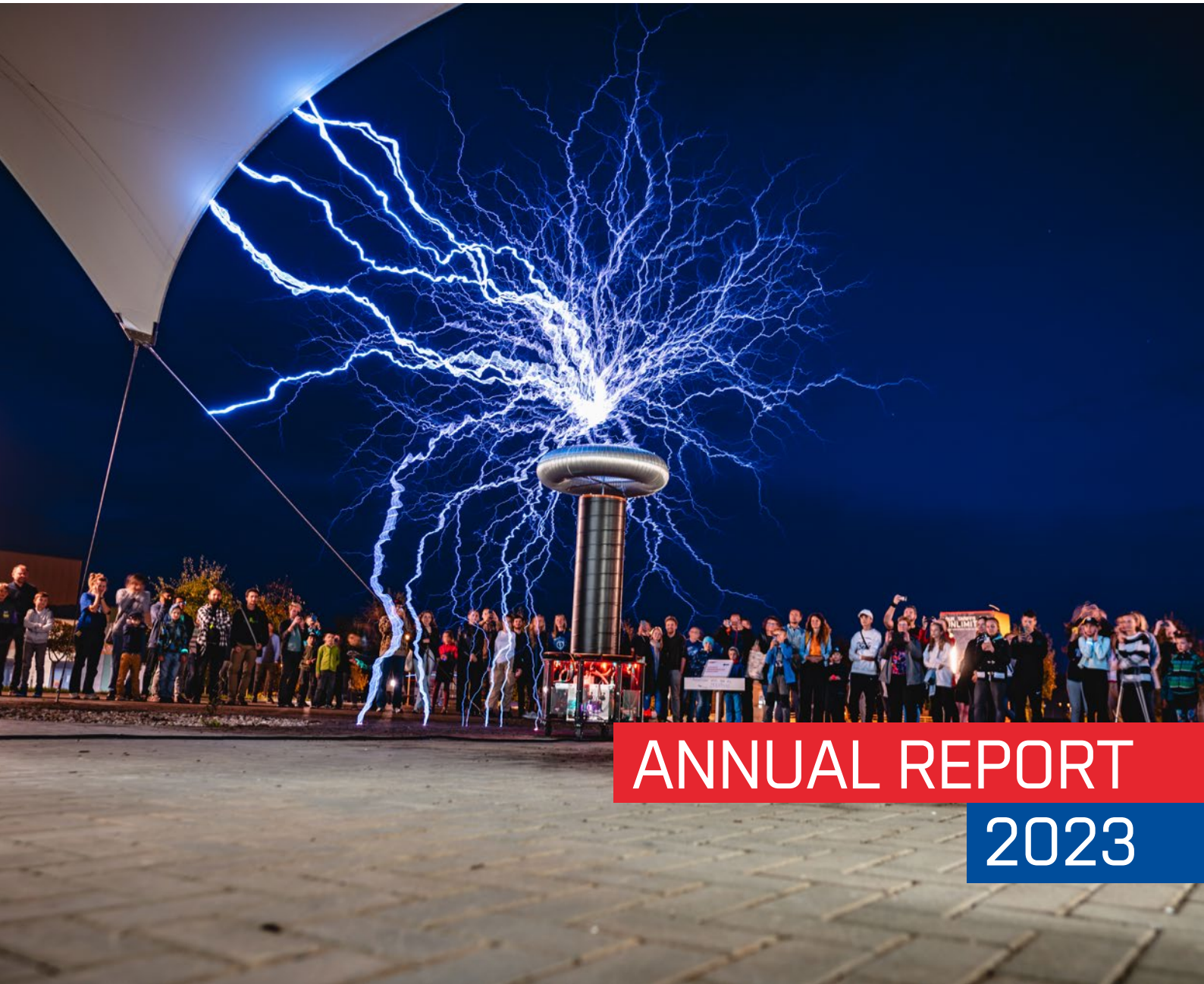
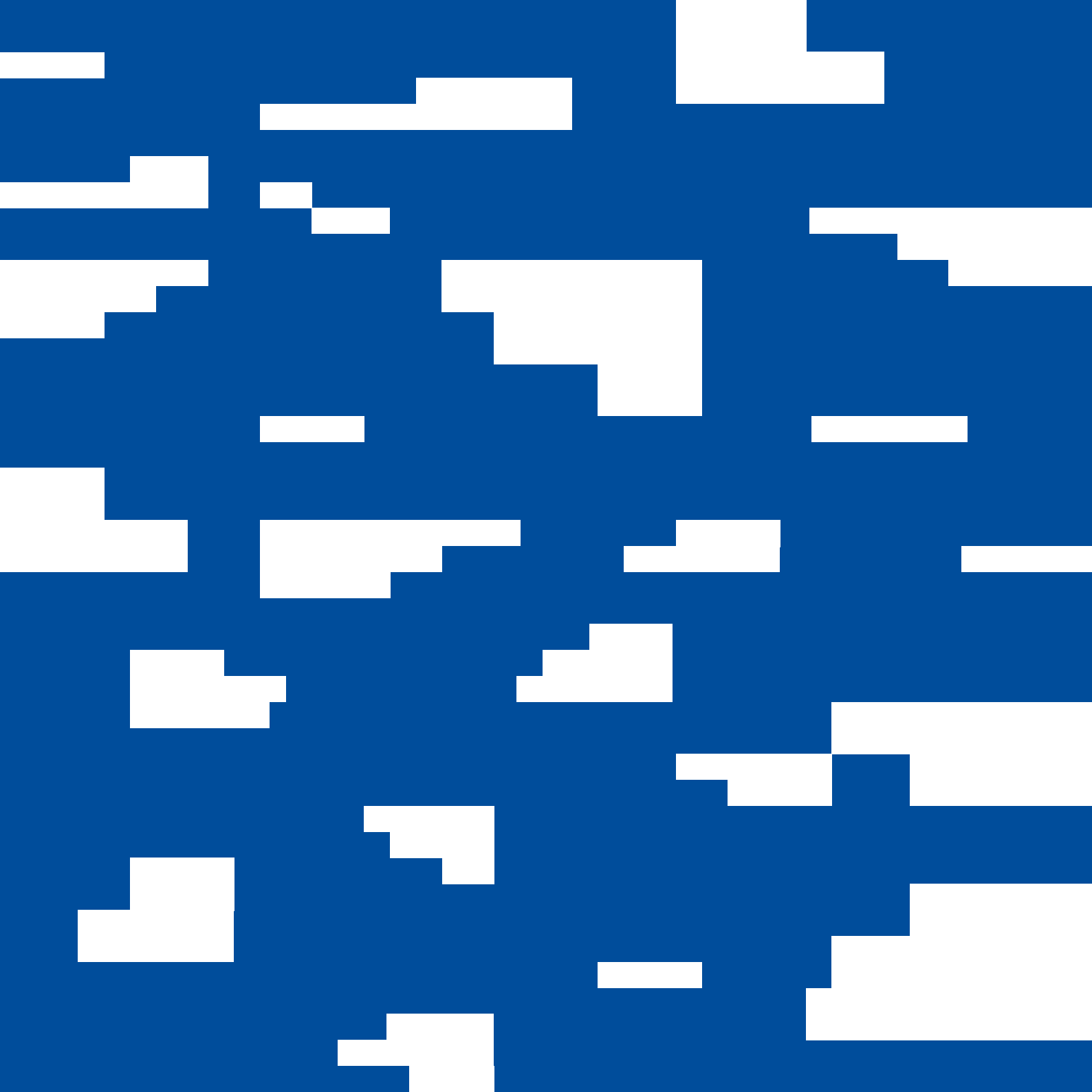
BRNO UNIVERSITY OF TECHNOLOGY
FACULTY OF ELECTRICAL ENGINEERING AND COMMUNICATION



ANNUAL REPORT 2023



FACULTY OF ELECTRICAL ENGINEERING AND COMMUNICATION

ANNUAL REPORT 2023

CONTENT

OPENING WORD OF THE DEAN

Dear readers,

the annual report on the activities of the Faculty of Electrical Engineering and Communication of the Brno University of Technology brings a summary of all significant facts on the faculty life and events in 2023. It is with pleasure that I open the summary by commenting briefly on individual topics of the faculty activities.

As an example, let us recall the AMPER 2023 fair, where the Cybernetic Arena BUTCA of the Department of Telecommunications received an honourable mention in the Golden AMPER competition. The implementation team subsequently received the Minister of the Interior Award for outstanding achievements in security research. We are also proud of the very successful cooperation with the Technical Museum in Brno on the exhibition "There is no TESLA like Tesla". Furthermore, I would like to highlight the record participation of secondary school students in the traditional Merkur perFEECt Challenge.

Our students excelled in various activities for which they were awarded with notable prizes such as the Professor Jaroslav Buchar Award, Prof. Daniel Mayer's Award for the Best Students of Electrical Engineering Faculty or the Hlávka Foundation Award. Other faculty achievements include the awards of doctoral students in the Brno Ph.D. Competition Talent or the YSpace student club being recognized by the European Space Agency. FEEC students have also excelled in university competitions such as the 8 from the BUT or the BUT Student Entrepreneurship Award.

One of the notable educational activities is the opening of a new attractive Bachelor's degree programme "English for Practice in Electrical Engineering and Communication Technologies", which, with its unique combination of professional English and a broad spectrum of topics across the electrical engineering sector, educates professionals appreciated in multinational corporations teams. Furthermore, an application for accreditation of the inter-faculty Master's degree programme "Nuclear Energy" has been submitted.

Worth of a particular attention is the lecture series called "Technical Challenges and Visions for Future Mobility" focusing on technological solutions for transport today

and in the near future from the perspective of selected experts, which took place throughout the year.

The fact that our academics and students' hard work and excellent results are appreciated by prestigious institutions is a proof to the high standard of our academic programmes and an advanced level of our expertise. Our faculty is adept indeed at handling the current electrical engineering challenges thanks to its focus and deep professional knowledge. Our students, scientists and researchers have thus a unique opportunity to participate in shaping the future of not only industry but also of the society as a whole. We make use of advanced laboratory and measurement technology in our research and development, and thanks to our meticulous work and everyday enthusiasm, the FEEC BUT is and will carry on to be one of the best educational and research institutions at both national and international levels.

I consider it extremely important to create such conditions in our campus in which students and faculty members will enjoy mutual support and which will strengthen their sense of belonging to the faculty and the university itself. I would wish for us to go on with creating together an environment full of innovation, shared ideas, respect and mutual understanding.

prof. RNDr. Vladimír Aubrecht, CSc.
Dean

Photo: Jakub Rozboud

FACULTY MISSION, VISION AND STRATEGIC PLANS

The aim of the faculty is to raise professionals with complex scientific knowledge and skills, to develop high quality research on both national and international levels and to produce results helping to extend further knowledge with high social impact.

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 a 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.

E

Engineering

Tradition of the faculty dates back to the second half of the last century. More than sixty years the faculty has been developing instruction and research activities in electrical engineering, electronics and other related fields. It was founded in 1959 by the Government Act no.58 which divided the Faculty of Energy into Faculty of Mechanical Engineering and Faculty of Electrical Engineering. Since 12 August 1959 the Faculty of Electrical Engineering has been working independently.

C

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.

FEEC numbers in 2023

3,083
students

1,083
courses

150+
projects solved

578
publications

42
prototypes, software or functioning samples

6
successfully completed habilitations

553
faculty employees

10
international conferences co-organized by the faculty

LIFE AT THE FEEC

The Faculty traditionally organizes or co-organizes dozens of events during the year for the general and professional public, both for students and employees. These include various conferences, competitions, popular educational events and lectures. Let us have a look at some of them.

PerFEECt year 2023

JANUARY

3.

Launch of nanosatellite BDSAT-2

Photo: BD SENSORS archive

At 15:56 sharp, the SpaceX's Falcon 9 rocket launched the twelfth Czech nanosatellite into space, called BDSAT-2. The satellite is 10 x 10 x 10 centimetres in size and it carries special pressure sensors or an alternative solar power system, the so-called supercapacitor bank. BD SENSORS and Spacemanic professionals, together with the researchers from the BUT and CEITEC worked on BDSAT. A team from the Department of Radioelectronics is responsible for the ground segment of the communication. One hour after the launch, the satellite was launched into free space and the first communication with it was made directly from the main command post in the Laboratory of Experimental Satellites at the Department of Radioelectronics.

16.

55th anniversary of the tragedy at the Kubínská Hole

On 16 January 1968, in the morning hours, an avalanche fell at the foot of Kubínská Hole (Slovakia), burying participants of a ski training. These were students of the former Faculty of Electrical Engineering of the Brno University of Technology. Six students lost their lives in the accident.

20.

Open Day for prospective students

Photo: Jakub Rozboud

This year's first round of the Faculty's open days was a great success, thanks to a huge interest in electrical engineering study programmes, which was manifested clearly in the completely "sold out" auditorium. Prospective students had the opportunity not only to see the laboratories, but also to meet students from all degree programmes.

24.–26.

Gaudeamus Prague

The last of the Gaudeamus' series of post-secondary education fairs in the academic year 2022/2023 took place in Prague and our students could not miss the opportunity to represent their faculty there.

26.

9th Superfinal of Merkur perFEECt Challenge

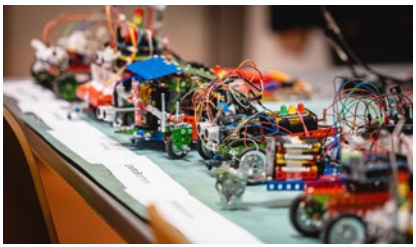


Photo: Jakub Rozboud

The overall winner of the Merkur perFEECt Challenge superfinals and the entire Merkur 2022-23 was the MARS team from the Edvard Beneš Secondary School of Industry and Business Academy in Břeclav. Their members were awarded with the challenge cup, which they will cherish until the next year.

Photo: Jakub Rozboud

The four-person teams, which had advanced to the final round of the competition for secondary school students in November 2022, were assigned to build a vehicle that would autonomously drive to a high obstacle, pass around it and return to the point from which it had originally started.

27.

FEEC and FIT 2023 Representative Ball

Photo: Jakub Vodrážka

After several years of hiatus caused by the coronavirus epidemic, the joint representative ball of the FEEC and FIT BUT took place again. The ball was held for the first time at a new venue, the Passage Hotel Brno.

FEBRUARY

10.

Open Day for prospective students

Photo: Jakub Rozboud

The second and last of the Faculty's open days of 2023 took place. Those interested in studying had the opportunity to meet representatives of individual bachelor's degree programmes and also to visit the faculty laboratories and premises.

18.–23.

UMEL staff visit to India

Photo: UMEL archive

In mid-February, Jiří Háze and Pavel Šteffan from the Department of Microelectronics visited their partner university Madanapalle Institute of Technology and Science (MITS) in India,

which the Department has cooperated with since 2019. However, so far the co-operation could not be fully developed due to covid restrictions. The aim was to finalise an agreement to involve MITS students in the Master's programme in Microelectronics at the UMEL.

28. 2. – 23. 5. and 26. 9. – 19. 12.

Technical Challenges and Visions for Future Mobility Colloquium

Under Petr Baxant's supervision, the Department of Electrical Power Engineering organized a continuing series of lectures focusing on technological solutions for transport today and in the near future from the perspective of selected experts and with the possibility of expert discussion on the topic.

Photo: UEEN archive

A total of 21 meetings of those interested in mobility information were held during 2023, during which expert lectures, technical excursions as well as test drives of electric vehicles (23 May) took place. Anyone interested in trying out electric cars could test them outside the faculty and compare swift city cars such as Škoda City Go or SUV Škoda Enyaq with their bigger and sportier counterparts such as Tesla Model S. The aim of the event was, among other things, to introduce people who have never driven an electric car to this type of transport and to stimulate further discussion on the operation, production and further development of these cars.

MARCH

14.

Talk show with students

Photo: Jakub Rozboud

The online talk show with the faculty students and staff representatives was intended for applicants who could ask questions about studies and life at the faculty.

21.–23.

AMPER 2023 Fair

At the AMPER fair the BUT presented the BUT Cyber Arena (BUTCA), a training platform for the cybersecurity sector that offers training and playful lessons of ethical hacking, both for industry and education. BUTCA received an honourable mention in the Golden Amper competition.

Photo: Jan Prokopius

Photo: Jan Prokopius

The commercial operation of the Cybernetic Arena was launched by the Rector of the Brno University of Technology, Ladislav Janíček, in the presence of representatives from the National Office for Cyber and Information Security, the Ministry of the Interior, the Police of the Czech Republic and Vodafone CZ.

22.

Visit of students from the Ghent University in Belgium

As part of the ongoing cooperation between the FEEC BUT and the Kyndryl company, nearly 50 students from

the Ghent University in Belgium, led by Professor Jan Beyens, visited the faculty. These were final year students of two Master's programmes, Information and Communication Technologies and Automation, who visited the Czech Republic as part of their course "Emerging technologies in ICT and automation".

Photo: Jakub Rozboud

The Belgian students visited the Department of Telecommunications, where they were first briefly introduced to the faculty, discussing also the possibilities of doctoral studies in one of our English programmes. Afterwards, the students were given a tour of selected laboratories.

24.

Visit from the partner Vienna Technical University

Photo: UAS Technical School archive

The Department of Biomedical Engineering welcomed a group of students and staff from the partner university UAS Technikum Wien International.

APRIL

12.

Students' meeting with the Rector of the BUT

Photo: Jakub Rozboud

A discussion between students and the Rector of the BUT Ladislav Janíček took place at the faculty.

14.

Visit from the TU Graz

The Rector of the Technical University Graz (TUG) Harald Kainz and Deputy Director of the TUG Institute of Automotive Engineering Mario Hirz visited the Brno University of Technology. The visit included a field trip to the laboratories for research on Li-ion and Post Li-ion batteries and their electrode materials at the Department of Electrical and Electronic Technology, FEEC.

18.–20.

Expert Research Mission to Germany

Petr Münster from the Department of Telecommunications was one of the participants of Czech experts' first trip to the Federal Republic of Germany (Germany) within the framework of the Projects in Support of Economic Diplomacy (PROPED) of the Ministry of Foreign Affairs of the Czech Republic.

19.

Run for the 53 bus

Photo: SPS archive

The traditional sports and fun competition Run for the 53, organized by the Students for Students' Club, took place. This legendary event is a small sporting celebration of all those who have ever had to run in the Technology Park for the former 53 bus, which, unfortunately, was cancelled and replaced by the 72 bus during 2023. The race took place all day long outside the Technická 12 building, and it included VIP relays, where the FEEC management also participated.

19.

NXP CUP 2023

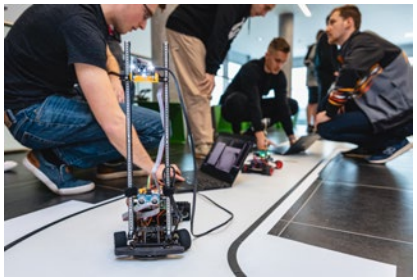


Photo: Jana Valchová

A competition of autonomous robotic vehicles was held at the faculty. The secondary school team competition is organized by the NXP Semiconductors company.

21.

Internal Open Day at UETE

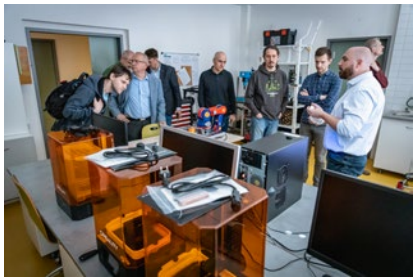


Photo: Jana Valchová

The Department of Electrical and Electronic Technology of the FEEC BUT held an open day for employees from other parts of the faculty.

24.

Debate of BUT students with the Minister for European Affairs

The Minister for European Affairs Mikuláš Bek visited the BUT. His visit at the FEEC also included a discussion with BUT students.

25.

29th Student EEICT 2023 Conference and Competition and 14th perFEECt Job Fair 2023

Photo: Jakub Rozboud

The traditional job fair PerFEECt Job Fair 2023 was held at the faculty, with visitors from a total of 42 companies from electrical engineering and related fields.

Photo: Jakub Rozboud

Simultaneously with the fair, the Student EEICT 2023 competition and conference took place, with 167 projects in 21 categories, ranging from secondary schools to doctoral levels.

27. 4. – 31. 12.

Exhibition "There is no TESLA like Tesla"

Photo: Technical museum in Brno archive

On 27 April, the Technical Museum in Brno opened the exhibition "There is no TESLA like Tesla", which lasted until the end of the year. Representatives of the Brno University of Technology (BUT), which was the co-creator of the accompanying programme, were also invited to the opening of the exhibition.

Photo: Technical museum in Brno archive

The programme consisted of several lectures and excursions that were organised at the FEEC. The opening toast ceremony with the museum director

Ivo Štěpánek was attended by the vice-rector Milan Houser and the dean of the Faculty of Electrical Engineering and Communication of the BUT Vladimír Aubrecht. The exhibition was held on the occasion of the 80th anniversary of Nikola Tesla's death, the eminent physicist and visionary, who has been an honorary doctor of the university since 1937. Visitors could experience specific physical phenomena through interactive exhibits such as the Columbus egg, a plasma ball and Tesla's transformer inside the Faraday cage. In addition, the faculty prepared several kits of a small Tesla transformer in the playground for children to try it out.

MAY

3.

Donate a drop of blood

At the beginning of May, students from the Students for Students' Club (SPS) organized a regular annual group blood donation at the University Hospital in Brno.

12.

Cyberneticians from the University of Defence tried out the Cyber Arena

Fourth-year students of the Cybersecurity study programme at the University of Defence tested the difficulty of a training realistic scenario called "Dream Holiday" at the Cyber Arena of the Department of Telecommunications, FEEC BUT. Brno University of Technology Cyber Arena (BUTCA) is a technical platform

Photo: Nikola Číková

for training in the field of cyber security. Users of the arena appreciate especially its connection with real industrial facilities, as well as its playability and user-friendliness.

24.

Sports Day at the BUT

Photo: Radek Pokorný

Employees of the Faculty Dean's Office went on a teambuilding trip to the Veveří Castle near the Brno Dam as part of the Sports Day.

24.–26.

IDET 2023

Photo: Jan Prokopius

At the International Defence and Security Technology Fair IDET, the BUT presented, among other things, a swarm of unmanned drones (UTEE), the BUTCA platform (UTKO), an experimental platform for underwater cable-free optical communication (UREL), the Orpheus-X robot (UAMT) and an optical fibre system for surveillance of critical infrastructure (UREL and UTKO).

24.–26.

23rd International Scientific Conference on ELECTRIC POWER ENGINEERING 2023

Photo: UEEN archive

The International Scientific Conference EPE (ELECTRIC POWER ENGINEERING) 2023, co-organized by the Department

of Electrical Power Engineering, focused mainly on the problems of power engineering in the field of science, research and practice. The conference provided a platform for the exchange of valuable information, a space for discussion and networking between industry, schools and researchers.

25.

Final workshop of the Microcontrollers are In! 2023 competition

Photo: Jakub Rozboud

The Microcontrollers are In! competition is a traditional competition organized by the Institute of Experimental Technologies at the Brno University of Technology (IET) and the Department of Theoretical and Experimental Electrical Engineering, which is intended primarily for secondary schools, grammar schools and university students. It is a competition for individuals or teams from the South Moravian Region and its surroundings. Participants were asked to design and construct a functional device containing a microcontroller.
25 projects were presented at the final workshop, representing a total of 39 competitors (6 team projects

Photo: Jakub Rozboud

and 19 individual projects). This is the highest number of participants in the history of the competition. As an example, competitors chose the topic called "Bojack - Mechatronic Unit and Robotic Arm", "Bipedal Walking Robot", "Exploration System (CanSat)", or "Digitron Clock". The competition runs from mid-February and concludes with a final presentation and demonstration of the equipment in front of a committee consisting of industry and BUT experts.

30.

Prime Minister Petr Fiala's Visit to the BUT

Photo: Jan Prokopius

The Prime Minister of the Czech Republic visited the Brno University of Technology. During the event, which took place in the Rector's Hall of the Rector's Office, some of the BUT research results were presented to the Prime Minister Petr Fiala. The Robotics and Artificial Intelligence Group of the Department of Automation and Measurement Technology demonstrated the Orpheus robotic system.

Photo: Jan Prokopius

The Department of Telecommunications presented the educational platform Cybernetic Arena BUTCA and the Smart Household project. The Department of Theoretical and Experimental Electrical Engineering presented a swarm of drones. The Conductive Concrete project, at which scientists from the Department of Microelectronics are collaborating, was also on display. Furthermore, our graduate student's educational project called OMG Robotics was presented.

JUNE

5.

Commemorative meeting on the 55th anniversary of the tragical avalanche at the Kubínská Hole

We remembered the anniversary of the tragedy at the Kubínská Hole with a commemorative meeting between the representatives of the FEEC management

and the town of Dolný Kubín at the monument to the victims of the avalanche that tragically took the lives of six students of our faculty 55 years ago. The meeting first took place at the town hall, where our delegation was received by the deputy mayor and his colleagues.

Photo: FEEC BUT archive

Afterwards, they moved together to the monument to the victims of the avalanche directly under the top of the Kubínská Hole. There they laid memorial wreaths, said a prayer together and observed a minute of silence in memory of the student victims of the tragedy from 16 January 1968, when the students of the former Faculty of Electrical Engineering at Brno University of Technology were hit by an avalanche during ski training.

12.

Launch of the URESAT-1 nanosatellite

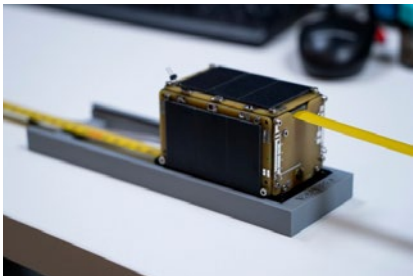


Photo: UREL archive

On Monday 12 June, the SpaceX Transporter-8 mission launched, among others, the URESAT-1 nanosatellite, which carries a miniature SSTV camera developed at the UREL FEEC BUT.

14.

Picnic with the Dean

Photo: Jakub Rozboud

The first annual Picnic with the Dean was held near Professor Brauner's Hall. It was an informal meeting of staff, PhD students and faculty management, including the participation of the band Vzdušné zámky.

15.–16.

International Conference on Mathematics, Information Technology and Applied Sciences – MITAV 2021

The Department of Mathematics co-organizes an annual conference, which is intended primarily for teachers of all types and levels of schools. It focuses on the latest findings in mathematics, computer science and other sciences, as well as on the issues of teaching the subject at all types and levels of schools, including e-learning and other applications of information technology in the educational process.

19.–21.

Summer School of Biomedicine

Photo: Oto Janoušek

The Summer School of Biomedical Engineering was held at the Department of Biomedical Engineering, FEEC BUT. During three days, secondary school students were discovering the world of technology and medicine. They measured muscle activity, evaluated heart rhythms, disassembled a laboratory CT scan and used their own DNA to evaluate how we differ from dinosaurs. Students from both Czech and Slovak Republics were also shown new discoveries in catheterisation of anatomical models of the heart, ultrasound examination and modelling for 3D printing.

19.–21.

44th NZEE Conference – Nonconventional Sources of Electricity 2023

The 44th year of the Nonconventional Sources of Electricity (NZEE) conference, which is organized by the Department of Electrical and Electronic Technology, took place in June at the Wellness Hotel Panorama in the Moravian Karst region. This year's conference was attended by a number of scientists from the Czech Republic and Slovakia, as well as many

Photo: UETE archive

experts from the private and industrial sector. One of the most discussed topics of the conference was the reduction of energy dependence on external energy suppliers, the introduction of legislative support for new areas of renewable energy use, especially photovoltaics and storage. A number of interesting papers were presented, ranging from balcony PV systems without storage, or a community energy sharing within apartment buildings, to economic analyses of the payback of PV installations. Another example worth mentioning is the project of an energy independent residential house, which builds on the already implemented project of the Czech Self-Sufficient House. A particular attention was given to the section tracking new trends in electromobility and new services that electric vehicles can provide (V2X), including pilot projects on second life for electric vehicle batteries.

22.

Workshop at the traffic polygon for the ELORYKS project

Photo: Jan Prokopius

At the request of the application guarantor of the Police of the Czech Republic, the results of the ELORYKS project (Electronic speed limitation of vehicles in emergency and crisis situations by security forces, VJ01010066) were presented at the traffic polygon in Jihlava. During the presentations, the objectives of the project itself, as well as the current state of the project were presented, including practical demonstrations of the use of non-destructive enforcement devices to slow down vehicles in an emergency situation. The Department of Telecommunications takes part in the project.

26.–28.

Summer School of Sports Technology

In cooperation with the Centre for Sports Activities of the BUT (CESA), the Department of Biomedical Engineering prepared a summer school for those interested in the field of sports technology. Secondary school students had the opportunity to get an insight into the field of sports technology and the respective study programme, which is taught at the CESA.

26.–30.

International Academic Visit 2023

Photo: UEEN archive

The Department of Electrical Power Engineering staff prepared a block of a cross-curricular course on electrical power engineering for 14 master degree students from the Strathmore University in Kenya, including practical demonstrations in laboratories and a field trip.

27.–28.

Graduation ceremony for graduates of Master's and Bachelor's degree programmes

Photo: Jakub Rozboud

Within two days, graduation ceremonies were held first for master's and then for bachelor's graduates from the FEEC BUT 2023.

JULY

12.–14.

TSP 2023

International conference for academic and scientific researchers working in telecommunication technology and signal processing, organized annually by the Department of Telecommunications of the FEEC in cooperation with other universities from the Czech Republic, Hungary, Turkey, Croatia, Taiwan, Japan, Slovak Republic, Spain, Bulgaria, France, Romania, Slovenia, Greece and Poland under the auspices of IEEE Region 8 and the Czechoslovak Section of IEEE. The conference proceedings are regularly indexed in the international databases IEEE Xplore®, Conference Proceedings Citation Index (CPCI) - Web of Science by Clarivate, SCOPUS, DBLP and Google Scholar. Selected and extended articles are included in special issues of reputed scientific journals Q2 AIS.

AUGUST

2.

Opening of the Eaton Student Hub

Photo: Jana Valchová

Eaton, a company dealing with intelligent energy management, opened the Student Hub at our faculty in early August. This is a joint workplace that will enable the Eaton European Innovation Centre (EEIC) in Prague to deepen collaboration with BUT scientists and students to participate in research and development in digitalization, energy transformation and sustainability.

27.–30.

24th International Conference Advanced Batteries, Accumulators and Fuel Cells (ABAF)

The international conference called Advanced Batteries, Accumulators and Fuel Cells (ABAF) is organized annually by the Department of Electrical and Electronic Technology. The event was attended by over 100 participants mostly from Europe, but also from other parts of the world, for example from South America and Asia. The conference focuses on research topics and applications of modern electrochemical power sources such as Li-ion batteries and newer battery technologies, fuel cells, supercapacitors, as well as areas related to renewable energy sources such as photovoltaic cells. The 2023 conference was organised with the support of the European Battery 2030+ initiative, which is a part of the European Battery Alliance. Prof. Kristina Edström from the Uppsala University, who is leading the initiative, spoke on a panel with representatives from the Eastern EU countries.

24. – 27. and 27. – 30.

BUT pre-school

Photo: Ondřej Lokos

The traditional familiarization event took place at the Vranov Dam under the auspices of the BUT Rector. Prospective students were "pre-trained" by student associations members operating at the BUT, including our faculty students from the Students for Students' Club. Participants took part in a wide range of activities and competitions aimed at getting to know their new classmates.

29. 8. – 1. 9.

ETACS 2023 and SP2I 2023 workshops at ARES 2023 conference

International workshops organized by the Department of Telecommunications focused on cyber security. The workshops in Benevento, Italy, were attended by a number of representatives from different universities (e.g. Italy, France, Austria, Lithuania) and key institutions, in particular the ENISA (European Network and Information Security Agency) and the USC (University of Southern California, USA).

SEPTEMBER

1.–8.

Nuclear Engineering Summer School 2023

The summer school for those interested in the future development of nuclear energy is co-organised by the BUT and CTU. The programme included thematic lectures on practical or non-traditional nuclear topics, excursions, nuclear competitions, nuclear cinematography, and nuclear and non-nuclear activities. The programme was supervised by experts from practice and Czech universities. The summer school was supported by the organisers and their industrial partners.

4.

BluEMI Ampere Open

This year, the Department of Radioelectronics hosted the BluEMI Ampér Open doubles tennis tournament for the fourth time. As usual, the tournament was held on the courts of the BUT Centre of Sports Activities and this year 8 pairs participated. After a difficult duel, the victory was finally won by the pair Stanislav Hanus and Roman Maršálek. The organization of the tournament was supported by the company BlueEMI, whose representatives also participated in the tournament.

4.–8.

XXIV International Symposium on Physics of Switching Arc

Photo: Physics of Switching Arc archive

The Department of Physics together with the Department of Power Electrical and Electronic Engineering and CVVOZE organized the XXIV International Symposium on Physics of Switching Arc, which took place in Nové Město na Moravě. A total of 75 scientists from 11 countries participated in the symposium. The presentations covered both modelling and experimental research of electric arc plasmas in low and high voltage switches, as well as non-traditional uses of plasmas, such as their application in biology, medicine, and so on.

6.–8.

SEMICON Taiwan

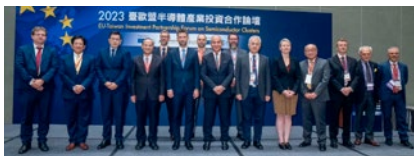


Photo: EEAS

Researchers from the Department of Microelectronics FEEC headed for SEMICON Taiwan, the largest

trade fair in the field of semiconductor technology. BUT was the only university at the Czech stand, where it presented its research together with industrial partners and other representatives of the Czech National Semiconductor Cluster (CNSC), being its member.

11.–13.

Trends in Biomedical Engineering Conference

Photo: conference archive

The conference, organized by the Czech Society of Biomedical Engineering and Medical Informatics, enabled a meeting of departments dedicated to teaching and research in biomedical engineering, with the aim of strengthening cooperation and sharing experience between experts from the Czech and Slovak Republics.

13.

Opening ceremony of the FEEC photovoltaic polygon

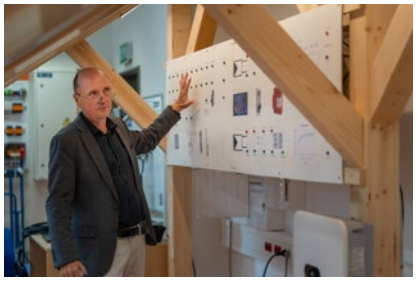


Photo: Václav Koníček

A photovoltaic polygon was inaugurated at the faculty in mid-September to serve as a training laboratory for students to teach them how to install photovoltaic roof systems. During the morning, visitors could see the lab equipment and try out the simpler parts of the installation themselves. The polygon was created in cooperation with the Czech Photovoltaic Association (CFA).

15.

Student matriculation ceremony

Photo: Jakub Rozboud

Just before the beginning of the winter semester, the matriculation ceremony of newly enrolled students took place. The matriculations moved on freely from the official ceremonial part to the opening presentation for the first-year students.

15.–17.

PerFEECt start

A traditional welcome event for first year undergraduate students, organised by students from the Students for Students' Club (SPS). The new students had the opportunity to get acquainted with the faculty premises and their future classmates. They were given practical tips from current students on both registering for courses and studying at the FEEC in general.

20.

Music from the FEEC

Photo: Jakub Rozboud

The beginning of the semester at the FEEC BUT is always tuned to music, specifically in the form of the traditional Music from the FEEC festival, which is organized by students from the faculty Students for Students' Club. This year's

15th anniversary round started again with the students' bands competition, which was attended by 5 competitors.
During the day, a student formula of the TU Brno Racing team was presented in the parking lot of the FEEC Pod Palackého vrchem campus, an accompanying programme was provided by the event partners and the students were also greeted by hockey players from the BUT Cavaliers club.

Photo: Jakub Rozboud

The BUT Rector Ladislav Janíček and the Dean of our faculty Vladimír Aubrecht were also part of the audience, and they handed over prizes to the three best-rated bands. The winning band with the highest number of student votes was the band Disonant. The musical performance then ended with the phenomenal Vypsaná fixa, which made the whole crowd sing. A drone show of the FlyinDiamons graduate project came at the very end.

OCTOBER

2.–6.

YSpace team at the International Astronautical Conference in Baku

Photo: YSpace archive

The aim of the annual conference is to create a platform where professionals from the space industry can share their ideas, research results or technology news. BUT representatives and members of the YSpace student association also attended the conference as part of the official delegation of the Czech Republic, which consisted of research institutions, companies and students.

3.–5.

Gaudeamus Bratislava 2023

The first stop of the European Fair for Post-Secondary and Lifelong Learning in the academic year 2023/24, of course with the participation of FEEC representatives. Gaudeamus seeks to reach mainly final secondary school students, but is also targets at their teachers and educational advisors.

6.

Night of Scientists 2023

Photo: Jakub Rozboud

The faculty traditionally participated in a popular nationwide event called the Night of Scientists. This year's topic was SECRETS. Visitors could find out how the levitation of objects works using sound or they could take a virtual reality tour through the primary circuit of a nuclear power plant and a fusion reactor.

Photo: Jakub Rozboud

Other highlights included an exhibition on switching devices, electric arc and safety, as well as the opportunity to explore the ins and outs of a laboratory computed tomography machine. The most interesting part of the programme this year was

the demonstration of a large Tesla transformer, with its several-metre-long lightning bolts providing an unforgettable light and music show. The Professor List Science and Technology Park was also open, which is used primarily for conducting research on renewable energy, power engineering and electrical power engineering.

Photo: Jakub Rozboud

This was the first Night of Scientists when a direct bus connection was provided by line 72, which had a positive impact on the large turnout. In the 2023 edition, 790 visitors, including children, visited us.

9.

GRBAlpha: The smallest astrophysical space observatory

On 9 October 2023, the so-far brightest gamma-ray burst was observed. It was detected by a number of instruments, one of which was the GRBAlpha satellite, which is the result of an international collaboration involving the Department of Radioelectronics. The scintillation detector at the satellite of 75 x 75 x 5 mm was measuring sixteen energy ranges at a time, with the first three ranges being below the set threshold due to noise in the measurement system. Measurements were taken at four-second intervals. The flash was observed just before the satellite entered the Van Allen radiation belt.

10.–13.

64th International Engineering Fair Brno

Photo: Nikola Číková

The Department of Telecommunications introduced and presented a demonstrator of a wastewater treatment plant with the deployment of 5G technologies. It also presented the Master of Science in Cybersecurity professional education programme as part of the Czech National Exposition at the International Engineering Fair. At the BUT stand, the Department of Telecommunications presented defectoscopy using artificial intelligence.

17.

The launch of Weak Signals book by Miroslav Kasal with a subsequent discussion

Photo: Václav Koníček

The Technical Museum in Brno hosted a launch of the book Weak Signals by Professor Miroslav Kasal from the Department of Radioelectronics, who is an internationally recognized expert in long-distance radio communication, particularly in space communication. The godfather of the book was the Vice-Dean of the faculty Tomáš Kratochvíl, joined by the Vutium Publishing director Jana Kořínková and the TBM director Ivo Štěpánek.

20.

ARTISEC

The Department of Telecommunications co-organized a workshop held under the auspices of the Governor of the Hradec Králové Region and with the participation of other regions (Pardubice and Liberec) on regional cyber security within the Smart City concept. The event was a unique opportunity to present research on Smart

City and cyber security and at the same time to get feedback from municipalities.

21.–22.

Maker Faire Brno

Photo: Karel Horák

A festival for fans of innovation, technology and technical education took place at the Brno Exhibition Centre with the participation of the YSpace student association.

24.

CSRES

Photo: Miloš Neuman

The Department of Telecommunications participated in the CSRES meeting, where it presented applications of the BUTCA Cyber Arena for all distribution companies (PRE, CEZ, EG.D). The aim of the event was to present scenarios focused on energy, specifically on the cyber security of smart meters. The scenarios were diversified for the different levels of technical background of the trainees.

25.

Breakfast with the Dean

Photo: Jakub Rozboud

At the first-ever Breakfast with the Dean, students had the opportunity to have a morning coffee and a bite to eat with the dean and the faculty's inner circle and discuss ideas for improving the environment and the running of the faculty.

26.–27.

IMAPS Flash Conference 2023

Photo: UMEL archive

IMAPS CZ & SK organized the 9th IMAPS Flash Conference in cooperation with the Department of Microelectronics. The conference is focused on modern trends in microelectronics. This year's conference focused mainly on SiC and GaN semiconductors, photonics and nanotechnology.

30. 10. – 1. 11.

ICUMT 2023

International congress organized in Ghent (Belgium) by the Department of Telecommunications of the FEEC BUT in cooperation with the local Ghent University and also the Tampere University (Finland) as an open forum mainly for researchers in telecommunications, control systems, automation and robotics. The aim of the event was to present original results from basic and applied research. The event was attended by more than 80 representatives from academia and industry. The proceedings of the event are regularly indexed in the international databases IEEE Xplore®, Conference Proceedings Citation Index (CPCI) – Web of Science by Clarivate, SCOPUS, DBLP and Google Scholar.

30. 10. – 1. 11.

FOAN 2023 Workshop Security in Communication Networks

The Department of Telecommunications organised an international workshop at the ICUMT 2023 conference in Ghent

(Belgium). It was a special workshop focused on security in communication networks. The aim was to have an open discussion to identify security risks and at the same time to enhance the security of existing communication networks. The workshop was attended by eminent personalities from academia (Boston University, Feng-Chia University), research (CNRS France) and industry (NTT Japan, BH Telecom).

31. 10. – 3. 11.

Gaudeamus Brno 2023

Photo: Václav Koníček

The BUT and FEEC representatives could not miss the Gaudeamus Brno post-secondary education fair. Visitors had the opportunity to see the university stand at the fair, where, in addition to exhibits, student representatives were waiting for them, ready to answer any questions.

NOVEMBER

3.

Regional round of the Logical Olympiad

Photo: UTEE archive

At the beginning of November, the regional round of the 16th Logical Olympiad organized by Mensa Česko took place at the premises of our faculty. Logical Olympiad is well-known for its tasks that require creative thinking, analytical skills and logical deduction. The coordinator of the regional round is Karel Juřík, a student from the UTEE.

6.

Students for Students' Club Quiz with the faculty management

Photo: Jakub Rozboud

A quiz was held by the Students for Students' Club (SPS) with the faculty management to deepen the relationship between the student organization and the management. Five teams competed, with the captain being one of the faculty management representatives each time. The questions covered both the running of the faculty and general knowledge, such as facts about Brno or music.

11.–12.

BASTLfest at the VIDA Centre

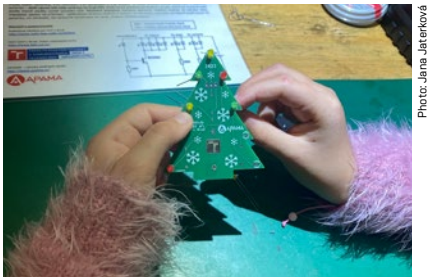


Photo: Jana Jeřerková

Traditionally OK2KOJ radio club and Department of Radio Electronics organized a workshop within BASTLfest in VIDA! center. This year was again visited by more than 100 interested future bastlers. In addition to the traditional kits, new and improved Christmas tree kits were also available at our Labworkshop. Visitors could take the assembled and animated devices home as a souvenir. Electronics is all around us and we are glad that not only did we show it to curious children, but we could also teach their parents.

14.–15.

Gaudeamus Nitra 2023

Another happening in a series of Gaudeamus, this time in Slovakia, where our faculty is quite popular. The annual high participation of secondary school students at this event reinforces the importance of personal meetings with our potential prospective students.

17.

Brno 17th November

The fundamental values of democracy, which include freedom, tolerance and solidarity, have not always been as common as they might seem today. Past generations had to fight for such ideals and values.

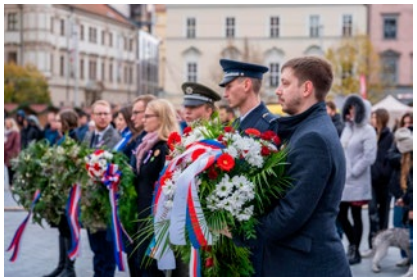


Photo: Václav Koníček

That is why every year, on 17 November, the BUT commemorates the events of 1939 and 1989, when it was students who were at the forefront of this struggle for freedom and democracy. We are aware that democracy is not a common thing and that many before us gave their lives for it. Students of our faculty participated in the organization of the Brno 17th celebrations and laid wreaths on the Náměstí Svobody Square as part of the events.

23.

First round of the Merkur perFEECt Challenge 2023-24

Photo: Jakub Rozboud

Thursday 23 November 2023 became the day of the historical 10th anniversary year of the Merkur perFEECt Challenge competition for secondary school teams. An incredible 228 students from 35 secondary schools across the Czech Republic participated in the jubilee year. The four-member teams were divided into nine groups according to the completed assignment, with the winner of each group advancing to the February superfinals.

Photo: Jakub Rozboud

There were no limits to creativity, and, as a result, a number of interesting and imaginative solutions were created. During the competition day, students worked on building a working model of a wind power plant, controlling a car with their muscles or building an automated waste sorting plant.

27.–28.

Gaudeamus Košice 2023

The most distant location of this education fair, but again a beneficial one for us, as a considerable number of young people come from eastern Slovakia to study at the FEEC.

DECEMBER

6.

Punch by Students for Students' Club

Traditional St. Nicholas' punch organized by the Students for Student's Club outside the faculty.

6.–8.

St. Nicholas Day' Meeting of the Young Generation of the Czech Nuclear Society

Photo: UJEEN archive

The Department of Electrical Power Engineering was a co-organizer of the 23rd annual St. Nicholas meeting of the Young Generation of the Czech Nuclear Society. The meeting presented both the award-winning final theses of nuclear students from all over the Czech Republic, as well as other works of young professionals dealing not only with nuclear energy. The participants of the meeting also visited the BIOSTER company, which deals with radiation sterilisation.

16.

BUT Junior at the FEEC

On Saturday 16 December, 100 primary and secondary school pupils visited the faculty as part of the BUT Junior programme. The children had an opportunity to focus on one of five topics. Some were able to make and take away an electronic dice, while others explored body signals. Some groups studied electronic components, others tried their hand at working with robotic arms and some focused on nuclear power. Moreover, children could visit the faculty's interactive playroom, the Elektrikárium.

Photo: Jakub Rozboud

The aim of the event is to introduce the participants to the BUT environment in a playful way and get them excited about modern technologies. Thanks to the programme, students visit a different faculty each month, where an interesting programme is prepared for them as a teaser for the topics that the faculties deal with. More information about the programme at: www.vut.cz/junior

19.

Prof. Jiří Jan celebrates his 60th professional anniversary

Photo: UBMI archive

Professor Emeritus Jiří Jan celebrated his 60th anniversary in the academic environment by meeting his biomedical colleagues and friends.

21.

Astronaut at the BUT

Photo: Václav Koníček

Biomedical experts from our faculty measured the biosignals of the European Space Agency's backup astronaut, Major Ales Svoboda, at the FME. They will now evaluate how the effect of extreme cognitive load is manifested in these signals.

Important awards and merits

The FEEC team won the award for the best security research project

The Department of Telecommunications team won the Minister of the Interior Award for outstanding achievements in security research. The award went to the project "Cyber arena for research, testing and education in the field of cybersecurity".
The award ceremony took place on 14 December at the premises of the Ministry of the Interior (MoI) in Prague, Letná. "The awarded project is an example of effective financing of research and development with already documented societal impact and a wide potential for further use in issues that are and will be crucial for ensuring the security of the Czech Republic. We are glad that we are able to find and support such projects in security research," said Luděk Michálek, the Director of the Department of Security Research and Police Education of the Ministry of Interior of the Czech Republic.

Photo: Nikola Číková

Representatives of the Department of Telecommunications research team (from the left) Petr Číka, Willi Lazarov, Radek Fujdiak and Jiří Mišurec accepting the award from the Chief Director of the Internal Security and Police Education Section of the Ministry of the Interior Jan Paďourek (fourth from the right)

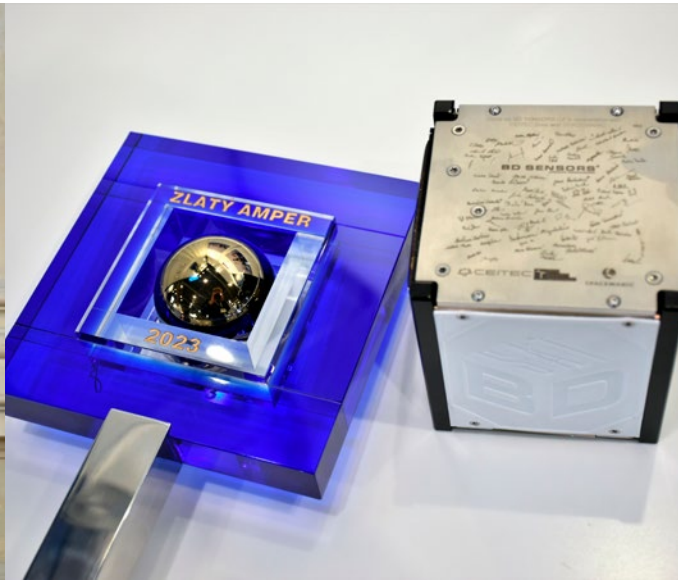


Photo: archiv MŠMT, archiv BD SENSORS

Minister Bek awarded Professor Emeritus Pavel Jura with the Medal of the Ministry of Education

At the beginning of the winter semester, Minister of Education, Youth and Sports Mikuláš Bek presented the 1st degree medal to Pavel Jura, professor emeritus at the BUT, which is the highest possible award in the field of education and upbringing.

Professor Pavel Jura specializes in solving theoretical and application issues in system modelling and signal processing. He has laid foundations of high-quality university courses in both undergraduate and graduate studies. He has significantly contributed to the introduction of the combined form of bachelor and master studies at the Faculty of Electrical Engineering and Communication. He was also a popular teacher, regularly ranking to the top of student evaluations of instructions and teachers.

Between 2006 and 2014, Professor Jura was appointed Vice-Rector of Brno University of Technology and as such, he did a tremendous job in consolidating the information technology agenda, libraries and databases of electronic books and journals.

Golden AMPER

The expert committee of the Golden AMPER 2023 competition assessed the exhibits at the AMPER fair venue and decided on the most beneficial exhibit of the fair. The BDSAT project won in its category. The BDSAT nano-satellite was designed for experimental verification of sensor systems in our orbit. Specialists from BD SENSORS, Spacemanic and researchers from the CEITEC BUT and the Department of Radioelectronics FEEC participated in the development. BUT was also awarded an honorable mention for the Cyber Arena for Research, Testing and Education in Cybersecurity (BUTCA) by researchers from the Department of Telecommunications.

Hlávka Foundation Awards

The celebration of the International Student Day and the commemoration of the Velvet Revolution is preceded every year by the awarding the Josef, Marie and Zdeňka Hlávka Foundation Prize to talented students under the age of 33. The Josef Hlávka Awards are decided by the Foundation's Board of Directors on university rectors' proposals. This year's award ceremony took place on 16 November at Josef Hlávka's chateau in Lužany near Přeštice. Based on the proposal of the Rector of the BUT, the award was received by Oldřich Panáček, a graduate of the Bachelor's degree programme Biomedical Technology and Bioinformatics. He received the award for his bachelor thesis "Analysis of diagnostic parameters of the heart in 4D CINE MRI data", which he prepared under the supervision of Jiří Chmelík. In his bachelor thesis, focusing on the analysis of diagnostic parameters of the heart, he used technical, medical, mathematical and programming approaches. Karel Juřík was presented with the Professor Daniel Mayer's Special Prize, which is awarded by the Hlávka Foundation to the best students of electrical engineering faculties on the proposal of their deans. Karel Juřík is a PhD student at the Department of Theoretical and Experimental Electrical Engineering. He focuses on research on electromagnetic resonators for ion engines energy pumping and their use in satellites at a very low Earth orbit.

Photo: Hlávka Foundation

Awarded BUT students (on the right) with Rector Ladislav Janíček (centre). Oldřich Panáček (FEEC) as the second from the right

Photo: Hlávka Foundation

Karel Juřík from the FEEC (first on the right) with the Rector of the BUT during the Daniel Mayer Award ceremony

Brno Ph.D. Talent

Two FEEC PhD students received a scholarship cheque for their further research within the Brno PhD programme during a gala evening at the Brno City Hall. Each of them received a scholarship at the amount of CZK 330,000. One of the awarded students is Martin Ptáček. His research, which he conducts at the Department of Radioelectronics, focuses on signal processing and in particular on the estimation of the space-time function related to localisation. Estimation of the spatio-temporal function finds applications in astronomy, telecommunication network planning or weather forecasting. The PhD student wants to develop estimation methods in order to improve the forecasts quality. He believes that the experience will help him solve further practical problems in industry and research collaboration. The other awarded FEEC PhD student is Lukáš Zezula, who is studying a doctoral programme at the Department of Control and Instrumentation. He focuses on diagnostics of electric drives used also in electric cars. From the perspective of reliability, it is important to secure that the drives will not cease to function even in the event of a malfunction or failure. Thus, the aim of his research is to design diagnostic algorithms with parametric estimation to monitor fault indicators and to use these indicators to compensate optimally for a given fault. What Lukáš Zezula likes about science is the interconnection between theoretical designs and practical experiments.

Photo: Jan Prokopius

Martin Ptáček, Ph.D. student from the Faculty of Electrical Engineering and Communication BUT.

Photo: Jan Prokopius

Lukáš Zezula, Ph.D. student from the Faculty of Electrical Engineering and Communication BUT.

1st place in the Jaroslav Buchar Prize 2023 competition

A faculty student Natália Pločeková took 1st place in the student competition called Professor Jaroslav Buchar Prize 2023 organized by SVS FEM. With her bachelor's thesis "Sensors for electromagnetic detection of partial discharges" written under the supervision of Petr Drexler from the Department of Theoretical and Experimental Electrical Engineering, she also beat the students of master's degree programmes.

She has thus perfectly completed her bachelor studies in the Electronics and Communication Technologies programme. The committee especially appreciated the excellent technical level of the work and the innovative approach of the student in designing the sensor.

Natália is also a member of the Students for Students' Club and has participated in the presentation of our faculty at the Gaudeamus fair.

Silver medal onsemi

Jiří Háze from the Department of Microelectronics was awarded the onsemi Silver Medal for his long-term cooperation with industrial partners and strong support for education in close cooperation with onsemi. The medal was awarded on the occasion of onsemi's 30th anniversary in the Czech Republic.

ESA awards satellite project involving students from the BUT and the Mendel University

The mission called CIMER (Cyanobacteria in Microgravity Environment Research), led by a scientific team from the Mendel University together with the YSpace student team from the FEEC, wants to help one step further on the path to human colonization of Mars and the Moon. The aim of the mission is to send the first Czech student satellite into the Earth orbit, which will include a bio-container containing dried bacteria. The scientists will then try to revive the bacteria remotely to test the possibilities of rehydrating them and putting them into an active state in which they can serve other purposes, such as generating oxygen. In addition to the scientific objective, this mission also provides an opportunity for practical training for students.

Photo: Václav Koníček

YSpace team representatives.

Well-known figures

Swarm of unmanned drones with ground robots to help army explore hazardous areas

A chemical plant accident, a hit by a dirty bomb or a military attack. A multi-agent system of unmanned drones and ground robots controlled by artificial intelligence will enable quick and detailed human exploration of risky areas. Researchers from the FEEC BUT are currently working on its development in cooperation with the University of Defence. It will be presented for the first time at the upcoming IDET International Defence and Security Technology Fair in May.

The use of drones by the military forces or the police is not a novelty currently. They are mostly operated manually, where a drone is controlled in real time by an operator. However, the monitoring system, which experts from the FEEC BUT and the University of Defence began to develop a year ago, will offer much more complex monitoring options. Instead of a single drone, a whole swarm will fly into the air equipped with sensing technology – radiation detectors and conventional and thermal imaging cameras. It will be accompanied by ground robots, which will complement the data obtained from the aerial view with those on the ground.

Photo: Jiří Janoušek

Mission preparation for the swarm of drones.

"The security specialist marks an area of interest on the map. He then presses a button and a swarm of drones, along with ground robots, explores the area. Thanks to the use of artificial intelligence, the system will be autonomous and will work even without human control. If some drones are lost - either due to an enemy intervention or weather effects, the system should solve the entire task by itself," Luděk Žalud from the FEEC BUT explains.

A system of unmanned drones with ground robots can take up-to-date three--dimensional maps of the area. Specialists will thus immediately obtain information on whether an adversary has deployed military equipment in a given area or how much damage the attack has caused to buildings. Mapping will be enabled not only in the visible spectrum, but also in the infrared thanks to the use of thermal imaging, which will allow, for example, a detection of people. In this way, the military and other branches will obtain information about the situation and the security of the terrain before they send a unit there. "The swarm detects that there is a source of radiation in the area and passes the

Photo: Jiří Janoušek

Command post with swarm of drones.

information to a ground robot, which can come to the location and conduct a more detailed survey or take samples," the project leader Petr Marcoň from the FEEC BUT describes one of the scenarios.

The experts also plan to incorporate the Orpheus series ground robot into the monitoring system. Since 2003, Luděk Žalud's team has been developing these machines in several versions – both for military and civilian use. However, they will also develop a small mobile robot that can be carried by a drone to the desired location. Moreover, the flight paths of individual drones will be dynamically reconfigurable. Artificial intelligence algorithms can change the route of the drones during the intervention so that the given area is explored as quickly as possible. Artificial intelligence will also be used in the recognition of objects in the field, including camouflaged military equipment.

The joint project of experts from the FEEC BUT and the University of Defence was originally intended to serve only for the army purposes. Nevertheless, the police and firefighters have already shown an interest in it. It will also be used by security forces for chemical, biological and nuclear defence. "If there was an explosion of a so-called dirty bomb, which is a bomb with radioactive material dispersing it over a wide area after the explosion, our reconnaissance system will help to detect whether the area is safe or whether there is a source of ionizing radiation," Žalud explains. "There are more and more subjects interested in the system. Therefore, we are thinking about the development of a more massive system, where each of the users will be able to choose only some robotic elements according to the sensor equipment. Under normal circumstances, each component will only use its part, but in the event of a greater threat, they can cooperate," Marcoň adds.

The monitoring system is currently in its second year of development, and should be ready at the end of 2025.

An algorithm developed by the FEEC is intended for identification and transfer of injured soldiers away from the battlefield

An algorithm processing soldiers' biosignals could identify soldiers who are in life-threatening danger and need an immediate rescue. Researchers from the Department of Biomedical Engineering (UBMI) are focusing on its development. They are in their third year of collaboration with the US Navy and the prestigious Mayo Clinic medical facility on algorithms that can assess the physical condition of soldiers in real time. Lukáš Smítal from the UBMI came up with the idea of developing software for wearables – smart devices that can be worn on the body – four years ago. "We were developing software for ONR Global and Mayo Clinic was producing hardware for them. We decided to get together and design a device that would be used by the US Navy in training soldiers," the researcher explains the origins of the team specialising in ECG recording and analysis at UBMI. The algorithm, which originally analysed only heart activity, was gradually extended to include other functions, including an accelerometer. "We get information about a person's heart activity in relation to their movement. We can thus evaluate whether increased cardiac activity corresponds to walking up stairs or whether the patient is at rest and there is an abnormal cardiac response," Smital describes.

Photo: Oto Janoušek

Research team from the UBMI FEEC BUT – Lukáš Smital, Martin Vítek, Andrea Němcová, Radovan Smíšek

However, to test and debug an algorithm that could track soldiers' fitness, the researchers needed to collect data not only from patients but also from people undergoing heavy physical stress. "One of our PhD students, Lucie Šatlová, is an endurance runner. Together with other athletes, she helped us with the data collection. We also discovered other practical problems – athletes sweat and move around a lot, so it is necessary to use better electrodes than those used at the doctor's," Smital explains.

The US Navy has also expressed an interest in the technology. "They can monitor soldiers' vital functions in real time – ideally in training and on the battlefield. They monitor whether a soldier is under any physical stress, whether he is injured or needs help," says Martin Vítek, another member of the research team.

While software is being developed at the FEEC, the Mayo Clinic is working on developing hardware that would capture

the ECG curve as accurately as possible without interfering with movement. "They are experimenting with spots where an ECG activity could be sensed. So, in addition to the standard chest leads, they are trying to collect data from the side, back or shoulder – this has proven to be the second most accurate location after the chest," Smital adds.

The UBMI researchers now want to go on in their research with another follow-up project. "The US Navy should provide us with new data involving crisis situations – including simulated explosions and military trainings at the sea. This will not only improve the algorithms, but it will also allow us to measure additional complementary signals, including PPG – this is used to monitor changes in blood volume in the microvascular tissue," explains the researcher.

Biosignals could then detect whether a person is seriously injured and dying. "The algorithm would then enable an efficient identification of such soldiers who need to be rescued soon and which of them can wait until later, but this is still a subject for future research," the researchers conclude.

Electricity consumption is growing worldwide. Innovative motors from the FEEC can save up to 20% of energy

The more economical permanent magnet motors can be powered directly from the single-phase mains. FEEC BUT experts have designed unique synchronous machines within the TAČR project that minimize electrical losses and thus meet the new stricter standards of the European Commission. They can be used in heat pumps, ventilation systems or large household appliances such as washing machines and refrigerators. In fact, electric motors consume around 30-40% of all electricity. According to a technical report by McKinsey & Company, an electricity consumption is growing by up to 1.1% per year. By 2050, the total consumption in the European Union could rise up to 40% more. Reducing energy demand is therefore one of the prerequisites for sustainable development.

"There is a great potential for energy savings. Every percentage that can be saved in an electric motor consumption sums up in big numbers. That is why the EU is imposing increasingly stringent requirements for high efficiency of electrical machines and minimising losses," explains Jan Bárta, the head of the FEEC research team. In response to the new European Commission regulation, the TAČR project therefore

Photo: Václav Koníček

Jan Bárta from the FEEC BUT.

developed new motor models for the South Moravian company EMP.

The international standard IEC/EN 60034-30-1 (in the Czech Republic standard ČSN EN 60034-30) defines four efficiency classes: standard efficiency (IE1), increased efficiency (IE2), high efficiency (IE3) and very high efficiency (IE4). As of 1 January 2017, the minimum required efficiency class for motors in the 750 W to 375 kW power range is IE3 and, and when supplied with a switch, it falls into IE2. From 1 July 2023, European Commission Regulation 2019/1781 sets stricter efficiency parameters for single-phase machines, which must now meet at least efficiency class IE2.

These are unique single-phase motors whose design is supplemented by permanent magnets and which are started directly from the single-phase mains. "These are not typical synchronous machines that cannot start from the grid and need a frequency converter. Our motor gets plugged into a wall socket and runs immediately at the highest efficiency standards. There's no electronics in between that could go faulty over time. This leads to further significant material and energy savings," Bárta explains.

It is the use of permanent magnets that can ensure high energy savings – the machine immediately goes into a synchronous operation, where the rotor rotates at a constant speed.

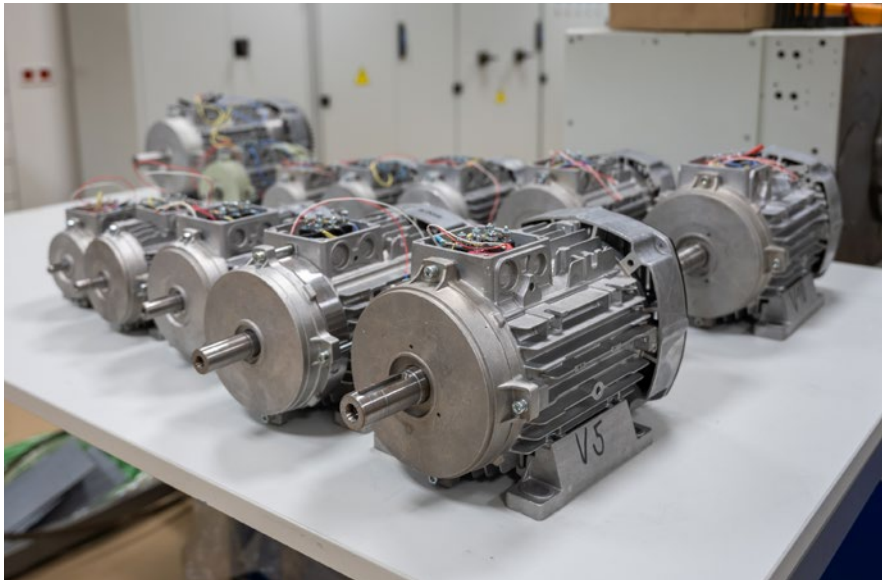


Photo: Václav Koníček

Unique single-phase motors from the FEEC with permanent magnets.

The energy losses that used to occur in the wound cage of a standard motor are eliminated. And while in asynchronous machines the magnetisation of the circuit is provided only by the mains, in permanent magnet motors the magnetisation is largely provided by the permanent magnets and as, a result, it requires less supply current.

The FEEC research team designed a total of 10 prototype motors in different sizes and for different revolutions. Some of the machines allow saving up to 10-20% of electricity and thus meet the standards for the highest efficiency class IE4.

"It's a great result, because for single-phase mains-powered machines, even achieving IE2 class is a big challenge," Bárta evaluates the three-year development. Now the experts are looking forward to the implementation phase and the creation of a testing series. In 2023, EMP should start a pre-series production so that greener motors can be sold in a standard series production as early as 2024.

The project was co-financed with the state support from the Technology Agency of the Czech Republic under the THÉTA 3 Programme.

Since his early childhood, he has been dreaming of space. Now he wants to launch the first student satellite into orbit

In a couple of years, the first satellite in the Czech Republic may be in orbit, created by the student group YSpace from the FEEC (Faculty of Electrical Engineering and Communication) BUT (Brno University of Technology). Although the student team, led by Adam Hláčik and his classmates, was officially established only this summer, it has already received positive feedback from the European Space Agency and invitations to conferences. According to Adam Hláčik, the aim of the association is to offer students practical experience. Adam Hláčik says he knew from childhood that he wanted to build planes or satellites.

After the secondary school, he enrolled the BUT, and when a new master's degree in Space Applications opened last year, he didn't hesitate. "Eleven of us signed up, nine stayed. The few of us have formed a group of really good friends who are close to each other," says Adam Hláčik. In any case, it is not a coincidence when he mentions a group of friends. They decided to start a student association together. "During the first semester we had to develop simulated missions. It wasn't anything specific, it was more of a learning process. But then I found out that there was a possibility to plan a mission at school and then apply for a consultation at the European Space Agency. Their expert team will evaluate the plan, and give advice on what to improve. I was interested because we didn't have anything so purely practical at school. As a consequence, my friends and I decided to give it a try," he says.

Photo: Václav Koníček

Adam Hláčik has loved space since childhood. After school, he is considering a career at the European Space Agency.

Initially, they had a few ideas on what to focus the mission on. However, when they met Libor Lenža, who is the head of biological research at the Space Agri Technology laboratory at the Mendel University in Brno, the decision was made. "We invented together a nice experiment based on reviving bacteria in orbit to generate oxygen. This is a CIMER mission. We started working on it and got feedback from the European Space Agency saying they liked it. We were invited to present our work. Consequently, we felt it would be a shame not to go on with our project. That's how we started the process of establishing the association," says Adam Hláčik about the path to founding YSpace.

They managed to complete the whole process this summer, when the student association was founded under the supervision of the professional researcher Tomáš Götthans. "Such associations are a common part of complementary education abroad. This enables aerospace engineering students to apply their knowledge in practical projects. There has been nothing like that at the FEEC," he adds. YSpace's dream goal is to launch

the first Czech student satellite into orbit. "Nevertheless, we have a development divided into several parts. The ultimate goal is to complete the cooperation with the Mendel University. However, first we want to build a smaller and less complex satellite and test the technologies from the Institute of Aeronautics of FME (Faculty of Mechanical Engineering) BUT within the KOSTKA mission. It should be ready within two or three years," says Adam Hláčik, adding that it also depends on the necessity to find enough funding. "We are currently looking for sponsors because the development is not cheap. We have to buy a test environment for software development first. This school year we would like to get a so-called flatsat for the laboratory," says Hláčik.

Moreover, they are also in the process of recruiting new members and setting the rules of the association. "We define a strategy for how to teach new members the development process in general, the basics of writing requirements, and development plans," he notes, adding: "We are still at the beginning, but we are already quite successful. Building a satellite is, of course, a key goal, but the learning process and the things around it are equally important. For example, we have now been selected to present the CIMER mission at the European CubeSat Symposium." Several YSpace members, including Adam Hláčik, have also completed internships in Belgium.

Photo: Václav Koníček

Thanks to the association, Space Applications students have already been able to attend conferences and internships.

"Subsequently, I was selected for the European Space Agency school in Austria. This year I will attend another course in Belgium," adds Hláčik.

In addition to the study and co-management of the association, he also manages work in the commercial sphere. "I work as a systems and project manager in a company that also develops satellites," he says, adding that the satellite he is working on is due to launch next year. He also highlights the fact that Brno is a unique place for space engineering enthusiasts. "Brno is unique in Europe. There are so many projects that there aren't even enough local experts. Thus, companies hire people from all over the world - Italy, India, the USA," he points out. He is still considering his future plans.

"I'm thinking of applying for a graduate position at the European Space Agency. But my current job is interesting, so I haven't decided yet," he adds. Yet, he said the members of the association will not get lost in the world. "Several people from the association have pitched their ideas in business competitions or have already started a company. It naturally generates spinoffs. The association allows us to train in the industry, to get the necessary contacts, to find out how it works. We know what subsidies to apply for if we want to develop something or start our own company. It's not just about building a rocket or a satellite, but also about learning how to approach sponsors and how to negotiate. We are getting excellent life lessons that one cannot learn in the classroom," concludes Adam Hláčik.

We cannot just keep increasing a battery production without anticipating what happens when they are used up

These days, the battery recycling is an increasingly important link in the industrial chain. It allows us to reduce the waste of natural resources or the amount of CO_2 released during extraction and production. Is it also economically advantageous? And what types of industrial processes can we use for recycling? How is the Czech Republic doing in building recycling capacity? We asked Tomáš Kazda from the FEEC questions related to the current topic.

Why is it important to recycle batteries?
First and foremost, it allows to increase the efficiency of the use of natural resources. It means that we don't need as many direct resources from mining and it also helps to reduce our carbon footprint. And it will become increasingly important, because we cannot just increase battery production without thinking about what happens when they are used up. The new EU legislation then clearly defines what percentage of the battery weight must be recycled or what minimum amount of recycled material must be used to produce new batteries.

Is the awareness of battery recycling important? Does it make sense to motivate people to collect AA or AAA batteries when the main volume will be contained in electric cars or even airplanes?
It definitely makes sense. Electric vehicle batteries will represent a bigger part of recycling in the upcoming years. Now, the largest share is taken by batteries from typical products such as mobile phones, computers, power tools, electric bikes and the aforementioned AA and AAA batteries. It is also likely that the car industry itself will take care of the efficient collection of electric vehicle batteries, which will result in a take-back obligation. However, batteries from other devices will continue to constitute a significant part of the waste stream in the future and the efficiency of their collection and subsequent recycling will depend on the common users.

Is the cost of producing batteries from recycled materials comparable to producing batteries from natural sources?
That's a difficult question. This expectation applies to products that are produced and marketed in steady quantities, as is the case for lead-acid batteries, the production of which is largely covered by recycled materials. However, such an expectation does not apply to investing tens or rather hundreds of millions of crowns in the development and construction of a recycling line, for example for Li-ion batteries, and, as a result, 30 waste batteries of the electric cars sold in the Czech Republic 12 years ago, are expected yearly to be recycled there. In such a case, the price of the obtained material will be too high. Only when the market stabilises and there is a large number of batteries suitable for recycling, will the costs be spread and the price will be acceptable.

How does the battery recycling actually work?
After a mechanical disassembly of the battery, the individual fuel cells are crushed. From the resulting grit, pieces of iron, aluminium and copper scrap are gradually separated, leaving a black powder. It contains compounds of cobalt, manganese, lithium and carbon. Next, this powder is processed either thermally, which is called pyrometallurgy, or chemically, which means hydrometallurgy. Pyrometallurgy is an older recycling type, now used on all lead-acid batteries from conventional cars. However, such a process is not efficient enough for

Photo: Jan Prokopius

Tomáš Kazda from the FEEC BUT is involved in the development of new types of batteries such as lithium-sulphur (Li-S) and sodium-ion (Na-ion) cells.

Li-ion batteries. Only about 50 percent of the total mass of the article is obtained. Hydrometallurgical processing is a more recent process, where carbonates, hydroxides or sulphides of individual metals - lithium, manganese, nickel, cobalt - are obtained by leaching. After purification, these materials are equivalent to those extracted from mining and can be freely added to the material used for the new batteries production.

Does recycling vary by a battery type?
Yes, recycling varies for different types of batteries. Each battery type has a different composition according to which a recycling must be optimised in order to achieve high efficiency.

Are there any recycling lines already in operation in the Czech Republic?
Yes, there have been such lines on classic batteries for decades. In the case of Li-ion batteries, one is in trial operation and others are in the preparation phase.

Should we focus more on battery recycling in the Czech Republic?
No doubt about it. Due to the increasing carbon footprint, it does not make sense to transport waste Li-ion batteries from the automotive industry over longer distances. It is much more efficient to recycle them somewhere nearby and then recover them.

Does recycling have a place in the FEEC curriculum? Is the topic and its research attractive to students?
Personally, I see a lot of interest among students. Within our research group, several diploma theses have already been written on the topic and one of my doctoral students is doing research in this area. I myself mention battery recycling only marginally in my teaching. However, we are preparing new programmes related to electromobility, such as the study programme Automotive Electronics and Electromobility and recycling will be a big part of it. We are also currently working quite a lot with industrial partners who are trying to develop the technology on an industrial scale.

This year's Majáles queen crown belongs to the BUT

Patrícia Janigová, a third-year student of Biomedical Engineering and Bioinformatics at the FEEC, became the queen of the Brno Majáles festival. Her energy and passion proved that she is not only a great person, but also an ideal choice for the Majáles Queen. She likes to improve other people's mood and motivate them. She can also look at the bright side even in the most difficult moments. On stage, Queen Patricia together with the Majáles King Petr Sedlák, who is from the Masaryk University, declared that the BUT and the MUNI are not just two universities, but in fact a single family. Recognition for the BUT representation also goes to the King candidate Martin Sedláček from the Institute of Forensic Engineering.

Photo: Jan Prokopius

STUDY AT FEEC

The faculty offers a comprehensive range of study programmes focusing on electronics, electrical engineering and all related fields from microelectronics to telecommunications, cybernetics, and power engineering to interdisciplinary ones such as biomedicine or audio engineering, in 15 three-year bachelor's degree programmes, 25 two-year follow-up master's degree programmes and 32 four-year doctoral degree programmes. We are the faculty that offers the widest range of electrical engineering degree programmes, both combined and full-time, in Czech or English. At the same time, with more than 3,100 students, we are the largest electrical engineering faculty in the Czech Republic and Slovakia.

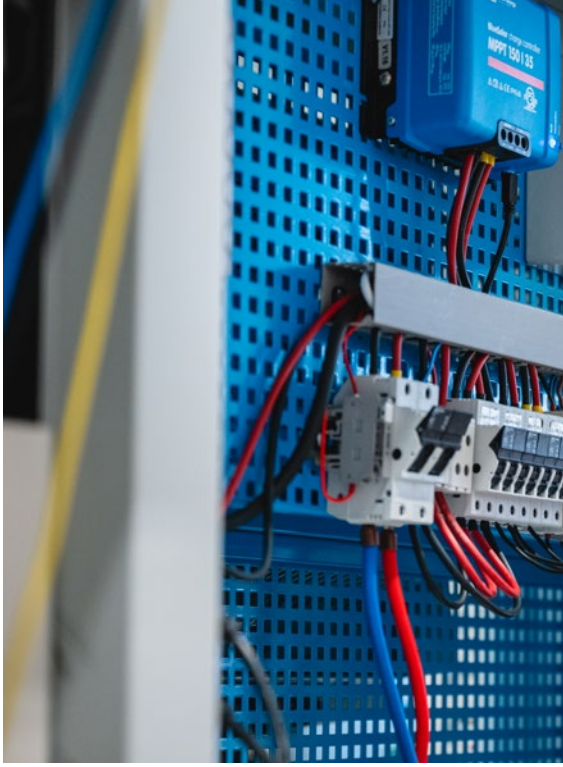


Photo: Jakub Rozboud

Top facilities

Since 2013, the Faculty of Electrical Engineering and Communication has been housed in several modern buildings in the Pod Palackého vrchem campus in Brno. After more than fifty years, the facilities for teaching, cutting-edge research and student life are located in one place, where the most modern technologies, laboratories, lecture halls, canteen, library, as well as spaces for relaxation and sports are available.

Connection with practice and graduate employment

Thanks to the faculty's coherent cooperation with commercial entities and industrial partners, students have the opportunity to obtain not only quality theoretical training, but also practice, which is crucial for their future employment. The current survey on graduates of Brno University of Technology shows that in 82% of cases students of the Faculty of Electrical Engineering and Communication have secured a job already during their studies. 97% of graduates have a job within 3 months of successfully completing their studies. We can therefore say that our graduates are very adept at the labour market.

Photo: Nikola Číková

FEEC graduates have one of the highest starting salaries at the BUT

Our students are in great demand at the labour market and the starting salary is among the highest rated graduates in the entire BUT. The average gross starting salary of a FEEC graduate is currently CZK 54,189.

Teaching with an emphasis on curriculum innovation

The range of study programmes and the content of the teaching itself are undergoing constant innovation. The faculty thus responds, for example, to trends in the industrial field, so that our graduates are 100% competitive and can easily find their place in the current and future labour market. This is enabled by the broad experience our staff gained by participating in various research projects with industrial partners, and thus, they can transfer their professional and practical knowledge into teaching.

Study programmes

Bachelor studies

Attended form:

- English for Practice in Electrical Engineering and Communication Technologies (CZ)
- 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

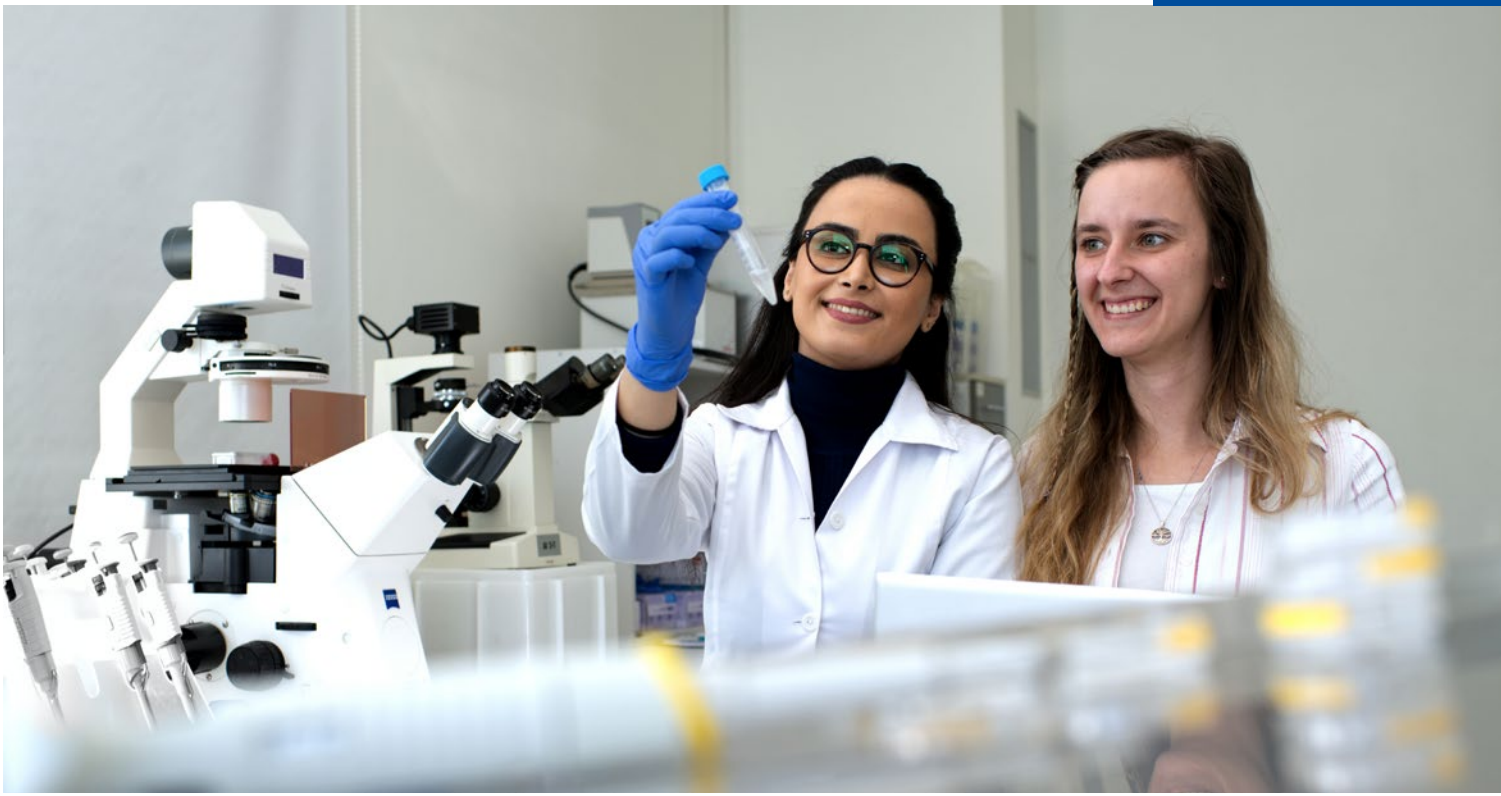
Attended form:

- 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)
- Electrical Power Engineering and Communication Technologies (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)
- Automotive Electronics and Electromobility (EN)
- Bioengineering (EN)
- Communications and Networking (EN)
- Electrical Power Engineering (EN)
- Microelectronics (EN)
- Power Systems and Communication Technology (EN)
- Space Applications (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)

Photo: UBMI archive



Doctoral studies

Attended form:

- Biomedical Technologies and Bioinformatics (CZ)
- Electronics and Information Technologies (CZ)
- Information Security (CZ)
- Cybernetics, Control and Management (CZ)
- Microelectronics and Technology (CZ)
- Power Electrical and Electronic Engineering (CZ)
- Teleinfomatics (CZ)
- Theoretical Electrical Engineering (CZ)
- Biomedical Technologies and Bioinformatics (EN)
- 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:

- Biomedical Technologies and Bioinformatics (CZ)
- Electronics and Information Technologies (CZ)
- Information Security (CZ)
- Cybernetics, Control and Management (CZ)
- Microelectronics and Technology (CZ)
- Power Electrical and Electronic Engineering (CZ)
- Teleinfomatics (CZ)
- Theoretical Electrical Engineering (CZ)
- Biomedical Technologies and Bioinformatics (EN)
- 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)

Number of students

(sum total 3,083)

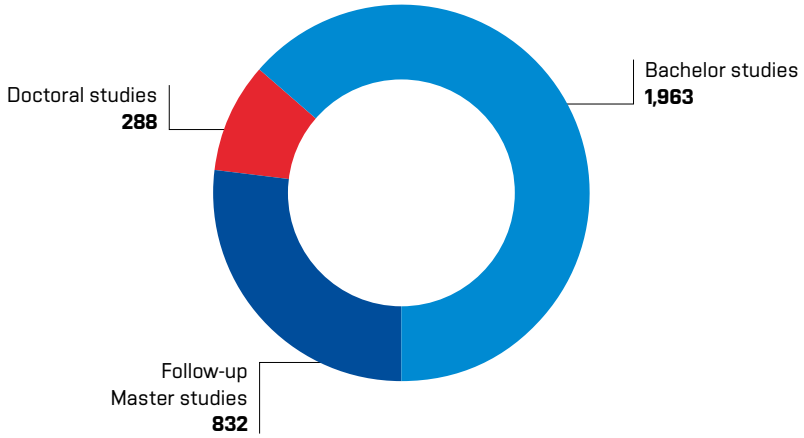
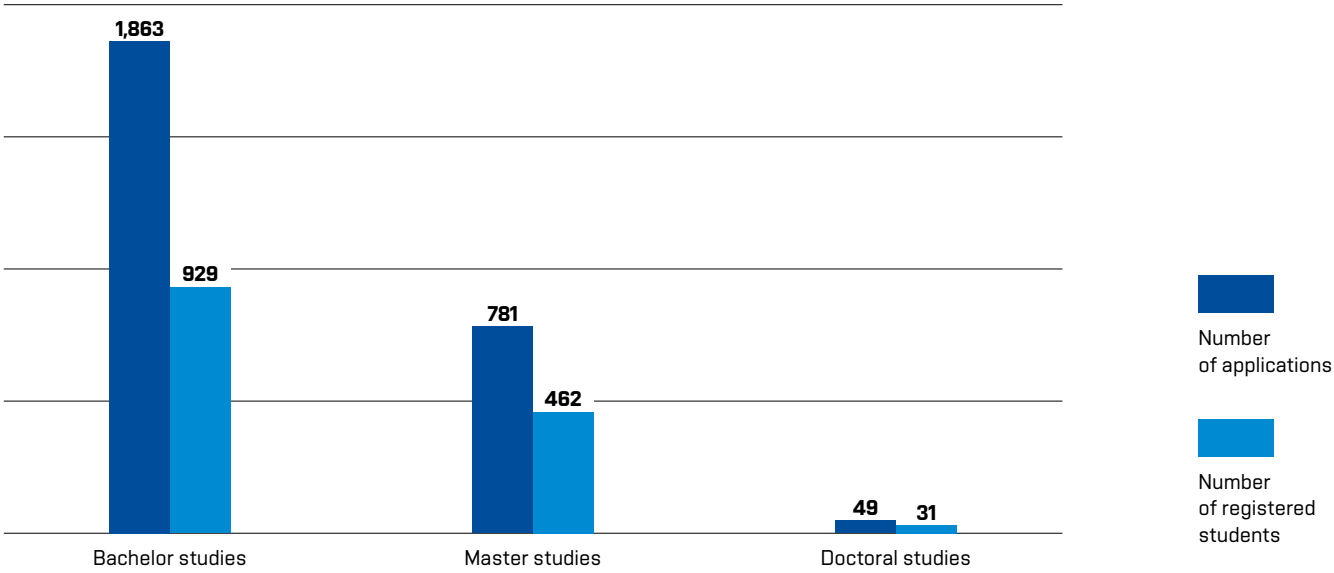


Photo: Oto Jandušek

Interest in study



Students for Students' Club

The Students for Students Society (SPS) has been active at the Faculty of Electrical Engineering and Communication since 2005. During the period of its activity, it has become a reliable mediator between the school management and students, a helper and advisor not only for first-year students, but also an organizer of fun events for the student community.

During the year, the club once again grew with new enthusiastic students and also celebrated the successful graduation of long-standing members who have made it significantly more progressive and visible. With new members new ideas come which help to improve and innovate the events organised. For the first time, the Club has been able to attract corporate partners, enabling the SPS to organise new events while improving the individual skills of members.

Thanks to the efforts of the members of the association, the 15th annual Music from the FEEC student festival was traditionally held in the parking lot between buildings T10 and T12 on the first Wednesday of the winter semester. With an attendance of 10,000 people, Music from the FEEC consolidated its place as one of the largest student events organized at the BUT. Once again, the legendary and now rather commemorative Run for the 53 event took place, when students and faculty management got the opportunity to run on the former bus line.

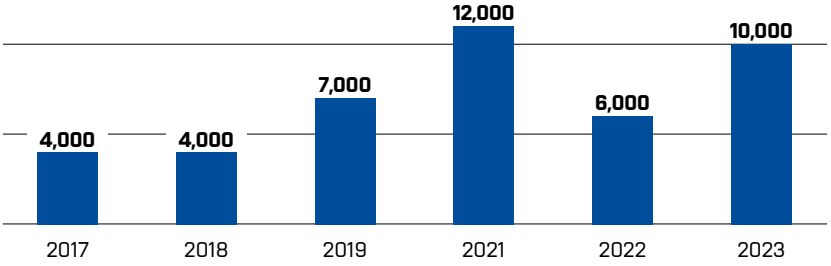
The Club is also concerned with health, so during the year it organised a first aid course with specialised lecturers and also took part in an event called "Drop of Blood", where the club's students together with others donated blood at the University Hospital in Brno. In addition to a large number of activities for students, the club also held internal events aimed at the self-development of members and strengthening relationships within the team.

Photo: Jakub Rozboud

Selected events organized by the Students for Students' club:

- PerFEECt Start
- Music from the FEEC
- Tournament in CS:GO FEEC vs FIT and a League of Legends
- Run for 53
- Board Games Day

Music from the FEEC visitors



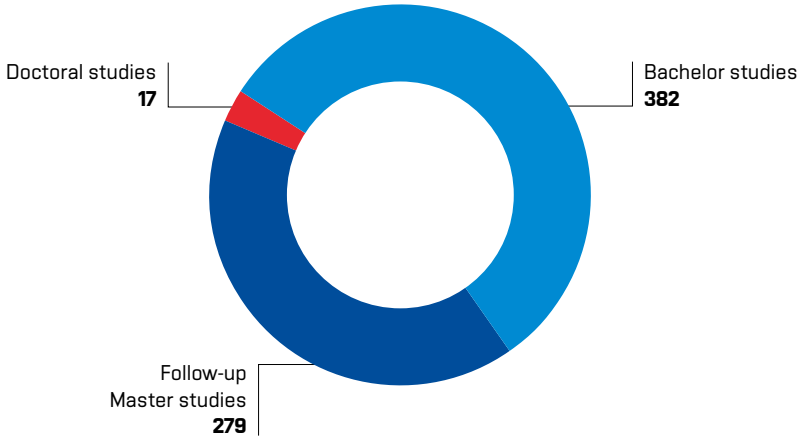
Note: in round numbers of thousands

Photo: Jakub Razboud

Graduates

Number of graduates in 2023

(Sum total 678)



FEEC graduates are in great demand on the labour market. They are employed in a wide range of professions and industries, for example as experts in professional or managerial positions in various areas of low- and high-current electrical engineering, electronics, robotics and applied informatics, as well as in the production and administration of medical technology, and in institutions providing cyber security, diagnostics and environmental protection, as electronic engineers.

FEEC EMPLOYEES

Faculty of Electrical Engineering and Communication (FEEC) Management

Dean
prof. RNDr. Vladimír Aubrecht, CSc.

Vice-Dean for Creative Activity, statutary representative of the Dean
prof. Ing. Jaroslav Koton, Ph.D.

Vice-Dean for Education
prof. Ing. Jarmila Dědková, CSc.

Vice-Dean for External Relations
prof. Ing. Tomáš Kratochvíl, Ph.D.

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

Chief financial officer
Ing. Tomáš Rosenmayer, Ph.D.

Organisational Structure

DEAN'S OFFICE

- Organising Department
- Student Affairs Department
- Department of Science and International Relations
- Personnel 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

- doc. Ing. Vlasta Sedláková, Ph.D.

STUDENTS' CHAMBER OF THE SENATE

Chairman of the Chamber

- Ing. Daniel Janík
  from 21. 11. 2023 Ing. Jiří Dvořáček

SCIENTIFIC BOARD

Chairman

- prof. RNDr. Vladimír Aubrecht, CSc.

STUDY PROGRAMME BOARD

Chairman

- prof. Ing. Jarmila Dědková, CSc.

DISCIPLINARY COMMITTEE

Chairman

- Ing. Helena Polsterová, CSc.
  from 26. 9. 2023 doc RNDr. Edita Kolářová, Ph.D.

ETHICS COMMITTEE

Chairman

- doc. Ing. Jana Kolářová, Ph.D.

DEPARTMENTS AND RESEARCH CENTERS

- 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 Radio Electronics (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 ACTIVITIES

- 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 2023

BIOMEDICAL ENGINEERING

- doc. Ing. Radovan Jiřík, Ph.D.
- doc. Mgr. Ing. Karel Sedlář, Ph.D.

TELEINFORMATICS

- doc. Ing. Radek Fujdiak, Ph.D.
- doc. Ing. David Kubánek, Ph.D.
- doc. Ing. Jiří Mekyska, Ph.D.
- doc. Ing. Václav Oujezský, Ph.D.

Photo: Václav Koníček

Photo: Jakub Rozboud

Number of faculty employees in 2023

Number of faculty employees:	553 (420.1 recalculated number)
Number of academic and scientific staff:	275 (224.3 recalculated number)
Average age of FEEC employees:	44.2 years (as of 31. 12. 2023)
Ratio of women employees at the FEEC:	25.0 % (as of 31. 1. 2023)

FEEC DEPARTMENTS

Department of Control and Instrumentation (UAMT)

In 2023, the Department of Control and Instrumentation continued to upgrade its teaching and research laboratories.

In control technology, research activities were focused mainly on the area of predictive control algorithms and their computationally efficient implementation in control systems of electric drives and methods of diagnosis of electric drives using AI.

Advanced methods for identification of dynamic systems were also studied.

Representatives of the Robotics Group have presented their results internationally, for example at the ICRA 2023 conferences in London, the MESAS 2023 in Palermo or at invited lectures and presentations at the IAEA Vienna and UMA Malaga. Research results were also presented at IDET 2023.

On 23 October 2023, a book called 60 years of cybernetics at the Department of Control and Instrumentation was launched, which will provide an opportunity to reflect on the development of technical cybernetics over sixty years, as well as to learn about the history of the Department in terms of pedagogy, scientific and project work, theses and alumni lists.

Head:	doc. Ing. Václav Jirsík, CSc.
Number of research teams:	5
Number of employees (recalculated):	26.3
Average age of employees:	43.8 years

Photo: Jan Prokopius, UAMT archive

Photo: UBMI archive

Department of Biomedical Engineering (UBMI)

The Department of Biomedical Engineering trains specialists in technologies that help save lives. For example, our graduates are the authors of the Rescue and Don't Panic application. The responsibility for our graduates' skills and knowledge binds us to do our best in passing on our professional experience and to provide a high-quality education.

In 2023, we implemented a number of innovations aimed at ensuring quality laboratory instruction in bachelor's, master's and doctoral degree programmes. We also continue to internationalise our teaching – we have welcomed students from the University of Applied Sciences Technikum Wien to our laboratories and have sent students abroad to gain experience.

The department's staff actively builds relationships with national and international scientific teams, which in turn is reflected in collaborations with top experts in biological signal processing, biomedical imaging, bioinformatics and cell and tissue engineering. However, we are also expanding our know-how nationally – this year, for example, we welcomed students of psychology from the Faculty of Arts from the MUNI to our laboratories to expand their education in biosignal evaluation.

Head:	prof. Ing. Valentine Provazník, Ph.D.
Number of research teams:	9
Number of employees (recalculated):	30.2
Average age of employees:	40.9 years

Photo: UEEN archive

Department of Electrical Power Engineering (UEEN)

The Department of Electrical Power Engineering is involved in the teaching of electrical power engineering in bachelor, master and doctoral degree programmes. Financial donations in the amount of 2.7 million EUR have been received to support education in electrical power engineering and communication technologies, intended primarily for scholarships and laboratory equipment. The preparation of the Nuclear Energy degree programme and the construction of the related Nuclear Energy and Ionising Radiation Laboratory was initiated. The international ElMicro project for micro-certificates in the design of renewable energy installations and advanced lighting systems was also launched.

In the field of research, the department focuses on the production, transmission, distribution and use of electricity. In 2023, the most important activities addressed included the verification of compliance of generating plants with the power grid, testing and optimisation of switches for connecting dispersed energy sources, fault location in power grids, research on accelerator-controlled nuclear reactors, research on light pollution and development of a brightness analyser.

The department has started to solve the applied research projects approved within the framework of the National Centre for Energy II and the Centre for Advanced Nuclear Technologies II, which were supported by TAČR NCK II.

Head:	prof. Ing. Petr Toman, Ph.D.
Number of research teams:	8
Number of employees (recalculated):	37.7
Average age of employees:	41.2 years

Department of Electrical and Electronic Technology (UETE)

Department of Electrical and Electronic Technology provides instruction in courses related to technical materials, their manufacturing processes, diagnostics, testing engineering, management and quality control. Most first year students in the newly accredited bachelor study programmes are taught subjects of Technical Documentation, Materials for Electrical Engineering, and Introduction to Materials for Electrical Engineering.
The department, together with the Department of Microelectronics, provides instruction in a bachelor study programme Microelectronic and Technology, and it teaches on its own Electrical Engineering Production and Management in a master study programme. In cooperation with the Department of Microelectronics and the Department of Physics it teaches a doctoral study programme called Microelectronics and Technology. Apart from material--oriented subjects the department also provides instruction on subjects oriented at alternative energy sources and ecology.
The department deals with electron microscopy, photovoltaics and electrochemical current sources (batteries and accumulators). At the beginning of September 2023, the Department of Electrical and Electronic Technology inaugurated the photovoltaics and electromobility polygon, which will serve as a training laboratory for students to install photovoltaic roof systems and electric vehicle charging stations. The FEEC offers courses on renewable energy sources to students to gain professional practice in the assembly of rooftop photovoltaic systems.
The laboratory will thus enable students not only to test their theoretical knowledge in practice, but also to achieve the professional qualification "Electrical fitter of photovoltaic systems" or "Fitter of charging stations for electric vehicles".

Head:	doc. Ing. Petr Bača, Ph.D.
Number of research teams:	5
Number of employees (recalculated):	25.0
Average age of employees:	44.4 years

Photo: Václav Kaníček, Jana Valchová

Department of Physics (UFYZ)

The Department of Physics provides teaching of basic physics courses and other physics courses in bachelor, master and doctoral full-time and combined studies not only for the Faculty of Electrical Engineering and Communication, but also for the FIT, the Centre of Sports Activities and the Faculty of Arts of Masaryk University. All courses are also taught in English for international students. A new course "Fundamentals of Astrophysics" has been introduced as part of the new Master's programme "Space Applications". In order to raise the student success rate at the exams, a new elective course "Physics in Examples" has also been introduced for the first year of the Bachelor's degree, aimed at a more in-depth practice of the material covered. In research, the Department focuses on basic and applied research on physical parameters of semiconductor and dielectric materials and components and nanosensors. The main areas of interest are mechanisms of electric charge transport, noise spectroscopy, local characterisation with nanoscale resolution, design of quality and reliability indicators for components and acoustic and electromagnetic emission methods. The Department also collaborates with industrial partners to produce devices that enable monitoring and control of manufacturing processes. Projects addressed in 2023 included the development of a prototype for monitoring drug dispensing and control, the preparation of graphene layer-based sensors, and the successful completion of systems for soil analysis and evaluation.

Head:	doc. Ing. Vladimír Holcman, Ph.D.
Number of research teams:	3
Number of employees (recalculated):	19.1
Average age of employees:	42.2 years

Photo: UFYZ archive

Photo: Jan Prokopius

Department of Languages (UJAZ)

In 2023, the Department of Languages successfully accredited a new professionally oriented Bachelor's degree programme "English for Practice in Electrical Engineering and Communication Technology" (BPC-APE). This programme is a follow-up to a successful academic programme „English in Electrical Engineering and Informatics" (AJEI-H), which is currently ending. The programme provided its graduates with knowledge of linguistic theory, specialized language skills and the fundamentals of electrical engineering and computer science.
In the newly accredited programme, the Department of Languages draws on this tradition in many aspects, but it also increases significantly the amount of work experience and it puts an overall greater emphasis on the practical applicability of the acquired knowledge.

In addition to its own study programme, the Department continued to teach other technical bachelor, master and doctoral study programmes of the three faculties of the BUT. In addition to English, it continues to offer and expand the teaching of other languages, i.e. French, Italian, Spanish and German.

The Czech for Foreigners course is gaining increasing popularity, especially among Erasmus students and foreign students of the faculty's English study programmes, who can thus better adapt to everyday situations from life in the Czech environment.

In addition to the predominantly professional language teaching, the Department offers elective courses in law, economics (accounting, taxation, financial services), psychology, pedagogy and soft skills.

Head:	Ing. Martin Jílek
Number of research teams:	3
Number of employees (recalculated):	17.9
Average age of employees:	53.5 years

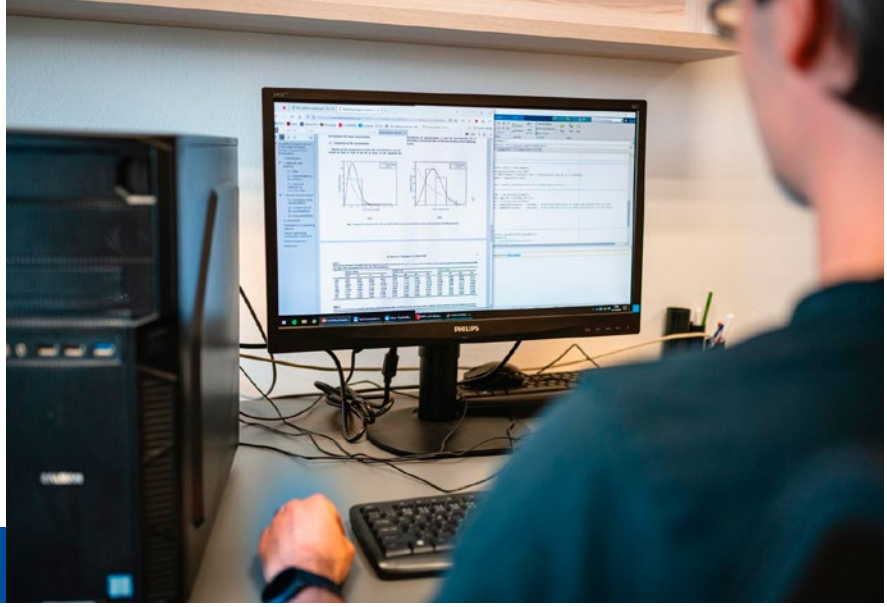


Photo: UMAT archive

Department of Mathematics (UMAT)

For the Department of Mathematics, the year 2023 was traditionally a year full of teaching, not only at the FEEC, but also at all other institutions where the Department provides instruction (FIT, CESA, ÚSI). The quality of the Department's work is best illustrated by the fact that both Associate Professors Edita Kolářová, as well as Dana Hliněná, defended their last year's victories in the poll for the best teacher at the FEEC and the FIT in 2023. Two more department members also ranked in the poll.
The UMAT also significantly developed its international cooperation, when it realized a total of 7 trips to 6 different European universities and at the same time welcomed 6 foreign colleagues, of which Prof. Yurii Rogovchenko from the University of Agder (Norway) worked at the Department for half a year.

The department research activities were mainly focused on basic research, especially on the investigation of qualitative properties of solutions of systems of both ordinary and partial differential equations, including dynamic systems of fractional order. Attention was also focused on the study of numerical methods for the solution of delayed continuous dynamical systems based on semi-analytic discrete methods.

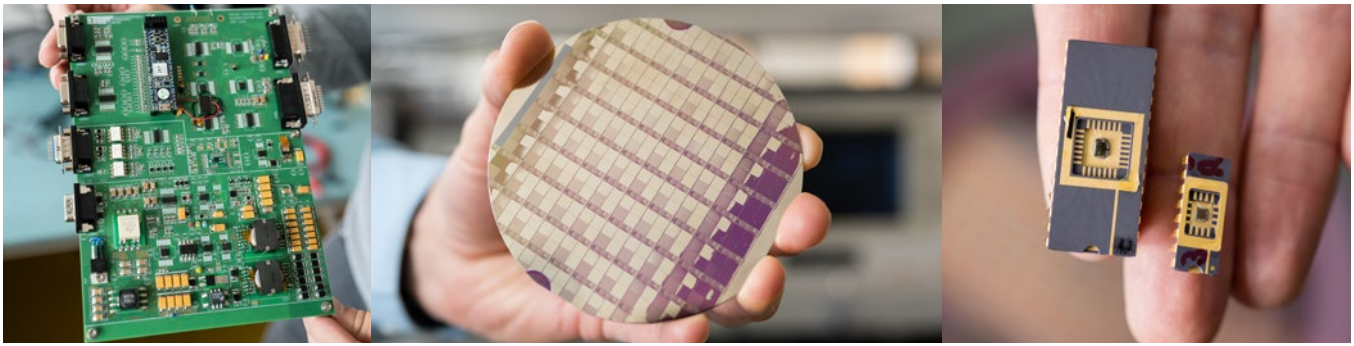
Head:	doc. RNDr. Michal Novák, Ph.D.
Number of research teams:	3
Number of employees (recalculated):	15.2
Average age of employees:	57 years

Department of Microelectronics (UMEL)

In 2023, the Department of Microelectronics worked very hard on the BUT becoming a member of the Czech National Semiconductor Cluster, a professional organization that represents all parties (universities, research organizations and companies) interested in the semiconductor value chain in the Czech Republic. The department head, Jiří Háze, then became the vice-chairman of the cluster's board of directors, which opened up a wide range of opportunities for the BUT to actively influence the developments around chips and semiconductors at the European level, thanks to the cluster's membership in Silicon Europe. Concerning semiconductors, several key partnerships have been established with universities in Taiwan and India, and the range of partners across Europe has also significantly expanded thanks to the active participation in the European Universities EULiST project. During the year, several projects were submitted to support semiconductor technology education, which are now being evaluated with a good chance of being approved. At the same time, negotiations were completed with the NARLabs in Taiwan for the establishment of a new semiconductor research and education centre, the Advanced Chip Design Research Centre, which will start its activities in 2024. The whole mission was completed by an active participation in the launch of the EU Chips Joint Undertaking programme in Brussels. In the field of education, preparations have therefore been initiated for the accreditation of new study programmes in Bachelor and Master studies entitled "Chip Design and Advanced Semiconductor Technology". In the scientific field, the Department also focused on other topics, especially on applied research on electronic systems for space applications, embedded systems, sensors and micro- and nanotechnology. Projects and direct contracts addressed areas of current interest, such as smart access systems, electronics for lunar landers, COVID-19 rapid detection issues and others.

Head:	doc. Ing. Jiří Háze, Ph.D.
Number of research teams:	4
Number of employees (recalculated):	23.4
Average age of employees:	48.1 years

Photo: Jan Prokopius



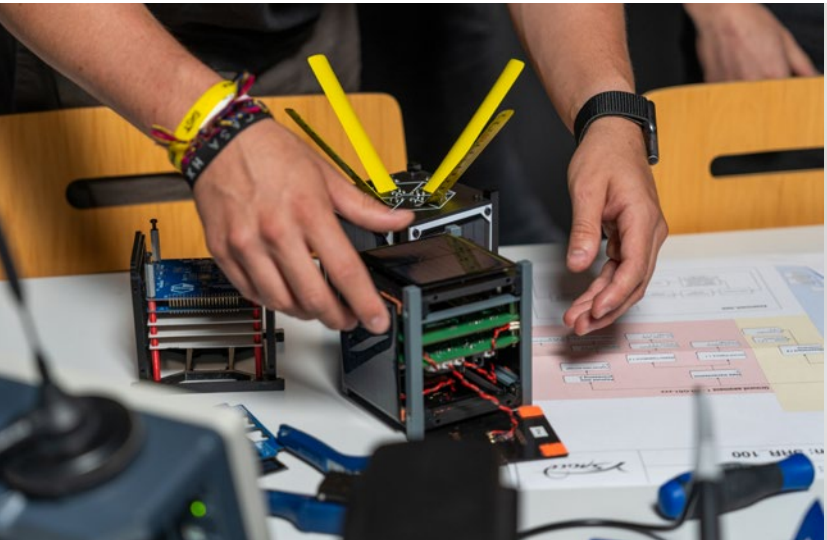
Department of Radio Electronics (UREL)

The Department of Radio Electronics is dedicated to research, development and education in the field of wireless systems and related areas. The main application areas are communication, sensing, location and navigation. Frequency-wise, applications range from low frequencies (sensing and processing of biological signals) to millimetre waves (local wireless systems for ISM-band 60 GHz or for W-band 80 GHz) to optical frequencies (free-space optical communication). Attention is paid to the system perspective (television and multimedia systems, electromagnetic compatibility, propagation of signals in the millimetre wave band) and to subsystems (electronic circuits, signal processing, antennas, and microwave structures).

Currently, UREL's focus is mainly on space applications and automotive applications. On 3 January, the BDSAT-2 satellite, which was developed by the Department´s staff, was successfully launched into space. The satellite has successfully completed its first year in orbit and continues to perform integrated experiments. The ground station, which receives radio signals from the satellite and controls it remotely, is located at the Department's Experimental Satellite Laboratory.

Prof. Ing. Miroslav Kasal, CSc., has published a book "Weak Signals", which deals with techniques and approaches to the reception of microwave signals at the thermal noise level with the corresponding bandwidth. Such signals occur mainly in communication with space probes and by a signal reflection from the lunar surface.

Head:	prof. Ing. Aleš Prokeš, Ph.D.
Number of research teams:	6
Number of employees (recalculated):	35.6
Average age of employees:	44.9 years



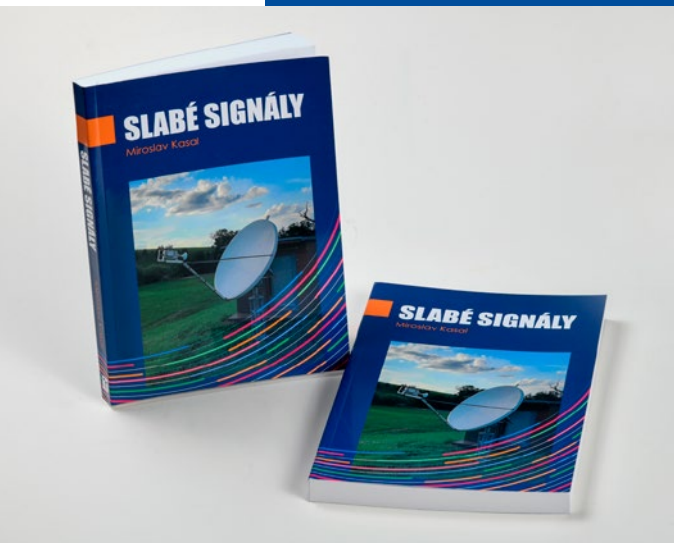


Photo: Václav Konček, Michaela Dvořáková

Photo: Nikola Číková

Department of Telecommunications (UTKO)

For the Department of Telecommunications, the year 2023 was a key year, especially in the area of cyber security. In the spring of 2023, the Brno University of Technology Cyber Arena (BUTCA) was launched, which was awarded an honorary mention at the AMPER 2023 trade fair and for which the implementation team subsequently received the Award of the Minister of the Interior for outstanding achievements in security research.

The BUTCA was deployed in secondary and higher education institutions during 2023. In the field of education, the Department of Telecommunications also introduced a unique professional training programme in cybersecurity – "Master of Science in Cybersecurity" (proCyber), for which the first candidates have started to enrol.

In addition to cybersecurity, other research activities were presented to the public, especially in artificial intelligence and 5G networks applications.

Head:	prof. Ing. Jiří Mišurec, CSc.
Number of research teams:	8
Number of employees (recalculated):	92.1
Average age of employees:	38.4 years


Photo: UTEE archive

Department of Theoretical and Experimental Electrical Engineering (UTEE)

The Department research is mainly focused on three areas:

use of numerical methods for modelling of physical fields, nanostructures, basic elements of matter; nanotechnological engineering of inorganic and organic nature, models of living matter, research of plasma and its parametric generation;

research into special measurement methods including nuclear magnetic resonance (NMR), nuclear quadrupole resonance (NQR) and electrical impedance tomography (EIT) techniques; low-level measurements, ultra-low frequency measurements, evaluation of the effect of small changes in magnetic fields on the human body;

research area of experimental and applied electrical and electronic engineering focused on the detection of short, high-power electromagnetic pulses, fast repetitive and single-step processes, non-standard sources of electrical energy and unmanned aerial vehicles.

In 2023, the Department of Theoretical and Experimental Electrical Engineering significantly expanded its cooperation in unmanned aircraft research. Cooperation with Fly4Future, s. r. o., Workswell, s. r. o., Arridere, s. r. o., Mendel University in Brno and the Czech Technical University in Prague was established. Cooperation with the Faculty of Military Technology at the University of Defence continued. Thanks to this cooperation, new projects for the development of autonomous drones were acquired. Cooperation with the St. Anne's University Hospital continued to deepen when working on joint outputs and projects. The development of air sensors for respiratory diseases and the verification of the liquid detection principle from the wastewater continued together with cooperation of the AČR (Těchonín laboratory) and the Elisabeth Pharmacon. A study of NQR probes for the identity detection of small amounts of organic impurities for the drug agent identification was carried out.

Head:	prof. Ing. Pavel Fiala, Ph.D.
Number of research teams:	7
Number of employees (recalculated):	18.0
Average age of employees:	46.5 years

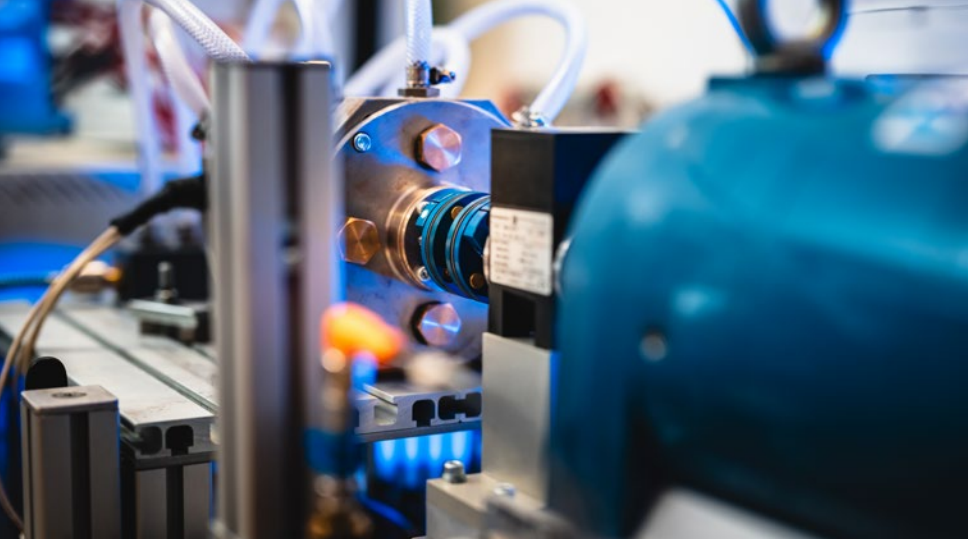


Photo: Jakub Rozboud

Department of Power Electrical and Electronic Engineering (UVEE)

In 2023, the Department's staff deepened the international cooperation through personal visits and meetings with the LUT University, JKU Linz, LCM, TU Delft, and Politecnico di Torino.
The network of collaborating institutes was newly expanded to include the University of Kragujevac and the Wrocław University of Science and Technology. Together with the colleagues from the Department of Physics we organized an international conference Physics of the Switching Arc. The Department continued its cooperation in the organisation of the colloquium "Technical Challenges and Visions for Future Mobility". In power electronics, the European TRANSFORM project carried on developing a fast charger with a single-stage three-phase AC/DC converter (100 V, 200 A, 20 kW) with a PFC function, soft switching, galvanic isolation and full DC output controllability (for an electric excavator battery). Moreover, within the framework of the TAČR MORENA project, three new charger topologies for Li-ion batteries (600 W, approx. 60 V) with soft switching and PFC functionality were built and simulated.

Head:	doc. Ing. Ondřej Vítek, Ph.D.
Number of research teams:	8
Number of employees (recalculated):	27.9
Average age of employees:	41.6 years

Concerning electrical machines, the staff actively participated in the research and development of innovative high-performance asynchronous machines for test benches in the automotive industry. The research is conducted in a close cooperation with partners such as AVL, the Johannes Kepler University – Institute of Electric Drives and Power Electronics (JKU-EAL), Linz Center of Mechatronics (LCM), Silicon Austria Lab (SAL) and many others. A sub-objective of the research is to advance the life span, efficiency and operating characteristics of these advanced electrical machines both under normal and fault conditions.
The electrical equipment group, in cooperation with the EG.D distribution company, has created preventive and educational materials for primary and secondary school pupils, including a video clip focused on the prevention of electric shock to minors on power lines. Representatives of the group also attended a press conference in Prague where the video clip was shown.
The laboratory of switchgear within the ZL CVVOZE continues its activities and has successfully obtained the accreditation according to ČSN EN ISO/IEC 17025, number in the list of accredited entities of the CIA: 1657, certificate No.: 416/2023 of 2 August 2023

RESEARCH AND DEVELOPMENT AT THE FEEC

Photo: Jan Prokopius

Projects

The Faculty of Electrical Engineering and Communication is a unique workplace dedicated to research predominantly in electrical and electronic engineering, information security and communications. It also achieves significant results in other areas such as biomedical and materials engineering. Increasingly, our research teams are working on scientific research questions in collaboration with other universities or with our industrial partners in national or international projects. The Faculty is also actively involved in transnational projects and consortia supported by European Union programmes.

Fields of research

Across twelve institutes, supported by two research centres SIX – Research Centre of Sensors, Information and Communication Systems and CVVOZE – Centre for Research and Use of Renewable Energy Sources, the Faculty has over 30 scientific teams engaged in research and development activities covering areas ranging from nanotechnology to energy. In cooperation with our partners from industry, scientific research projects achieve extraordinary results that find application in practice.

Research Teams:

- AUTOMATION, ROBOTICS AND SENSORICS
- MICRO- AND NANOELECTRONICS
- BIOMEDICINE AND SIGNAL PROCESSING
- RADIOELECTONICS AND COMMUNICATION TECHNOLOGY
- ELECTRICAL AND ELECTRONIC TECHNOLOGY
- TELECOMMUNICATIONS AND INFORMATION ENGINEERING
- INFORMATION AND CYBER SECURITY
- POWER ELECTRONICS AND ELECTRICITY

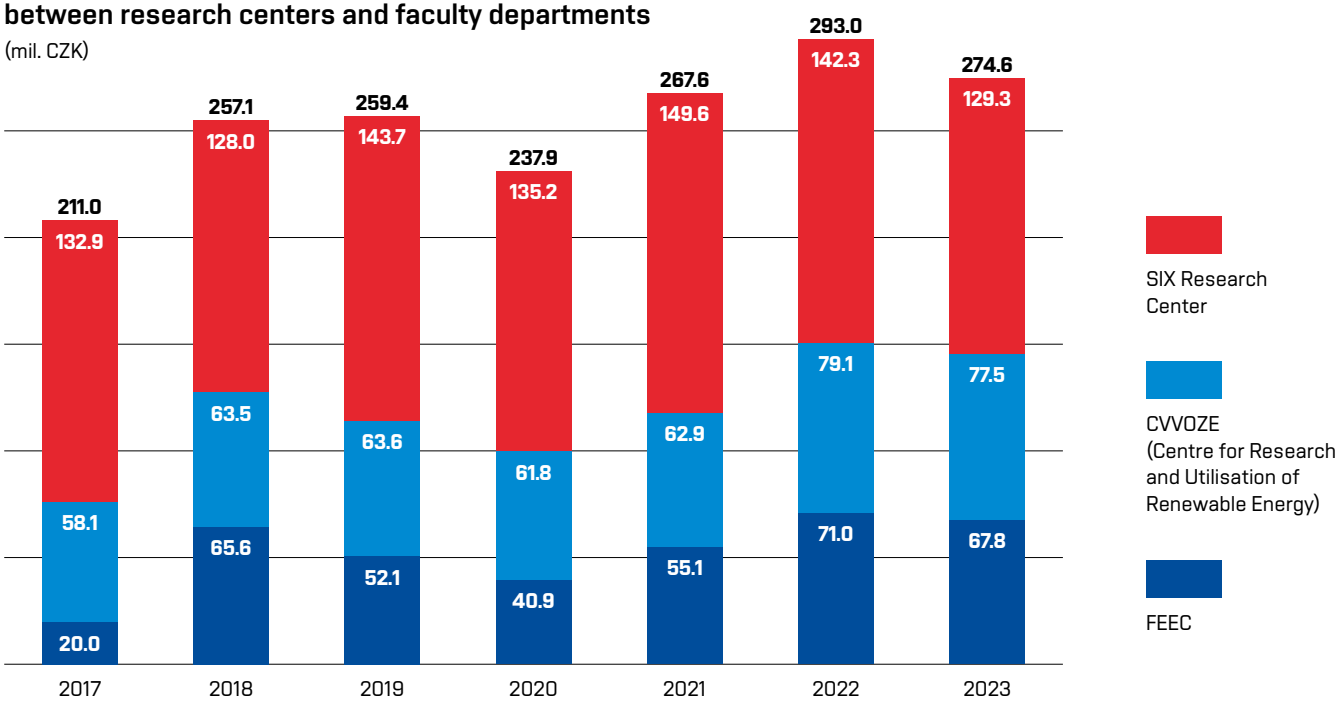
Photo: Jakub Rozboud

Research and development in 2023

In 2023, FEEC researchers worked on more than 150 projects in cooperation with industrial and foreign partners, where the total value of the special-purpose support exceeded CZK 275 million. The main providers of financial support for basic or applied research projects are the Technology Agency of the Czech Republic (TA CR), the Ministry of the Interior of the Czech Republic (MoI CR), the Grant Agency of the Czech Republic (GA CR) and the Ministry of Education, Youth and Sports (MŠMT CR). Within the framework of the largest grant projects, FEEC scientists continue to research and develop mechanisms for effective cyber security testing, control and protection of distribution networks and industrial energy systems, high-revolution machines, streamlining production processes in smart factories using the advantages of 5G networks, distributed optical-fibre sensor systems, artificial intelligence for multimodal non-destructive forensic material analysis systems or robotic systems for intelligence and reconnaissance purposes.

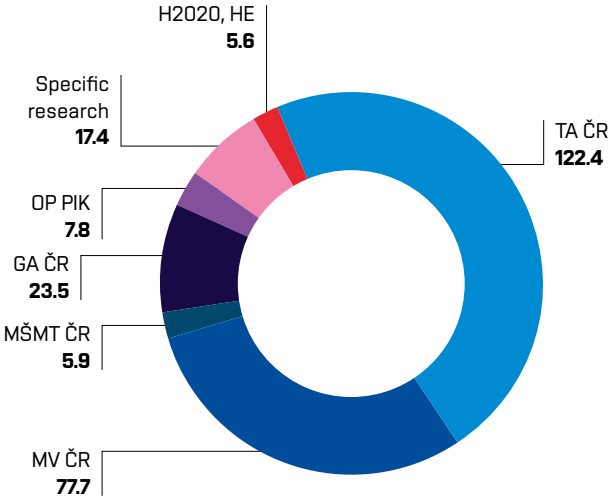
The distribution of financial support of research and development between research centers and faculty departments

(mil. CZK)



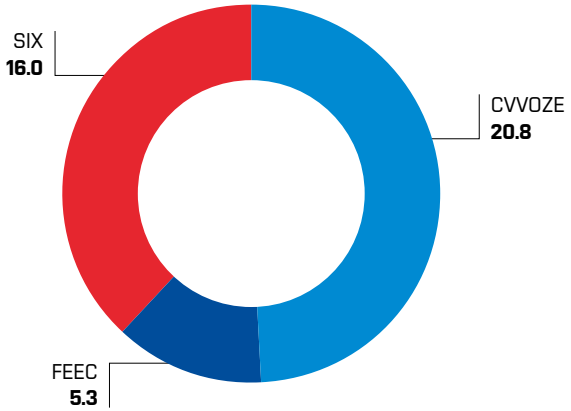
Main providers of R&D financial support in 2023

(mil. CZK, sum total 260.355)



Commercial contract research at the FEEC in 2023

(mil. CZK, sum total 42.1)



Commercial Contracts Research

Financial revenues from contract research, where our research infrastructure is used, amounted to over 42 million CZK for the FEEC in 2023. Contract research was carried out on the basis of commercial contracts as well as within the framework of our students' theses and dissertations.

Numbers of final works with a topic related to industry in 2023:

Bachelor theses:	38
Diploma theses:	48

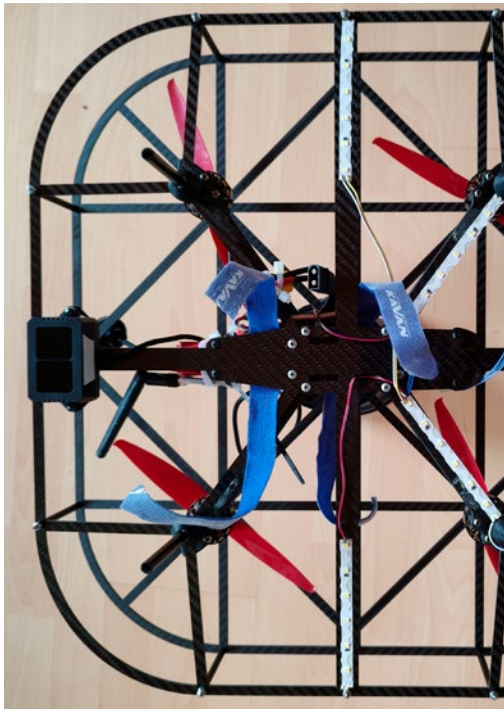
Knowledge transfer

Project activities carried out in cooperation with industry bring plentiful results which are then transferred into practice. In 2023, the faculty received CZK 1.3 million in revenue from profit sharing or from the sale of licences of selected results.

Important projects

AI-guided indoor service drone (UETE)

In the second half of 2023, the UETE team started working on a supported project proposal in the TAČR TREND Newcomers programme. The project is led by the Delogy company and focuses on the development of a drone for indoor flying and the solution of service tasks on the firefighting system. The drone will be equipped with an autonomous indoor navigation system (as GPS does not work in buildings), an object recognition system and autonomous guidance to a selected technological element on the ceiling of the hall, flying according to the map and recording the map background of the building.



Provider:	Technology Agency of the Czech Republic
Principal investigator:	Delogy Projects, s. r. o., for BUT Ing. Ondřej Čech, Ph.D.
Start date:	31 July 2023
End date:	31 October 2023
Total funding:	4,644,000 CZK

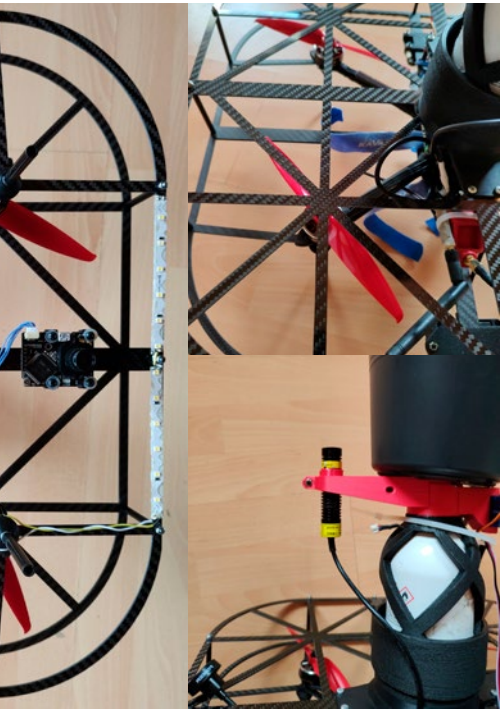
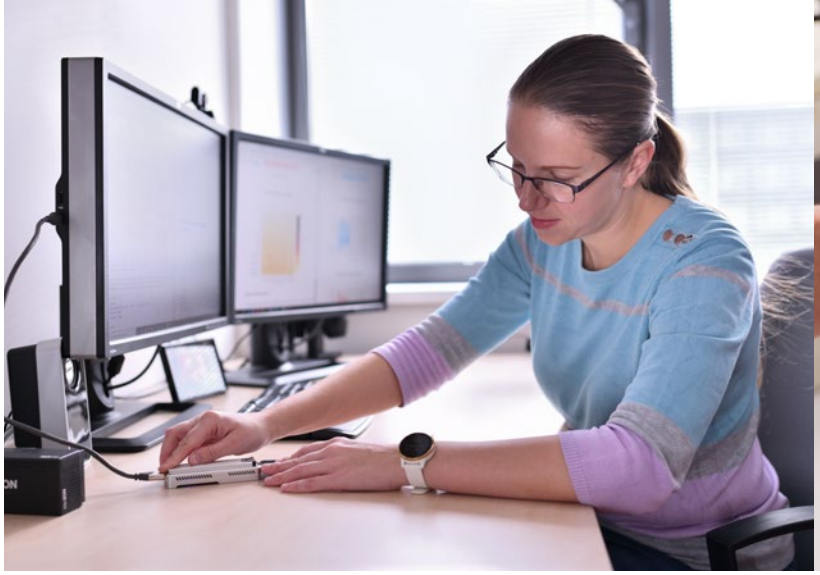


Photo: UETE archive

Analysis of Discrete and Continuous Dynamical Systems with respect to Identification Issues (UMAT)

The project focuses on the solution of identification and qualitative analysis of linear and nonlinear discrete and continuous dynamical systems. This involves research on new methods of discretization and numerical solution of systems, study of stability, identification of limiting behaviour of solutions of delayed systems, study of systems with weak feedback and application of delay matrix functions in solving controllability problems. The research also aims to propose a method for estimating nonlinear models in Bayesian terms by adopting a non-iterative learning scheme based on the global distribution approximation technique. The incomplete parameter evolution model will be compensated by selective forgetting, which will be automatically adjusted to reflect the degree of variability of the system. The outputs consist of new procedures for the identification and qualitative analysis of nonlinear dynamical systems.

Provider:	Grant Agency of the Czech Republic
Principal investigator:	prof. RNDr. Josef Diblík, DrSc.
Start date:	1 January 2023
End date:	31 December 2025
Total funding:	7,038,000 CZK



Real-time identification of infectious threats from raw nanopore signals using machine learning techniques (UBMI)

The project is developing new computational tools to analyse bacterial genomes during the sequencing process. The developed algorithms focus on raw sequencing data without lossy decoding. This will allow not only to evaluate the genetic relatedness of bacteria, but also to predict epigenetic properties such as antibiotic resistance, virulence and pathogenicity. Combined with miniature mobile third-generation DNA sequencers, rapid identification of dangerous microorganisms will become available even in field conditions outside the laboratory and hospital environment.

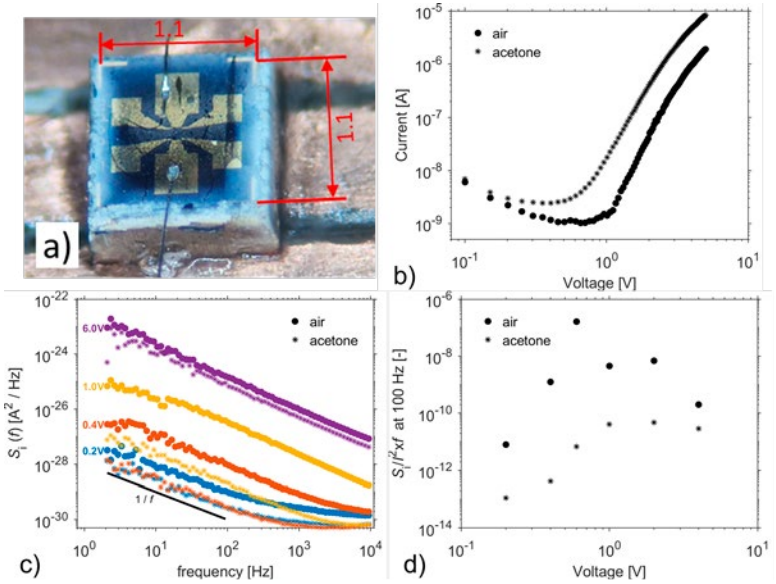
Provider:	Grant Agency of the Czech Republic
Principal investigator:	Ing. Helena Vítková, Ph.D.
Start date:	1 January 2023
End date:	31 December 2025
Total funding:	9,517,000 CZK

Photo: UBMI archive

Multilayer graphene gas sensors with a back gate: charge transport and charge fluctuation for improved properties (UFYZ)

The project focuses on the preparation of gas sensors with a graphene active layer. Based on the analysis of fluctuation processes it is possible to improve their sensing parameters. Different numbers of graphene layers will be studied, as well as SiO_2 and HfO_2 as gate dielectric and different active area of the sensor.
The samples optimized in this way have a mobility comparable to reference monoatomic layers and also produce lower noise levels, thus obtaining excellent detection sensitivity in addition to chemical selectivity.

Provider:	Grant Agency of the Czech Republic
Principal investigator:	Ing. Robert Macků, Ph.D.
Start date:	1 January 2023
End date:	31 December 2025
Total funding:	9,442,000 CZK



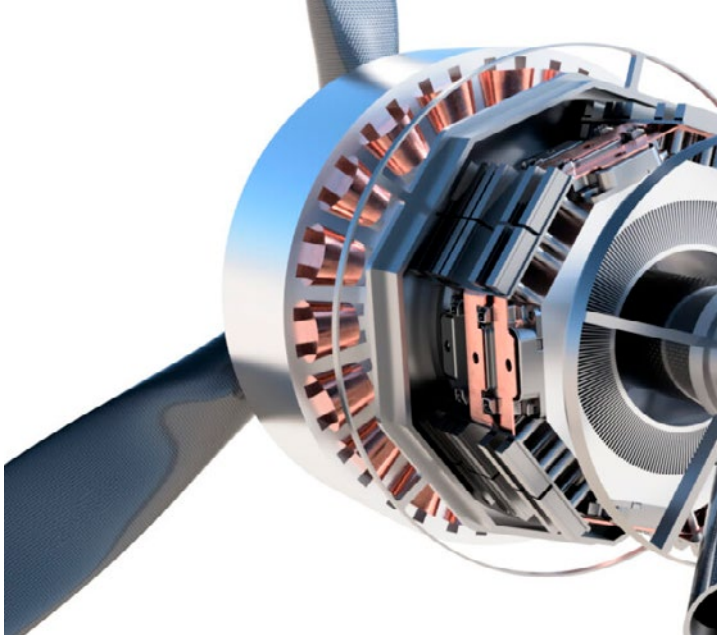
a) optical microscopy image of the graphene chemiresistor, b) I-V characteristics and c) current spectral densities in open air and in ambient air with addition of acetone, d) normalized noise spectral density SI/I 2 as function of applied voltage across the chemiresistor.

Enhancing tunnel safety using Continuous Vehicle Precision Location (UREL)

Doc. Ing. Tomáš Götthans, Ph.D., with CEDA Maps, a. s., have started a project aimed at creating a comprehensive system for increasing transport safety, a navigation reliability, information support in emergency situations and the use of cooperative or autonomous systems in tunnel structures and their immediate surroundings using advanced localization technologies. Technologies located on the transport infrastructure will be used to enable continuous precise localization of vehicles, data processing at the central system level, tunnel control system and transmission of warning and control instructions back to the vehicles. To further enhance safety, the project will investigate new approaches and methods using information from the vehicles and the infrastructure itself based on C-ITS communication, with emphasis on the specifics of tunnel construction where safety is paramount.

Provider:	Technology Agency of the Czech Republic
Principal investigator:	CEDA Maps, a. s., for BUT doc. Ing. Tomáš Götthans, Ph.D.
Start date:	1 January 2023
End date:	31 December 2025
Total funding:	19,045,000 CZK

Photo: UVEE archive



Development of a fail-safe multiphase drive in aerospace applications (UVEE)

The aim of the project was to create a functional sample of a multiphase drive that is operational after a fault and is used in laboratory conditions. Within the framework of the project, a functional prototype of the drive was realized, consisting of an electric motor with a maximum output of 60 kW, a switch, a control system with implemented control algorithms, the necessary cooling system and sensor equipment.

Provider:	Ministry of Industry and Trade
Principal investigator:	Ing. Ivo Pazdera, Ph.D.
Start date:	16 May 2022
End date:	31 May 2023
Total funding:	11,000,000 CZK

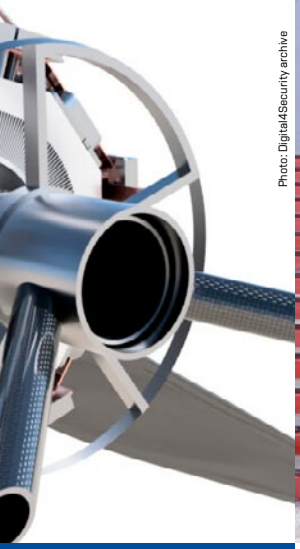


Photo: Digital4Security archive

In September 2023, a team led by Jan Hajný from the Department of Telecommunications participated in the Digital4Security project kick-off meeting held at the Bucharest Polytechnic University in Romania.

Digital4Security (UTKO)

The project aims to create a pan-European Master's degree programme in cyber security.

This programme should help industrial companies across sectors to address the growing global challenge of cyber threats and privacy to protect economic prosperity, promote long-term competitiveness and growth across Europe.

Provider:	European Union
Principal investigator:	doc. Ing. Jan Hajný, Ph.D.
Start date:	1 January 2023
End date:	31 December 2027
Total funding:	20,000,000 EUR

Research on a holistic model of interconnected critical electricity and communication infrastructure (UEEN)

The main objective is to research and develop a simulation tool for a holistic model of heterogeneous interconnected power, data and control (critical) infrastructure allowing to identify, quantify and represent (evaluate) potential external and internal risks.

The project brings together three research centres (CVOOZE, SIX and IT4I) and creates an interdisciplinary research team with available know-how (in modelling, power, communications and super-computing) focused on exploring the interconnectedness of individual (critical) infrastructures (control, data and power) in order to enhance resilience, robustness and preparedness against potential risks, threats or domino effects. The project outputs will help to understand the internal and hidden interdependencies and their potential negative effects. The results will find use in the planning, optimization and extension of these (critical) infrastructures through the involved user organizations from both public and private spheres.

Provider:	Ministry of the interior of the Czech Republic
Principal investigator:	prof. Ing. Petr Toman, Ph.D.
Start date:	1 January 2023
End date:	31 December 2025
Total funding:	24,530,461 CZK

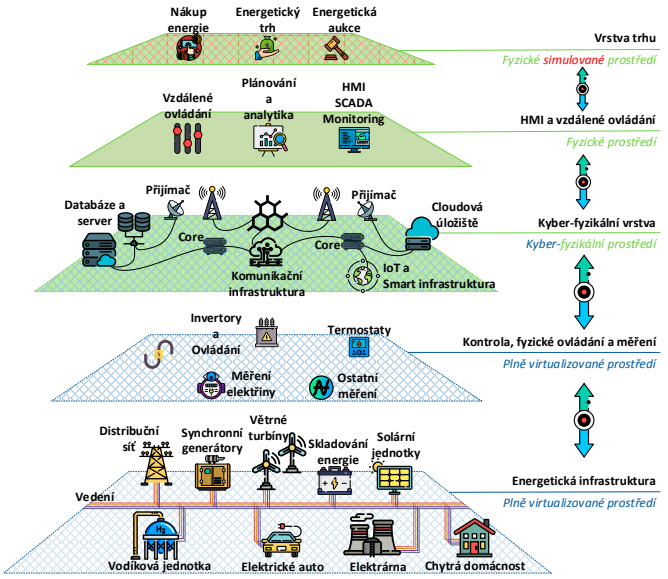


Photo: UEEN archive

Novel self-organized nanorod arrays of molybdenum anodic oxides, compounds and heterostructures as emerging multipurpose electronic nanomaterials (UMEL)

Substantially advancing the performance and reducing the manufacturing costs of modern electronic devices for generation, storage and utilization of renewable energy are becoming challenging tasks nowadays, which may only be solved through creating completely new nanostructured electronic materials with unusual or highly improved properties and performances. This project offers an original electrochemistry-based approach for producing new world-class multipurpose nanomaterials based on highly-perspective molybdenum oxides, their compounds and heterostructures. The materials look like arrays of very tiny hillocks, columns, whiskers, etc. – ten thousand times smaller than 1 millimetre and, therefore, visible' only in an electron microscope. The new nanomaterials are self-assembled – they grow almost like living things in a weak-acid solution in an electric field maintained by a low-power voltage supply. Notably, the new materials and technologies are cost-effective and environmentally unharmful.
We expect the unique and stable nano-topographies, multiplied and reversible oxidation states, and n-type semiconductor properties complemented by green and facile fabrication approaches will make the new nanomaterials highly attractive as emerging electrodes for microminiaturized photovoltaic cells, solar hydrogen-generation cells, Li-free batteries, and electrochemical supercapacitors for purpose-built industrial and home electronics.

Provider:	Grant Agency of the Czech Republic
Principal investigator:	Alexander Mozalev, Dr.
Start date:	1 January 2023
End date:	31 December 2025
Total funding:	7,538,000 CZK

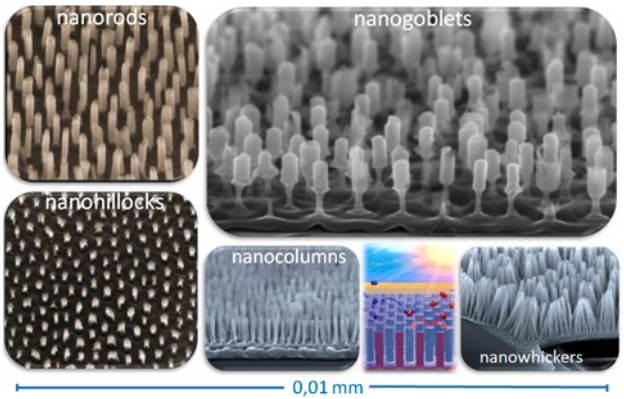


Photo: UMEL archive

3-D electron-microscopy views of novel molybdenum oxide nanoarrays α emerging multipurpose electronic nanomaterials

National Centre of Competence – Centre for Advanced Machinery and Manufacturing Technologies (UAMT)

The Centre brings together 17 partners from academia and industry to research advanced control and diagnostics systems for drives, machines and manufacturing technologies. The focus is on sub-technologies (sensors, power electronics, artificial intelligence) as well as on complete solutions for industry.

The Centre promotes a long-term cooperation and strategic partnerships between universities and industrial enterprises across the country.

Provider:	Technology Agency of the Czech Republic
Principal investigator:	doc. Ing. Tomáš Glasberger, Ph.D. (ZČU FEL), for BUT doc. Ing. Petr Blaha, Ph.D.
Start date:	1 January 2023
End date:	31 December 2028
Total funding:	350,000,000 CZK

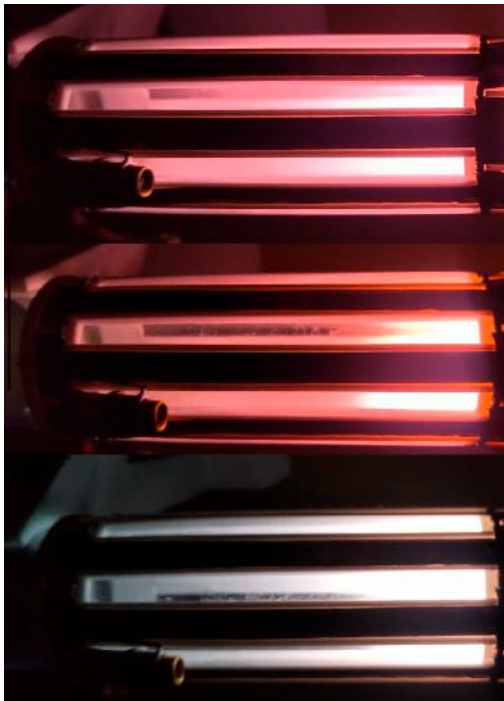


Photo: Jan Prokopius

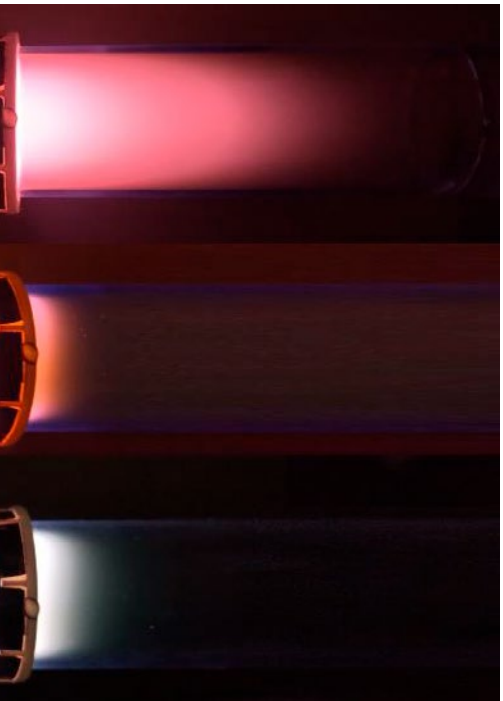


Photo: UTEE archive

Scalable Ioniser for Space Technology and Laboratory Applications (UTEE)

The project is carried out in collaboration with SpaceLab EU, SE and PlasmaSolve, s. r. o. The joint team is developing a low-pressure plasma source that is capable of operating in various gases and at a wide range of pressures. The source is designed with a view to future use for propulsion of satellites in very low Earth orbits (VLEO). One of the applications of these satellites is remote sensing. The satellites would operate at approximately half the altitude (compared to current reconnaissance satellites), which will give higher resolution, while maintaining the same optical array.

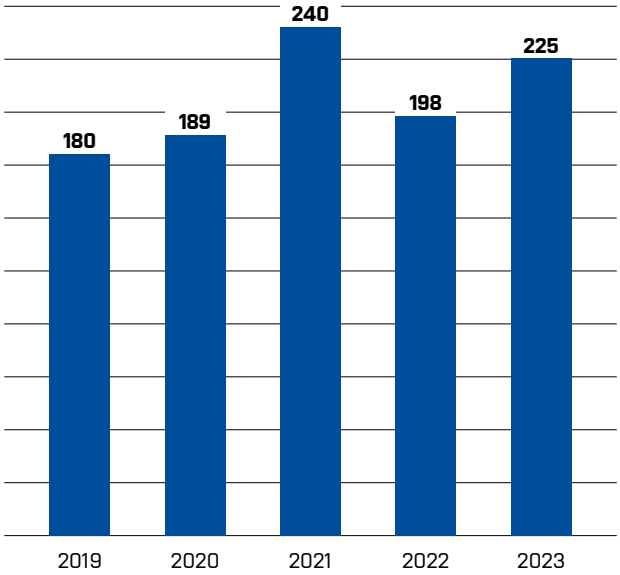
UTEE FEEC focuses on the actual construction of the source, in particular on the high-frequency resonators that excite the plasma in this source.

Provider:	Technology Agency of the Czech Republic
Principal investigator:	Ing. Petr Rychmach (SpaceLab EU), for BUT doc. Ing. Petr Drexler, Ph.D.
Start date:	1 January 2023
End date:	31 December 2025
Total funding:	24,535,000 CZK

PUBLICATIONS

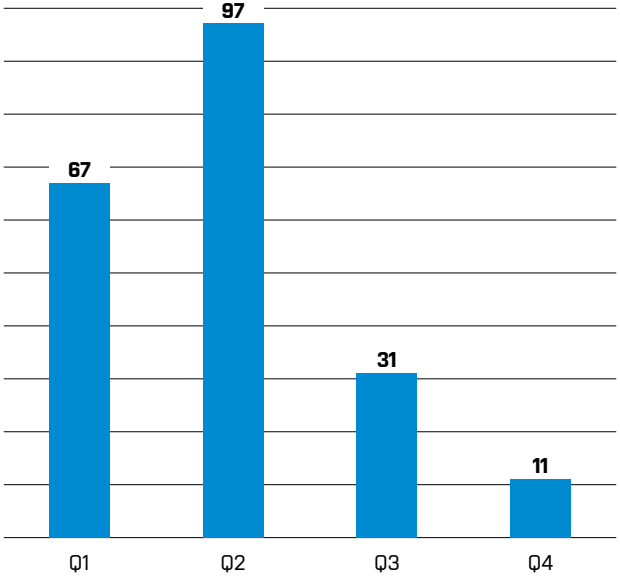
Number of WoS journal publications

(Without quartile specification)



FEEC publication profile in 2023

(Number of WoS journal papers)



Note: unsorted publications (19 pcs) not included

7
books or book chapters

225
papers in Web of Science Core Collection (WoS)

353
conference proceedings indexed by WoS or Scopus

42
prototypes, software or functioning samples

ORIGINATED AT THE FEEC

Utility models in 2023

- SRoad glare assessment kit
- Assembly for tracking the position of moving objects
- A sensor block of the modular axle counter
- A system for simulating multi-layer interconnected infrastructures

Photo: Jakub Rozboud

Patents in 2023

NUCLEAR FUEL, A FUEL PELLET CONTAINING THIS NUCLEAR FUEL, AND A FUEL ROD CONTAINING THESE FUEL PELLETS

Document no:	SE545115 C2
Authors:	K. Katovský, P. Mician
Patent owner:	BUT (100 %)

NUCLEAR FUEL, FUEL PELLETS CONTAINING THE NUCLEAR FUEL, AND FUEL RODS CONTAINING THE FUEL PELLETS

Document no:	KR102522445B1
Authors:	K. Katovský, P. Mician
Patent owner:	BUT (100 %)

ALKALI AND/OR ALKALINE EARTH ION-SULFUR BATTERY

Document no:	US 11,824,191B2
Authors:	M. Sedlaříková, T. Kazda, M. Slavík, A. Fedorkova Strakova
Patent owner:	BUT (20 %), Morrow Technologies AS (80 %)

A METHOD OF PRODUCTION OF A ROTOR OF A SYNCHRONOUS RELUCTANCE MOTOR AND A ROTOR OF A SYNCHRONOUS RELUCTANCE MOTOR

Document no:	309876
Authors:	O. Vítek, P. Klíma, P. Procházka, D. Koutný, J. Bárta
Patent owner:	BUT (100 %)

AN ADAPTIVE MONITORING SYSTEM FOR LARGE GRID NETWORKS OF THE ELECTRICAL DISTRIBUTION SYSTEM AND A METHOD OF ITS SETTING AND OPERATION

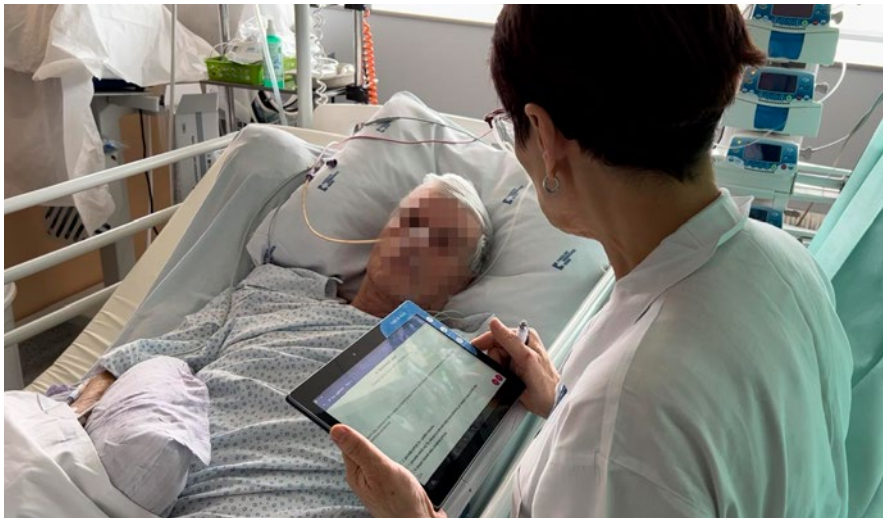
Document no:	309907
Authors:	D. Topolánek, M. Pampart, S. Mišák, M. Ptáček, P. Mlýnek, V. Vyčítal, P. Praks, J. Vysocký
Patent owner:	BUT (50 %), VŠB-TUO (50 %)

BUT Startups for 2023

SCICAKE, S. R. O.

Scicake's main focus is on research and development in the healthcare sector, using modern technology and artificial intelligence for objective, fast and accurate diagnosis of speech disorders such as dysarthria or non-invasive analysis of neurodegenerative and neurodevelopmental diseases. Scicake also focuses on custom research and development services.

Photo: Scicake archive



Speech therapist Milena Košťálová tested a prototype for a digital diagnosis of dysarthria at the University Hospital Brno

BUT spin-offs for 2023

LTR, S. R. O.

LTR develops and manufactures mobile robots for advanced remote sensing in areas dangerous or inaccessible to humans.
The company specializes in robotic assets for CBRN (chemical-biological-radiological-nuclear) threats, as well as assets for day and night reconnaissance and intelligence gathering.

The company is able to produce products for civilian and military use, including the processes required for introduction into the armaments of the Czech Armed Forces and NATO armies. Since the beginning of its existence, LTR has been cooperating with the Brno University of Technology.

Photo: LRT archive

INTERNATIONAL RELATIONS AND FEEC

The interest in student and staff mobility within the EU and also outside the EU has almost returned to numbers comparable to those before the COVID-19 pandemic. Many students of bachelor, master and doctoral studies have successfully gone abroad for short-term study stays and internships. The total number of students mobilities reached more than 90, mostly in the ERASMUS+ and Free Mover programmes. Academic and non-academic staff then completed more than 50 study and teaching stays abroad. At the university level, the "BUT Scholarship and Partnership Programme for Excellence" was implemented for the first time in 2023, thanks to which two excellent academic and scientific foreign workers were successfully invited for a longer stay at the FEEC:

Our former graduate Dr. Ondřej Franek from the Department of Electronic Systems, Aalborg University, Denmark visited the Department of Radioelectronics for one year for his academic sabbatical. At the FEEC, he has been dealing with efficient modelling of reconfigurable smart surfaces. Dr. Anubhab Baksi from Nanyang Technological University, Singapore, who achieves significant international results in cryptography and cybersecurity, spent four months at the Department of Telecommunications.

The same excellent mobility programme also supported four other short-term foreign trips and arrivals of academic and scientific staff, as well as two trips of PhD students as part of academic internships (each of them lasting about 1-2 months).

After more than two years of preparation and coordination of activities with foreign colleagues, a joint consortium of European universities EULiST (https://eulist.university/) was successfully implemented, which received a significant funding from the ERASMUS+ programme under the "European Universities" call. The consortium consists of ten partners from the EU (Austria, Czech Republic, Finland, France, Germany, Greece, Italy, Slovakia, Spain, Sweden). The consortium is coordinated by the Leibniz Universität Hannover, Germany, whose delegation visited the BUT in September 2023.

Photo: Václav Koníček

Visit of Leibniz Universität Hannover representatives to the BUT

Photo: UEEN archive

Students from Kenya received instruction at the BUT in electrical power engineering and computer security

During the summer, students from the University of Strathmore in Kenya visited the FEEC to acquire theoretical and practical knowledge in computer security and power engineering at the BUT within the Academic Programme. Fourteen Master's students thus attended a total of nine teaching blocks over three days, completed with a certificate, in various laboratories of the Department of Electrical Power Engineering. The programme and instruction were partly held at the Faculty of Information Technology of the BUT as well.

The students also had an excursion to the Červený mlýn heating plant in Brno and the whole stay was then concluded with a visit to the capital city of Prague.

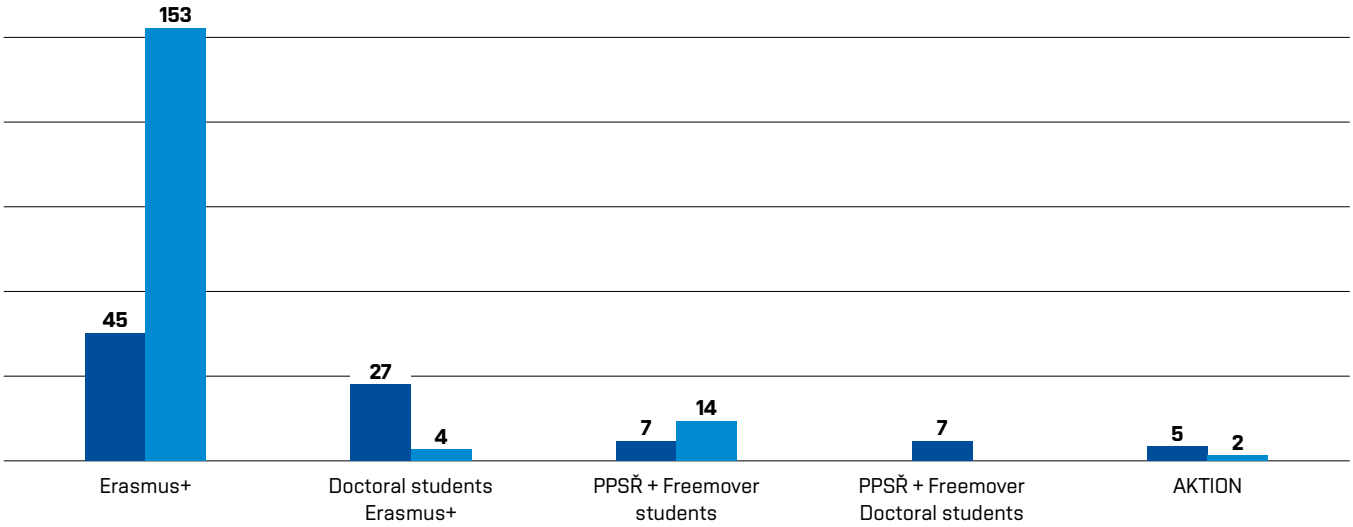
Great supervisors and research. Students from Alabama enjoyed their stay at the Brno University of Technology

A group of eight electrical engineering students from the University of Alabama (UA) had the opportunity to spend three months in Brno and work on their research in state-of-the-art laboratories. They participated in a joint UA and BUT project at the Department of Telecommunications led by Jaroslav Koton and members of the Research Group Development and Testing of Electronic Circuits, Elements and Prototypes.

Photo: Jan Prokopius

Number of FEEC mobilities in 2023

Incoming and outgoing students by programmes

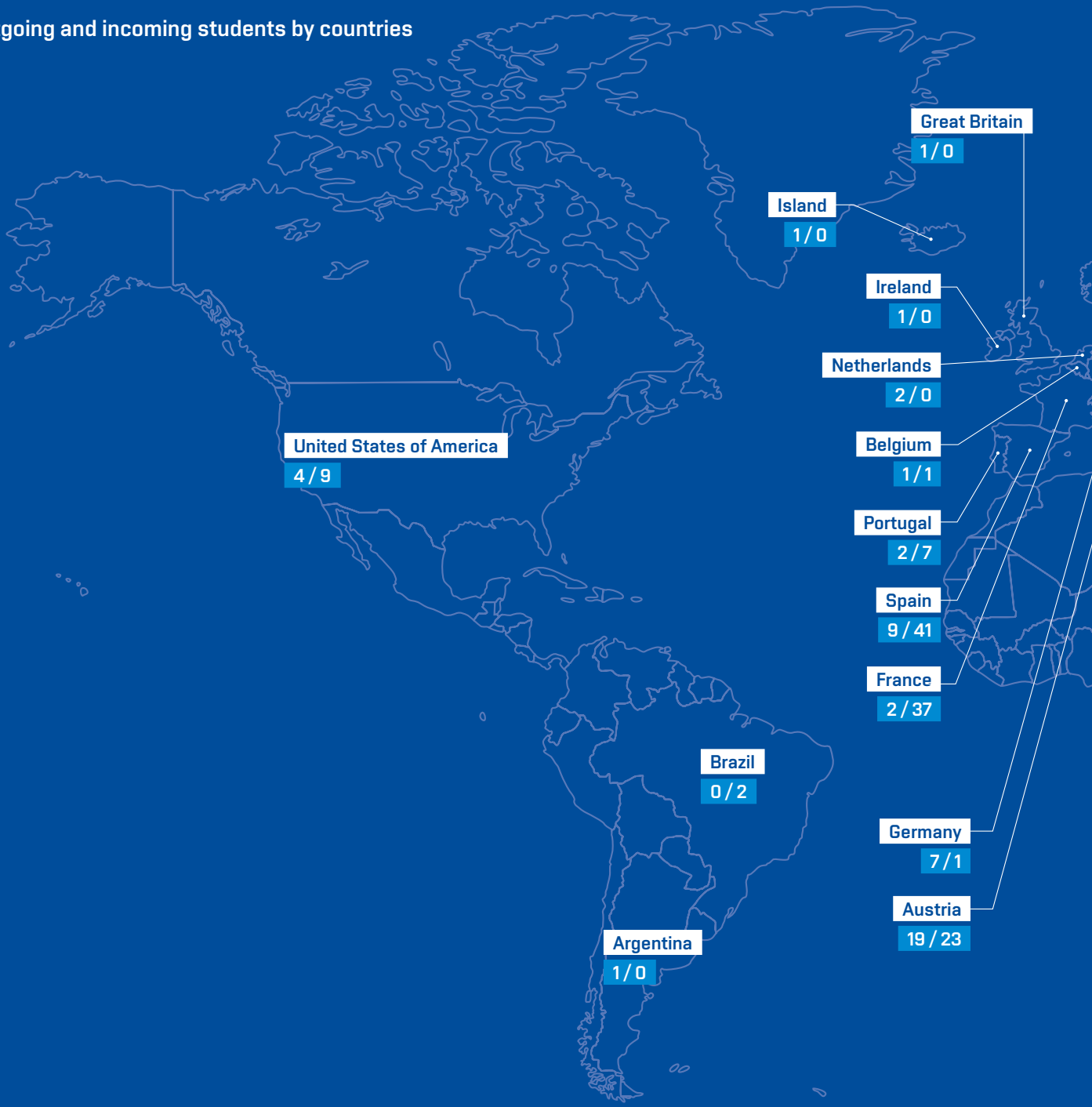


Number of outgoing students:	91
Number of incoming students:	173
Number of outgoing academic and scientific staff within the Erasmus+ project:	55
Number of incoming academic and scientific staff within the Erasmus+ project:	53

Number of outgoing students

Number of incoming students

Outgoing and incoming students by countries




Norway
5 / 2
Finland
21 / 0
Estonia
3 / 0
Latvia
1 / 1
Denmark
2 / 0
Poland
0 / 2
Slovakia
0 / 2
Republic of Korea
4 / 2
Romania
1 / 10
Bulgaria
0 / 6
United Arab Emirates
1 / 0
Taiwan
0 / 1
Turkey
0 / 11
Hungary
0 / 1
Greece
1 / 11
Italy
2 / 3

COOPERATION WITH CORPORATE PARTNERS

"With advanced applications, we create innovations that make everyday life easier. At the same time, we seek solutions to the current challenges the society faces today, thus fulfilling the university's responsibility to society. It is often new ideas and unexpected impulses that can create appropriate solutions. However, their implementation and chances of success require not only diligence, but also financial resources and often a supportive partner from practice. This is where opportunities for cooperation with the corporate sector open up."

Vice Dean for International and Public Relations
prof. Ing. Tomáš Kratochvíl, Ph.D.
tel.: +420 54114 6538
email: kratot@vut.cz

Levels of partnership

STRATEGIC PARTNERSHIP

represents the highest level of a mutual cooperation between a faculty and a company. The strategic partner is guaranteed a participation in the most prestigious faculty events and the mutual opportunity to present oneself as a partner is an integral part of cooperation.

PARTNER or **SME PARTNER**

varies in the number of faculty events in which it is possible to participate and in the amount of a marketing support from the faculty.

STARTER PACK

for new partners, we are able to offer selected services on a trial basis for an agreed period of time.

Why be a PerFEECt partner

Our faculty achieves top results in education, science and research in the Central Europe. We have state-of-the-art teaching and research facilities at the Pod Palackého vrchem BUT campus. Faculty cooperation with industrial partners brings benefits to all parties involved. Thanks to the partner companies, students have the opportunity to work on real-life projects, the faculty opens the door for more advanced research, and the corporate partners are in an immediate contact with the highly qualified graduates that are so much desired today.

Examples of cooperation opportunities

- Application and research projects
- Cooperation in teaching, thesis supervision
- Joint preparation of grants
- Contract orders
- Support for faculty events
- Support of student competitions (e.g. Merkur perFEECt Challenge, Microcontrollers are In!)
- Participation at the PerFEECt Job fair
- Participation in the Student EEICT Conference and Competition
- Participation in the Open Day
- Promotion of the partner in the faculty premises
- Branding of the lecture room

ABB s.r.o.
ČEPS, a.s.
ČEZ, a.s.
Eaton Elektrotechnika s.r.o.
EG.D, a.s.
E.ON Energie, a.s.
Honeywell, spol. s r.o.
NÚKIB
NXP Semiconductors Czech Republic s.r.o.
ON Semiconductor Czech Republic, s.r.o.
Siemens, s.r.o.
Škoda Auto a.s.
TESCAN GROUP, a.s.
Thermo Fisher Scientific Brno s.r.o.
TOKOZ a.s.
Vodafone Czech Republic a.s.
...

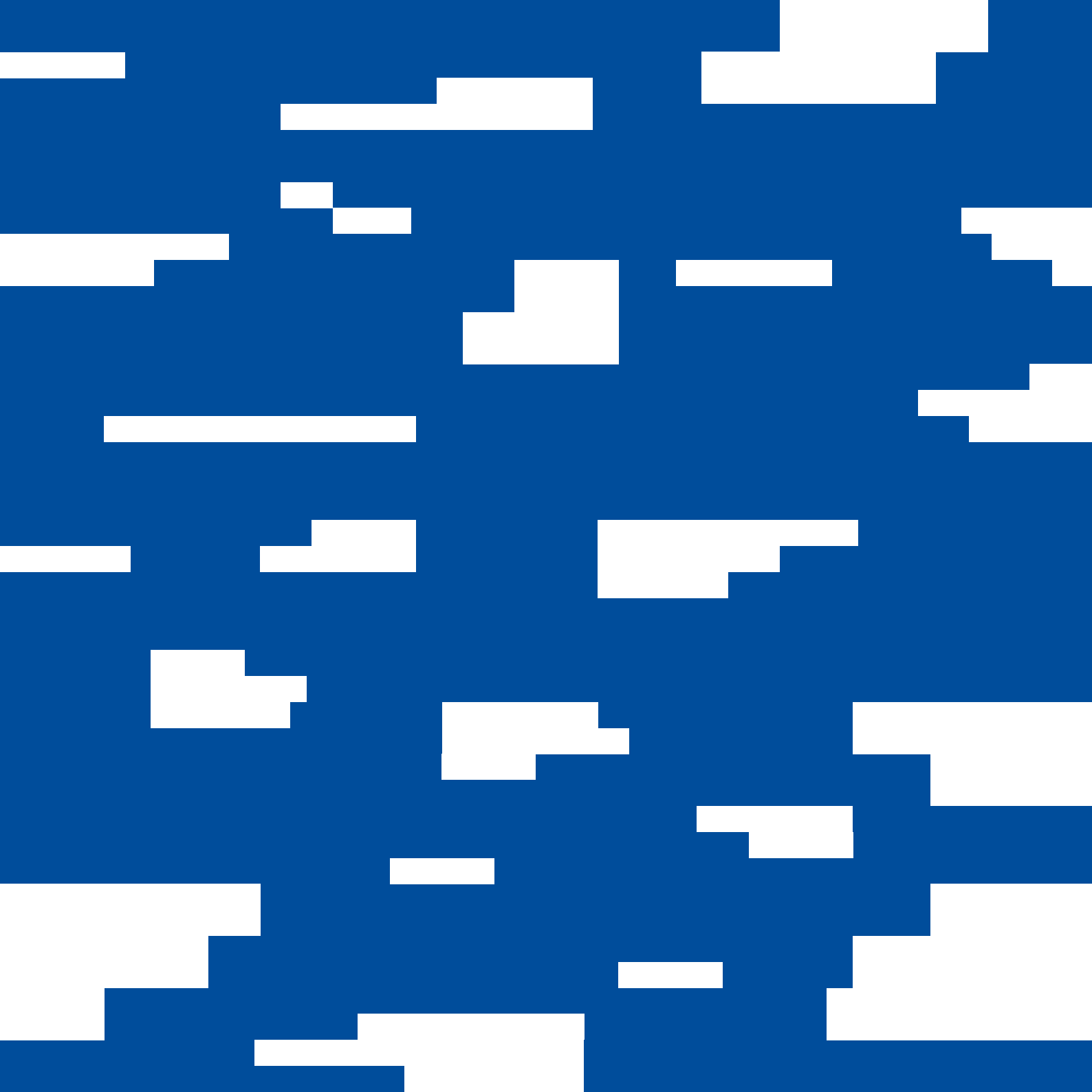
We treat each corporate partner individually, considering their needs and respecting our employees and students. If you are interested in collaboration opportunities, please visit our website where you will also find a complete list of our partners or contact the Vice Dean for International and Public Relations.

FACULTY OF ELECTRICAL ENGINEERING AND COMMUNICATION

Annual report of the Faculty of Electrical Engineering and Communication Brno University of Technology for the year 2023

Published by: Faculty of Electrical Engineering and Communication BUT 2024.
Some parts of texts adapted (with consent) from web pages of Brno University of Technology, www.zVUT.cz.
Metodika: if not stated otherwise, numbers are as of 31 October 2023
Document assembly: Jana Valchová
Translation: Petra Langerová
Editors: Ivana Jakubová, Zdeňka Koubová
Photographs on cover and title page: Jakub Rozboud
Grafic designs and DTP: Jana Valchová based on original design by Vojtěch Lunga from 2020
Printed by: Gill, s.r.o.

Impression 80 pcs



www.feec.but.cz