunications she met researchers, faculty management and representatives of enterprises. Together they saw selected laboratories and at

the round table they opened the issue of insufficient number of students of technology. The great demand for good quality graduates of technology was confirmed by present enterprise representatives and representatives of American Chamber of Commerce (AmCham).

25

Student conference EEICT celebrated quarter of a century

Photo: Studenti pro Studenty archive

Student scientific conference EEICT celebrated its 25th anniversary. The aim of the conference is to increase quality of presentational and publicational skills of students.

174 students of the faculty and selected secondary schools contested in electrical engineering, communication technology, biomedical engineering, audio engineering or information safety. Authors of winning projects received financial support or material gifts.

At the same time the faculty hosted perFEKT JobFair, a fair of job opportunities. 33 companies presented their job offers to almost 500 visitors.

MAY

2

Drop of FEEC and FIT blood

Joint blood donation at the University Hospital Brno was organized by the 'Students for Students' club together with Students Union of FIT BUT.

14–16

Conference: Unconventional Sources of Electrical Energy (NZEE), Vémyslice, Czech Republic

The 40th year of Unconventional Sources of Electrical Energy (NZEE) was organized by FEEC in cooperation with Czech Society for Electrical Engineering. The conference focused on topics of renewable sources, trends in electrical engineering, smart networks and other future trends.

15–17

Conference: International Scientific Conference on Electric Power Engineering (EPE), Dlouhé stráně, Czech Republic

The 20th year of international scientific conference covering the whole range of topics on power electrical engineering including the issue of renewable sources of energy. The conference is organized in turns by power engineering departments of faculties of electrical engineering in Brno, Ostrava and Prague.

JUNE

19

Student competition 'Golden Transistor'

Photo: Department of Radioelectronics archive

Department of Radioelectronics organized another year of 'Golden Transistor' (https://zlatra.sdelovacka.cz/images/zlatra_bulletin_2019.pdf), a competition for students of FEEC. Their task was to design and present practically oriented projects in electronics and communications which were evaluated by a judgement panel consisting mainly of practitioners. The authors of awarded projects received valuable material and financial prizes provided by sponsors to support their further professional development.

20

Celebrations of the 60th anniversary of the faculty at the Music Theatre of Brno City Theatre

Photo: FEEC archive

Celebrations of the 60th anniversary of the Faculty of Electrical Engineering and Communication were held at the end of June in the premises of the Music Theatre of Brno City Theatre. The performance of VIVA "LALALA" REPUBLIKA, a concert conducted by Dan Kalousek, was attended mainly by employees and friends of the faculty. The current dean, Vladimír Aubrecht, and former deans, Jarmila Dědková and Radimír Vrba, recalled times when the faculty was scattered at various places in Brno and the process of moving it to the campus 'Pod Palackého vrchem'.

JULY

1–3

Conference: The 42nd International Conference on Telecommunications and Signal Processing (TSP), Budapest, Hungary

A renowned scientific conference focusing on issues of telecommunications and signal processing was co-organized with eighteen universities from all over the globe including FEEC BUT. Its already 42nd year was held in Budapest.

AUGUST

11

VUT Junior at FEEC

Photo: Andrea Němcová

On Saturday, pupils of 6th–9th grades of elementary schools could, in a playful form, find out some interesting facts about electrical engineering, robotic systems or signals of human body.

25–28

Conference: The 20th International Conference: Advanced Batteries, Accumulators and Fuel Cells (ABAF – 20th), Brno, Czech Republic

The 20th year of the international conference ABAF focused on topics of developing materials, electrochemical sources of voltage, material research in electrochemistry, photovoltaic systems, etc.

SEPTEMBER

2–6

International Symposium on Physics of Switching Arc, Nové Město na Moravě , Czech Republic

Employees of the Centre for Research and Utilization of Renewable Energy Sources, FEEC (CVVOZE) organized an already 23rd international Symposium on Physics of Switching Arch. The symposium was attended by 105 scientists from 17 countries.

Apart from numerous lectures on computer modelling of arc plasma in low and high voltage circuit breakers, the attendants could follow interesting lectures on non-main stream use of plasma such as cleaning archaeological findings (coins), its application in medicine, biology, etc.

Photo: FEEC archive

19

Celebration of the 60th anniversary of Department of Radioelectronics


Photo: FEEC archive

Both current and retired department members, representatives of the faculty management as well as guests from partner faculties of electrical engineering and collaborating departments took part in informal celebrations held in the premises of Department of Radioelectronics. Guests and department members, especially the retired ones, were interested in seeing modern laboratories of the department, and when browsing the new Almanach celebrating the 60th anniversary of the department they recalled the events of the last ten years. The Almanach was launched by Jiří Masopust from the Faculty of Electrical Engineering in Plzeň and the department head Tomáš Kratochvíl. Together with the almanach 'Half a century of radioelectronics at BUT (1959–2009)' [Půlstoletí radioelektroniky na VUT (1959–2009)], edited by late department head Jiří Svačina, it maps the sixty-year long journey of the department from its humble origins in 1959 to its present form of a modern place of teaching and research.

27

Night of Scientists 2019

Differences between cold and warm light, alternative sources of electric current, robots, virtual reality, a prototype of a smart stop, searching for a radioactive source using a dosimeter, CT or a Tesla transformer able to play a tune – these are just a few examples of interesting exhibits and demonstrations which attracted over 600 visitors to the faculty premises during the Night of Scientists.


Photo: FEEC archive

During the Night of Scientists the visitors, especially the younger ones, enjoyed also the interactive playroom 'Elektrikárium', which presents the issue of electricity and electrical engineering in a playful way.

29

Installation of the Filtermac filtering device

Photo: Codasip a Filtermac

During a small ceremony we launched the operation of two special Filtermac automatic machines for filtering water. Thanks to these, students and employees of the faculty can fill their bottles with tasty cooled filtered water. In this way the faculty management is promoting an ecological alternative to water sold in plastic bottles. Within four months of operation the faculty saved a tone of plastic thanks to the machines.

20–22

PerFEKT Start

The traditional welcome event for students of bachelor degree programmes is held by the 'Students for Students' (SpS) club. Our new students have a chance to find out what it is like to be a student of the faculty, where to find lecture rooms, how to register subjects and other useful information for their perFEECt start of study.

25

'Music from FEEC' (Hudba z FEKTu)

As a part of our traditions, 'Music from FEEC' (Hudba z FEKTu) festival opened, in its already 12th year, a new academic year. Apart from the competition of student bands, it included performances of bands such as Wohnout or Medial Banana. The festival is held annually by the 'Students for Students' club with a financial support of the faculty. This year, the festival attracted 7,000 students who came to see and listen to the bands and headliners.

Photo: Jakub Rozboud

OCTOBER

14

Visit of representatives of Guangzhou College of South China, University of Technology

Photo: FEEC archive

On 14 October 2019 representatives of Guangzhou College of South China, University of Technology paid a visit at the Faculty of Electrical Engineering and Communication, BUT to present offers of both universities and initiate cooperation in the area of student and academic mobilities and in research and development.

16

Ceremonial launching of a ŠKODA UNI.Space corner

The operation of a students' corner opposite the library in T12 was launched during a ceremony visited by representatives of ŠKODA AUTO, faculty management and students, by whom this relaxation space is used.

Photo: Igor Šefr

18

Launching of a book by Prof. Jiří Jan

Photo: Oto Janoušek

Prof. Jan presented a book on biomedical image processing entitled Medical Image Processing, Reconstruction and Analysis – Concepts and Methods. The book is already a second edition in English, but it is supplemented with a chapter on a modern method of image analysis based on the process of deep learning. The book was published by CRC Press.

24–25

Conference: IMAPS flash 2019, Brno, Czech Republic

Jointly with IMAPS CZ & SK, CEITEC, Sanmina and DSP journal, the Department of Microelectronics organized the 5th year of a conference on recent trends in microelectronics, PBC and STM processes, simulation and testing as well as sensors and nanostructures.

28–30

Conference: The 11th International Congress on Ultra Modern Telecommunications and Control Systems (ICUMT), Dublin, Ireland

11th year of a conference on recent trends in telecommunications and control systems was held in Dublin.

29–31

Conference: The 16th IFAC Conference on Programmable Devices and Embedded Systems, High Tatras, Slovakia

A great number of researchers of the Department of Control and Instrumentation actively participated at the 16th year of the conference.

NOVEMBER

19

Merkur perFEKT Challenge

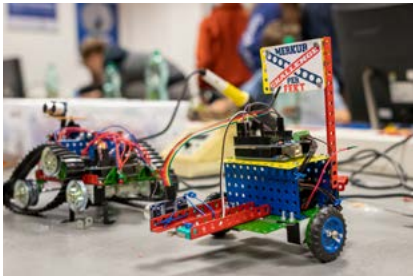


Photo: FEEC archive

In the course of the 7th year of the 'Merkur PerFEKT Challenge' more than 50 teams of secondary school students contested in nine construction disciplines. Using the 'Merkur' construction kit extended with electronic parts, teams of four designed and programmed functioning devices. Every year, Merkur perFEKT Challenge is very popular among students. More than 200 of them filled its capacity within the first week of registration. In January 2020, the winning solvers will take part in superfinals to determine the absolute winner.

Conference: 'Strojírenské fórum'

Photo: Tomáš Trojan

FEEC hosted the 10th year of 'Strojírenské fórum' during which its participants could learn about aspects of modern production in the context of digital factory.

26

'Open doors day' at FEEC for prospective students

Photo: Jakub Rozboud

DECEMBER

13

'Open doors day' at FEEC for prospective students

Photo: Jakub Rozboud

Life at the Faculty

Club 'Elektron'

'Electron', the club of graduates and friends of FEEC BUT celebrated its 20th anniversary. The club is a place for graduates and friends of the faculty who want to promote it and facilitate its development. In the course of the year the club organizes a row of interesting scientific and general topic seminars, trainings, lectures or excursions.

University nursery 'Edisonka'

Mini nursery 'Edisonka' has been operating at the Faculty of Electrical Engineering and Communication for six years. It gives employees and students of the university a possibility to place their children for an indispensable time and it enables them to link their work or study duties and their responsibilities as parents.

Studentárium

A multifunctional room, where students can spend their free time, solve group projects or learn in groups – Studentárium – has been in operation for a year now. A kitchenette, where students can heat meals or make coffee or tea is available. The room is open on weekdays from 6 am to 10 pm.

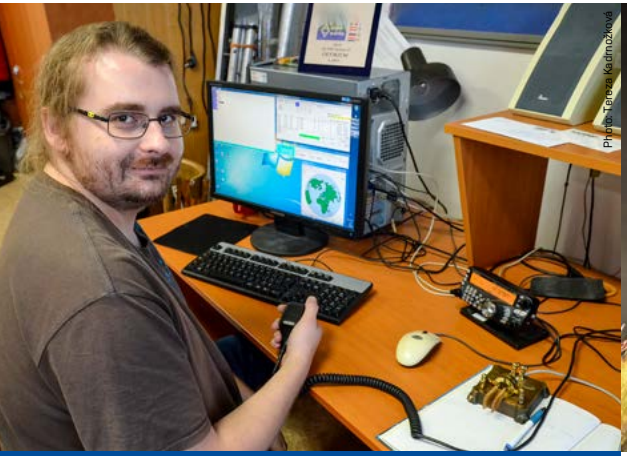


Photo: Tereza Kadmozková

Photo: Radioclub OK2KOJ archive

Radioclub OK2KOJ at BUT

Fans of phonic amateur radio operation of all age groups are organized in OK2KOJ. Members of the radioclub organize courses and lectures in electronics, construct and adjust broadcasters and receiving devices, take part in radio amateur contests and popularize radio frequency technology.

Elektrikárium

In the fashion of big research centres, our interactive playroom 'Elektrikárium' aims at popularizing science and technology to a broad variety of visitors. It has been operating for three years now. Since it is located in faculty premises, the playroom exhibits are related to issues of electrical engineering, electronics and related subjects.

There are 15 exhibits in the playroom. By testing and using them, the visitors can – in an entertaining way – learn principles of electrical engineering, physics and other areas. In 2019 the playroom was extended with an exhibition of historical electrotechnical devices.

Photo: Oto Janoušek

Library

More than 23,000 library items and 24 PC tables are available in the library for 42.5 hours per week. In 2019, the library at Technická 10 was closed and all library book stock was transferred to a reconstructed library at Technická 12. Apart from loans and access to electronic information sources and databases from library computers, the library offers additional sources such as 3D printing, laminating or binding printed matter.

Library items as of 31. 12. 2019:	23,200
Acquisitions and losses:	934/1,795
Number of active users:	854
Number of loans in 2019:	2,550
Assets for library book stock purchases in 2019:	61,508 CZK
Area of the original T12 library T12 419.52 m^2, extended in 2019 by 71.30 m^2	

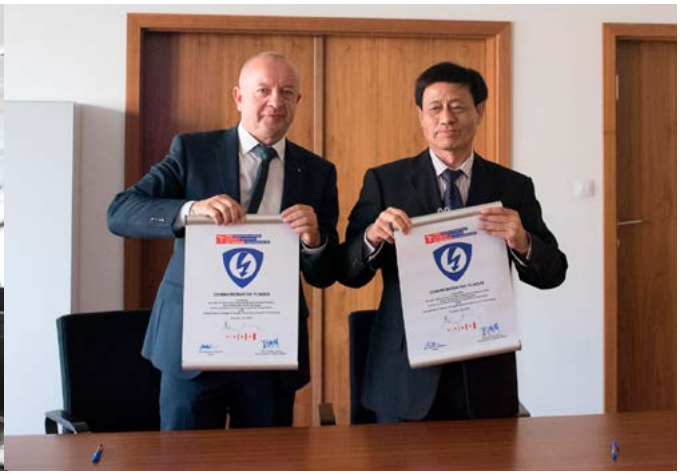
INTERNATIONAL RELATIONS AND FEEC

Every year, our faculty strengthens its internationalization. As a result, an increasing number of students spend their stays with the faculty in various mobility programs. Gradually, the number of incoming academic staff teaching intensive courses or delivering specialized research lectures is increasing.

Starting an international summer school for foreign students, Brno International Summer School on Electronics and Communication Technologies – BISSECT, has been an important milestone. We assume that it will raise further interest of foreign students to study at our faculty.

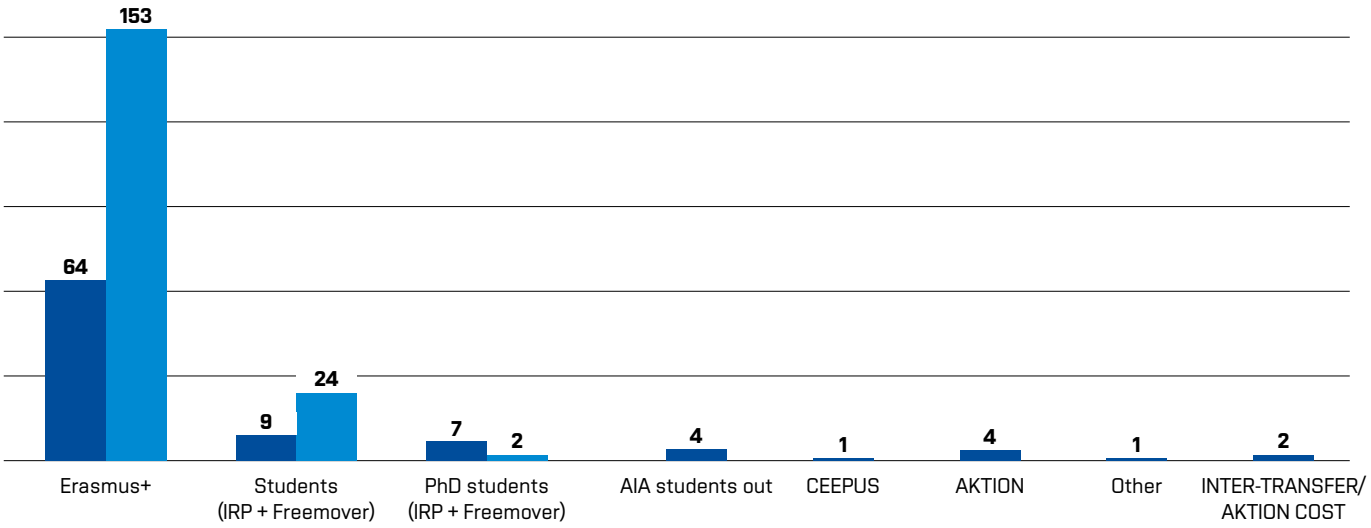
Another area in which we successfully internationalize academic environment is new double/joint degree study programmes. At the moment, 4 are in existence and more are scheduled to open.

Photo: FEEC archive



Number of FEEC Students on Research Stays in 2019

Outgoing and incoming students by programme

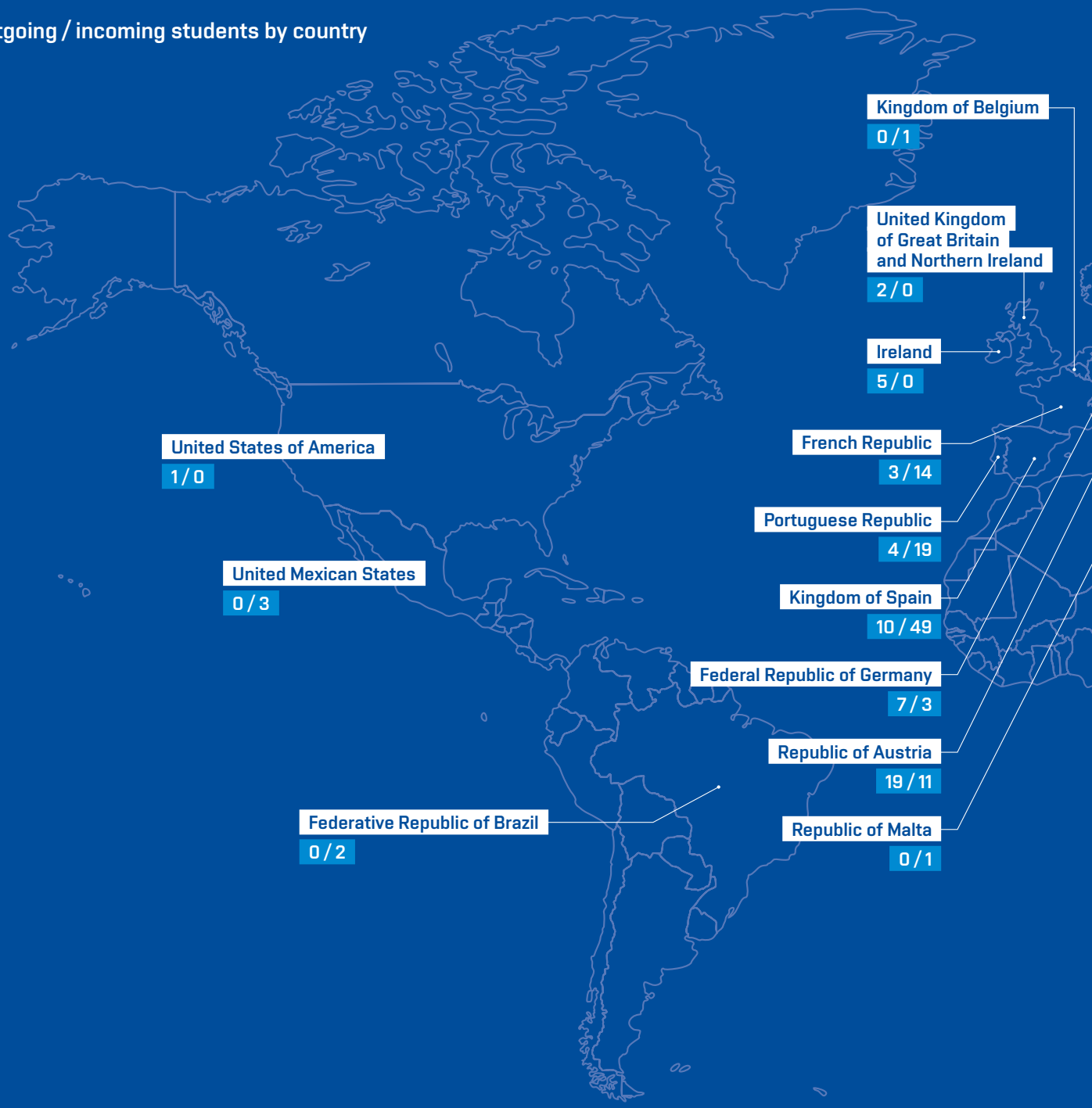


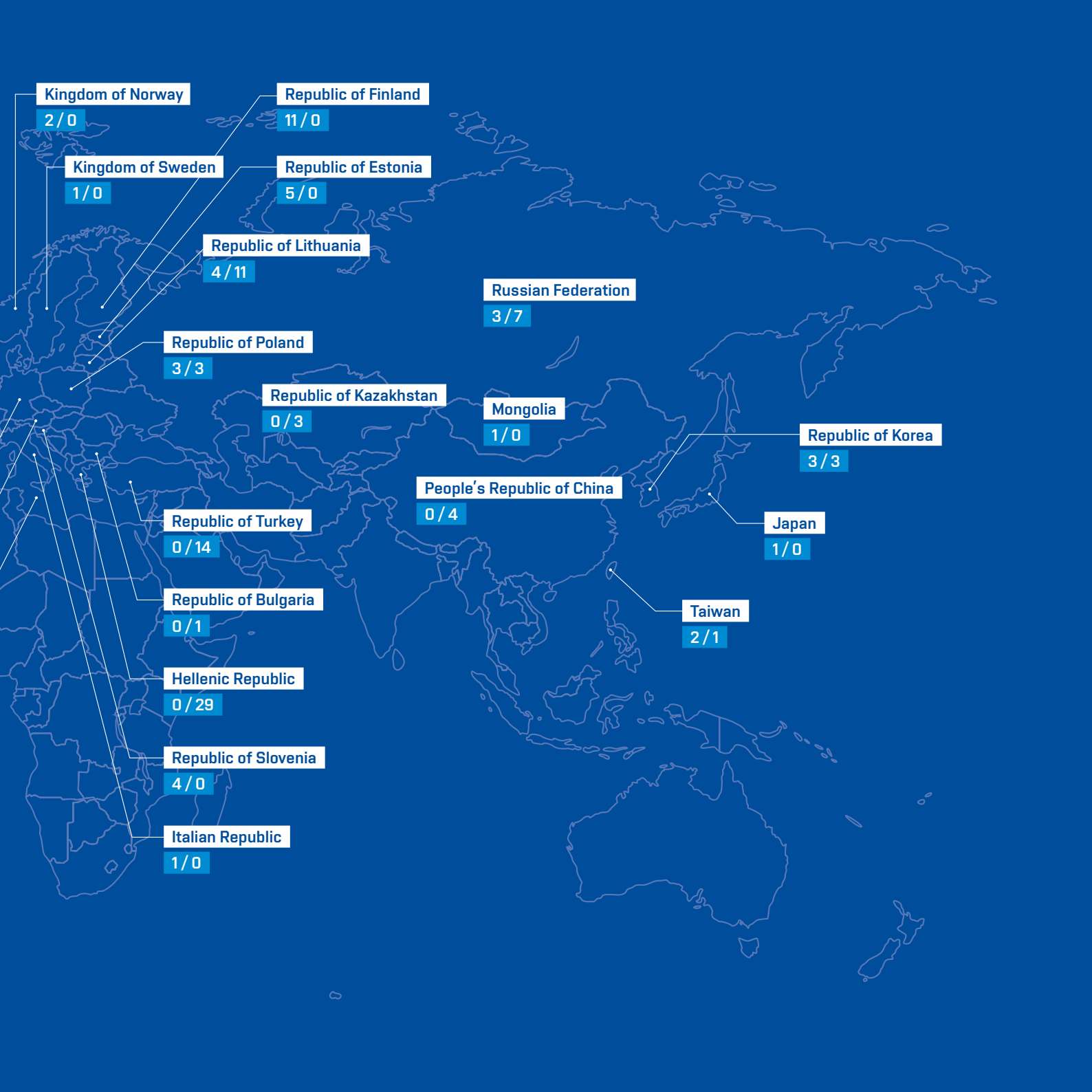
Number of outgoing students:	92
Number of incoming students:	179
Number of outgoing academic staff and researchers:	84
Number of incoming academic staff and researchers:	35

Number of outgoing students

Number of incoming students

Outgoing / incoming students by country




Kingdom of Norway
2 / 0
Republic of Finland
11 / 0
Kingdom of Sweden
1 / 0
Republic of Estonia
5 / 0
Republic of Lithuania
4 / 11
Russian Federation
3 / 7
Republic of Poland
3 / 3
Republic of Kazakhstan
0 / 3
Mongolia
1 / 0
Republic of Korea
3 / 3
People's Republic of China
0 / 4
Republic of Turkey
0 / 14
Japan
1 / 0
Republic of Bulgaria
0 / 1
Taiwan
2 / 1
Hellenic Republic
0 / 29
Republic of Slovenia
4 / 0
Italian Republic
1 / 0

Important Incoming Mobilities

1. 2.–31. 3. 2019

Miloš Orgoň, doc. Ing. Ph.D., STU Bratislava, Slovakia

1.–30. 4. 2019

Ivan Baroňák, Prof. Ing. Ph.D., STU Bratislava, Slovakia

1. 1.–30. 4. 2019

Alexandra Rodkina, prof. DrSc., University West Indies Mona, Kingston, Jamaica

1.–31. 5. 2019

Miroslav Joler, prof. dr. sc., Sveučilište u Rijeci Tehnički Fakultet Riijeka, Croatia

5.–7. 5. 2019

Slawosz Uznanski, Ph.D., CERN, Geneve, Switzerland

25. 8.–3. 9. 2019

Leonid Berezansky, prof. DrSc., Ben Gurion University, Beer Sheva, Israel

6.–12. 10. 2019

Irina Astashova, prof. DrSc., Lomonosov Moscow State University, Moscow, Russia

Photo: FEEC archive

Photo: Jakub Rozboud

INDUSTRIAL PARTNERS

How to Cooperate with Us

- Projects of applied research
- Research projects
- Cooperation in teaching, supervision of diploma theses
- Joint preparation of grants
- Contracts
- Support of faculty events
- Partner promotion in faculty premises

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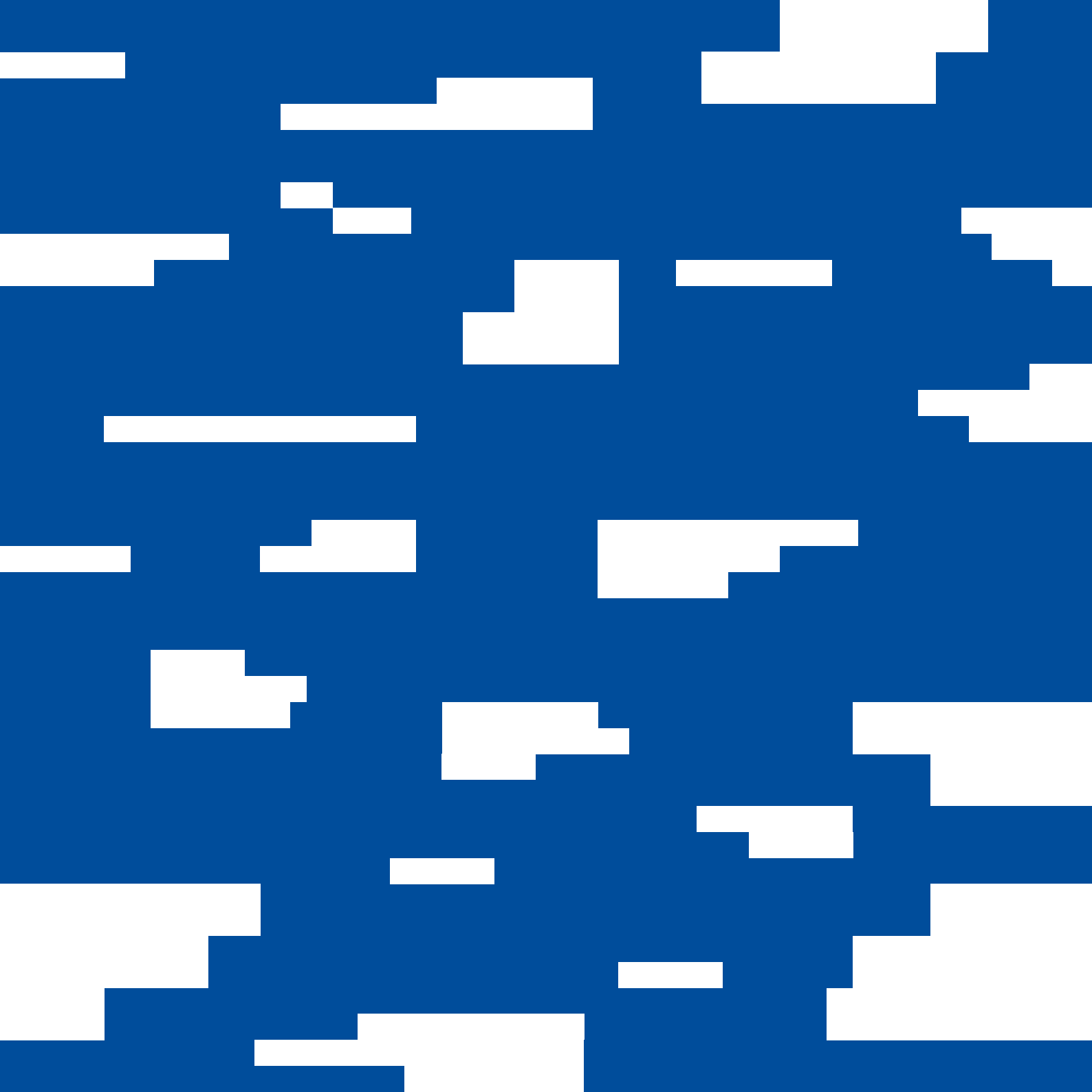

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