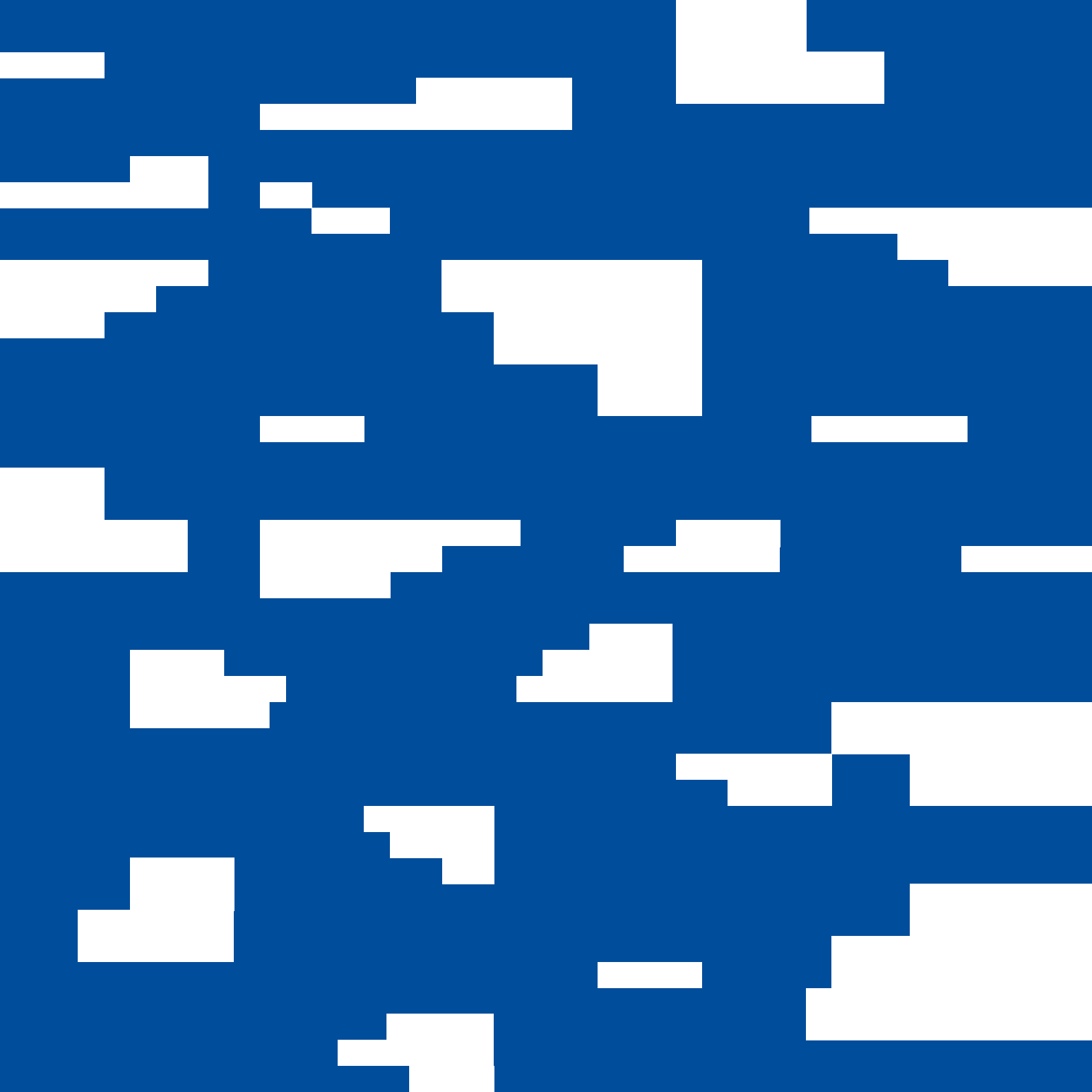
BRNO UNIVERSITY OF TECHNOLOGY
FACULTY OF ELECTRICAL ENGINEERING AND COMMUNICATION

ANNUAL REPORT 2020



FACULTY OF ELECTRICAL ENGINEERING AND COMMUNICATION

ANNUAL REPORT 2020

CONTENT

OPENING WORD OF THE DEAN

Dear readers,

the year 2020 was very unusual for everyone, our faculty being no exception, and it was different from any other years in almost all aspects. Very shortly after the semester start in early February the epidemic of highly infectious coronavirus COVID-19 hit the Czech Republic and since that all our steps have been influenced by, sometimes hardly predictable, government measures against spreading the virus. Rapid spread of the disease has vastly affected human society in all countries of the world. Medical and health crisis turned into economic crisis and only time will show what results and long-term effects it will have and how long it will take us to overcome the aftermaths.

Despite all adversities, last year our faculty managed to adapt quickly to new conditions and to secure a good quality education without presence of students and teachers. I thank to all employees who helped to create online teaching. My hearty thanks go to all who participated at the battle against coronavirus outside their working or studying duties, being it the manufacture of protective shields and masks and disinfectants, tutoring fellow students in times of limited instruction or helping the medical staff.

Even though the spread of the disease brought many questions and anxieties every day, we kept working hard and managed to reach many goals presented in our website. Our students were very active as well.

I would like to mention e.g. Iveta Lolová, a doctoral student at the UVEE, who succeded in Brno Ph.D. Talent contest or Veronika Kaminská from the Department of Biomedical Engineering who was awarded a Ministry of Education Award for her mobile application No Panic!

In 2020 756 students completed their studies at the FEEC. Were it Bachelor, Master or Doctoral study programmes, they are perFEECtly prepared for their future job career.

Faculty of Electrical Engineering and Communication of the Brno University of Technology ranks to highly appreciated educational institutions in the Czech Republic and abroad, thanks to its wide range of study programmes, excellent laboratories and research results. The development of the faculty is, however, closely connected to working enthusiasm of the people involved in its everyday course. Once again I express my thanks to all employees and students for their working results they managed to achieve in the difficult year of 2020.

prof. RNDr. Vladimír Aubrecht, CSc.
Dean

Photo: Jakub Rozboud

MISSION, VISION AND STRATEGIC GOALS OF THE FACULTY

Faculty mission is to raise knowledgeable experts with advanced skills and abilities gained from accredited study programmes, to contribute to development of high quality national and international research and to produce research products highly relevant for the society.

Photo: Jakub Rozboud

F

Faculty

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

E

Excellent

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

K

(K) Campus

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

T

Tradition

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

2020 FEEC Facts in Numbers

3,138
students

1,028
opened subjects

250+
solved projects

613
publications

86
prototypes, software or functioning samples

5
successful habilitations

550
employees

9
international conferences (co) organized by the faculty

FEEC EMPLOYEES

Faculty of Electrical Engineering and Communication (FEEC) Management

Dean
prof. RNDr. Vladimír Aubrecht, CSc.

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

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

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

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

Financial officer
Ing. Miloslav Morda

Organisational Structure

DEAN'S OFFICE

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

ACADEMIC SENATE

Chairman

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

ACADEMIC STAFF CHAMBER OF THE SENATE

Chairman

- doc. Ing. Vlasta Sedláková, Ph.D.

STUDENTS' CHAMBER OF THE SENATE

Chairman of the Chamber

- Ing. Daniel Janík

SCIENTIFIC BOARD

Chairman

- prof. RNDr. Vladimír Aubrecht, CSc.

STUDY PROGRAMME BOARD

Chairman

- prof. Ing. Jarmila Dědková, CSc.

DISCIPLINARY COMMITTEE

Chairman

- Ing. Helena Polsterová, CSc.

ETHICS COMMITTEE

Chairman

- doc. Ing. Jana Kolářová, Ph.D.

DEPARTMENTS AND RESEARCH 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 Radioengineering (UREL)
- Department of Telecommunications (UTKO)
- Department of Theoretical and Experimental Electrical Engineering (UTEE)
- Department of Power Electrical and Electronic Enginering (UVEE)
- Centre of Research and Utilisation of Renewable Energy Sources (CVVOZE)
- Cenre of Sensor, Information and Communication Systems (SIX)

OTHER 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 2020

POWER ELECTRICAL AND ELECTRONIC ENGINEERING

- doc. Ing. Karel Katovský, Ph.D.
- doc. Ing. David Topolánek, Ph.D.

TELEINFORMATICS

- doc. Mgr. Karel Slavíček, Ph.D.

ELECTRICAL AND ELECTRONIC TECHNOLOGY

- doc. Ing. Petr Vyroubal, Ph.D.

BIOMEDICAL ENGINEERING

- doc. Dr. techn. Eric Daniel Głowacki

Photo: FEEC archive

Photo: 'Students for Students' club archive

Number of faculty employees in 2020

Number of faculty employees:	550 (419.71 recalculated number)
Number of academic and scientific staff:	269 (226.35 recalculated number)
Average age of FEEC employees:	42.8 years
Ratio of women employees at FEEC:	23 %

STUDY AT FEEC

The faculty offers a wide range of study programmes focusing on electronics, elechtrotechnology and all related branches from microelectronics, telecommunications, cybernetics and power engineering to interdisciplinary studies such as biomedicine or English in Electrical Engineering and Information Technology.
It offers 16 three-year bachelor study programmes, 22 two-year follow-up master study programmes and 29 four-year doctoral study programmes.
Our faculty thus provides a comprehensive offer of electrotechnical study programmes, both in combined and attended form, in Czech and English. Moreover, we are a faculty with more than 3000 students, which makes us the largest electrical engineering faculty in the Czech Republic and Slovakia.

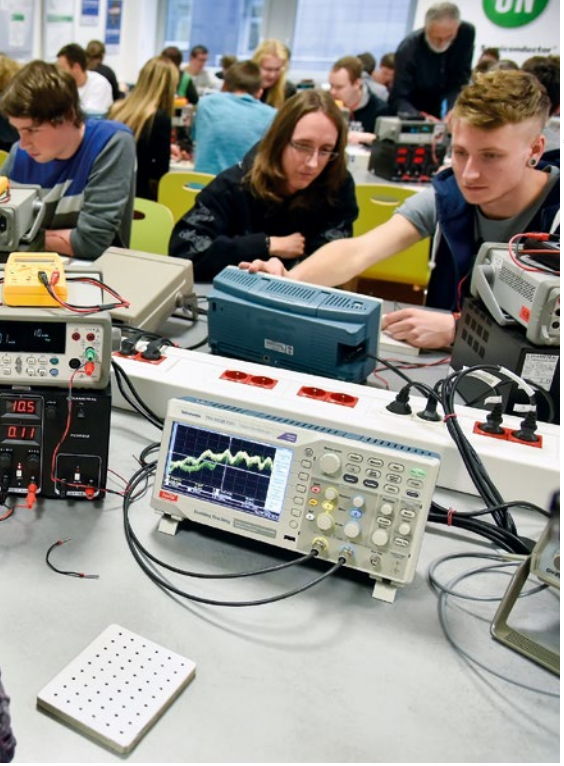


Photo: Igor Šefr

Excellent premises

Since 2013, the Faculty of Electrical Engineering and Communication has been situated in the newly constructed and modernly equipped campus area Pod Palackým vrchem. After more than 50 years it compounds the background for both instruction and students life, where students can enjoy both advanced technologies, perfectly equipped laboratories, lecture halls, canteens and libraries together with places for relaxation and sports.

Practical skills and job perspective of the graduates

Thanks to faculty's cooperation with commercial subjects and industrial partners students can enjoy not only an excellent theoretical preparation, but it also gives them opportunity to try out their practical skills in real life, which is crucial for their future job career. Based on current graduates' poll, 77 % of FEEC students secure their job positions during their studies. 97 % of graduates finds their job within 3 months after their successful completion of studies. These are the best results of all BUT faculties, which shows how successful our students are at the job mark.

Photo: Jakub Rozboud

FEEC graduates have the highest starting salary at the BUT

Our students are not only highly attractive for potential employers, but they are also highly appreciated, compared to other BUT graduates, having their average gross starting salary at 33 427 CZK, based on the data from 2017–2018.

Instruction focusing on study programmes innovation

Study programme offer and content also undergo continual innovations. They reflect and comply with trends in industry in order to make students easily fit the job market demand. Our researchers cooperate with industrial partners on different projects and thus they can apply their practical experience and skills to instruction and content of courses.

Study programmes

Bachelor studies

Attended form:

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

Combined form:

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

Master studies

Attended form:

- Audio engineering – Acoustics and Audiovisual Technology (CZ)
- Audio engineering – Sound Production and Recording (CZ)
- Bioengineering (CZ)
- Biomedical Engineering and Bioinformatics (CZ)
- Electrical Power Engineering (CZ)
- 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)
- Communications and Networking (EN)
- Electrical Power Engineering (EN)
- Power Systems and Communication Technology (EN)
- Telecommunications (EN)

Combined form:

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

Doctoral studies

Attended form:

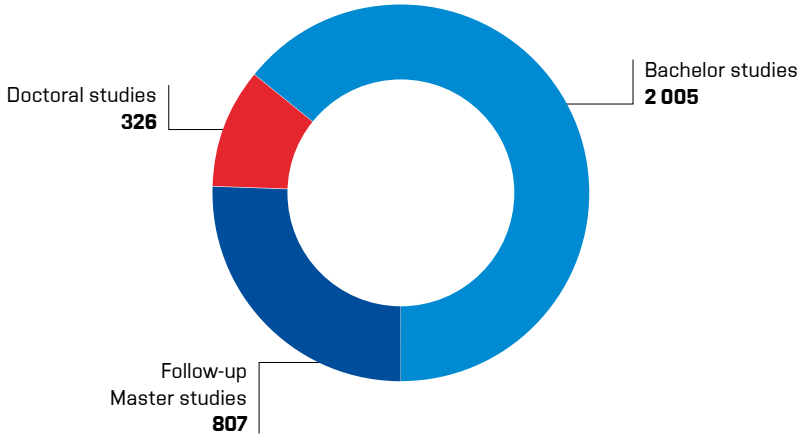
- Electronics and Communications (CZ)
- Information Security (CZ)
- Cybernetics, Control and Management (CZ)
- Microelectronics and Technology (CZ)
- Power Systems and Power Electronics (CZ)
- Teleinformatics (CZ)
- Theoretical Electrical Engineering (CZ)
- Biomedical Technology and Bioinformatics (CZ)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

Combined form:

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

Number of students

(Sum total 3 138)



Interest in study

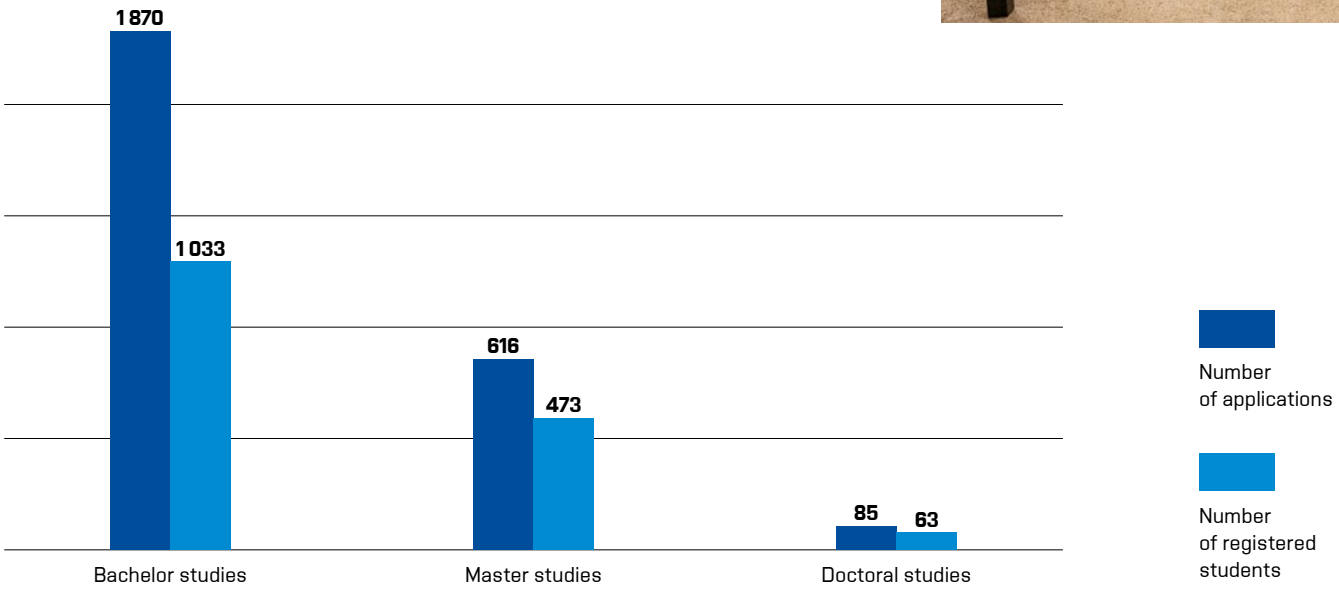


Photo: Jakub Rozboud

‘Students for Students’ Club

‘Students for Students’ Club (SPS) is a voluntary club with 15 years of tradition. Its main mission is to help new students with adaptation to faculty life, organising events for students and organisational help with events held by the faculty.

Twice per semester the club publishes E-FEKT, a bulletin for students full of interesting facts from behind the scene of FEEC and BUT. Readers can find reviews on books and movies as well as restaurants and clubs. First year students will appreciate the ‘Fresher’s guide’ published by the Club, giving them useful tips for successful semester start.

Last year was not favourable to organising events. The biggest SPS event, Hudba z Fektu, normally taking place the first Wednesday of the semester, had to be cancelled because of the epidemiologic situation. Nevertheless, securing all the health standards and preventive epidemiologic measures, the SPS managed to hold a getting-to-know-you weekend PerFEKT start where first year students are introduced to faculty and life in Brno in general.

Even though many events did not take place that year, the SPS did not idle. Club members volunteered for sewing masks, tutored secondary and primary school students, organised a group in Folding@Home project focusing on developing a vaccine aganist COVID-19 and participated in many voluntary activities.

Photo: Jakub Rozboud

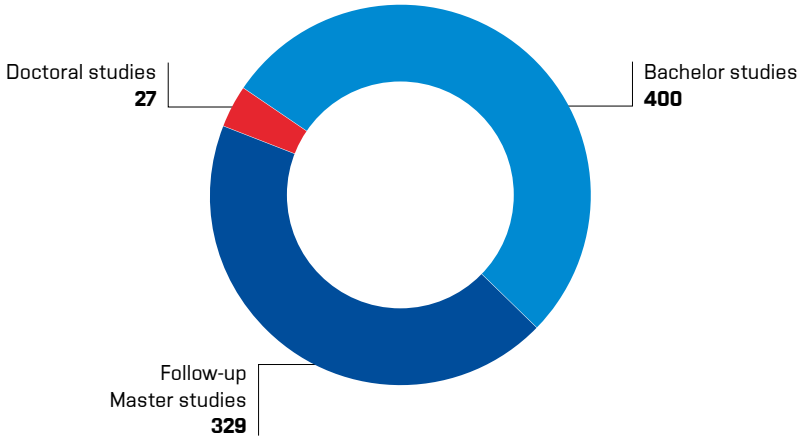
Selected event organized by the ‘Students for Students’ club:

- PerFEKT Start
- Music from FEEC (Hudba z FEKTu)
- Drop of FEEC and FIT blood
- Run to 53
- Board Games Days

Graduates

Number of graduates in 2020

(Sum total 756)



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

WELL-KNOWN FIGURES

Well-known students

Smart air pollution meter by Reair students team got selected to the Red Bull Basement finals

Students team Reair won the national round of the international Red Bull Basement competition for creative and competitive students. They became one of the 38 finalists who proceeded to the global December final round. More than 3800 students teams from all over the world entered the Red Bull Basement competition, which was held for the first time in the Czech Republic. All teams presented in videos their ideas how to change the world and competed to participate in the world final round.

Photo: Igor Pallatka

The national round winners started on 1 September by entering an application, proceeding, selection and development, and it had its winners, FEEC BUT team Jiří Janoušek and Dominik Klement. They wanted to find a solution to bad air condition in closed environment.

Thus, they made up a smart and compact sensor meter automatically measuring the concentration of poisonous particles in the air as well as the amount of carbon dioxide and dust particles. Based on the collected data they can create an individual plan by a mobile application, evaluating the environment a person lives in and they can suggest some solutions how to improve it. For example, it can suggest frequent ventilation, growing plants or using natural materials for the so-called active design.

Photo: Igor Palatka

"Reair uses algorithms of deep learning to acquire your everyday routine and after a couple of days it can even predict potential difficulties and prevent the problematic situations from actually happening. Our goal is to find the most suitable and efficient solution to create healthy and sustainable environment for our everyday life. We truly believe that we can improve the quality of life of the upcoming generations," the inventors say.

Red Bull and other partners such as Komerční banka, NTT group, Busyman firm, Impact Hub co-working space and Honor helped them to pass through the development stage, which was followed by a four-day virtual workshop. There they learnt how to negotiate better with potential investors using their mentors' advice and prepared for the international finals scheduled for 13 December.

Even though the Reair team did not manage to get to the top ten students projects, they acquired numerous skills and experience helping them to improve their gadget in the future. "We enjoyed the full course of the Red Bull Basement programme from the initial idea to the cooperation with knowledgeable mentors who brought us innovative views on the whole thing," say Janoušek and Klement.

"Being technical students, it was difficult for us to create a business plan, marketing and sale, but we managed to improve these skills gradually during the competition. The development stage helped us to realize how to create a business and what the important issues are to be solved, including how to prepare for the negotations with the investors, media and customers," respond the Reair team to the question what they learnt during the Red Bull Basement.

FEEC students project on neuron network helping to classify tumoral cells succeded in a competition

Two FEEC biomedical students impressed the EEICT committee by their project on classifying the cancer cells using mechanical and deep learning. Using the neuron networkJakub Majerčík and Michal Špaček can automatically identify aggressive cells which are characterised by their higher potential to migrate. This project helped to make some advancement in the cells research conducted by the Faculty of Medicine.

Photo: Jakub Majerčík archive

Jakub Majerčík (on the left) and Michal Špaček scored in one of the EEICT 2020 competition categories

The students decided to demonstrate a perfect match between technology and medicine, this is why they joined the Jaroslav Gumulec team at the Faculty of Medicine. Their task was to classify automatically the tumural cells of the prostate cancer which are resistent to zinc.

The researched cells showed more aggressive characteristics. "We research zinc in prostate cancer, as it plays a crucial role in transforming the cells from non-tumural to tumural. Moreover, it influences a wide range of characteristics related to tumor growth. The prostate cancer is the most frequent men's tumor," explained Jaroslav Gumulec from the Department of Pathological Physiology FM MU. It was his lecture which made the students interested in joining the research. "We did not have any expectations to be selected when we applied for it. Nevertheless, we at least wanted to get among the people we can learn things outside school from. But the feedback was surprisingly positive and after a couple of meetings they showed us what they are working on and what we could do for them." remembered the first impressions Jakub Majerčík, a bachelor student at the Department of Biomedical Engineering. He thus joined with his colleague, Michal Špaček, the team at the Masaryk University scanning live prostate cancer cells by a holographic microscope. The students were to sort them automatically. With help of neuron network the students managed to classify the cells automatically with 97.5 % accuracy. Their second supervisor, Tomáš Vičar from UBMI FEEC, gave them the tip to the EEICT faculty competition to join it. "We decided to write down our ideas and to present it there. Unfortunately, we didn't manage the last part that year," reflected upon the restrictions related to the pandemic Michal Špaček.

According to Vičar the deep learning network requires a large number of scans, so that the network is given a lot of practice. In this case an already existing neuron network was used which was 're-trained' to learn how to classify the cells. "It is noticeable that both students passed only their first year of studies, but they were able to participate at such a demanding

project. A course on similar subject awaits them only in their 5th year of studies," Vičan praises them.

"Deep learning will be attractive for more fields and areas of medicine, such as classifying various types of cells, or automatized tomography scans or MRI analysis. It could be also used for speech recognition. In our opinion machine learning will enable faster and easier diagnosing. With the rising number of data amount for the network training the quality of used algorithms will rise as well," Majerčík suggested his vision of the future.

Both students want to research this area more and they want to use it in writing their bachelor thesis.
"We would appreciate if we could apply the algorithm on histology cuts as well," Špaček concluded.

Tutoring maths application from FEEC supported by a well-known mobile operator

A home instruction is a very frequent topic in our current conversations. All parents would like to help their kids to learn effectively and efficiently. However, not all parents have the time and pedagogical skills and this is why they can find useful the teaching project of former students, now FEEC graduates. The Mathman application serves to practise secondary school mathematics. "Its main purpose is to tutor mathematics interactively.

First, students dicover the theory step by step and in the meantime they answer questions to check their comprehension and attention."
Jan Maloušek, the author of the project and FEEC Teleinformation graduate, describes the principles. Once the users pass the theoretical part, they can practise their knowledge on examples. Finally, they need to face a negative virtual hero and test their knowledge against him in a knowledge combat. "Students can create their own test. For example, they are preparing for some more important test covering more topics, they can select tasks on them, and they can set the timing and difficulty. The application then generates the requested setting," Matoušek explains. He has been working on the project for two years. Now it comprises 13 courses for Android free of charge. However, to cover fully the

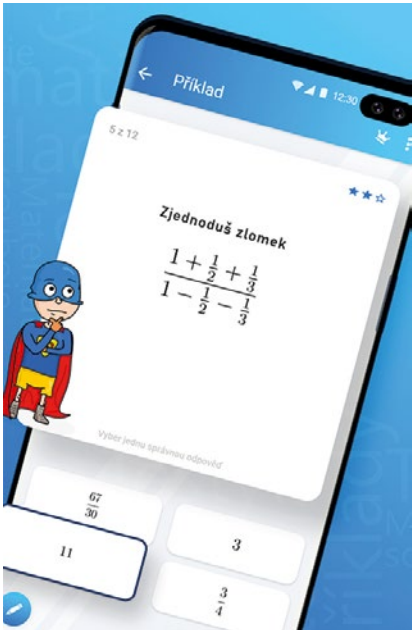


Photo: Mathman

secondary school topics used also by second grade elementary pupils it is necessary to have about a hundred topics. Jan has been trying to improve the application. His former diploma thesis supervisor Kryštof Zeman helped him substantially, as well as consultations with a private maths teacher.

He participated in the T-Mobile Rozjezdy competition supporting starting entrepreneurs by thousands of Czech crowns and he impressed the T-Mobile Rozjezdy jurors. In spring 2020,during the time of closed schools the application was downloaded by 13.000 users. You can download it for free in the Google Play Store.

Well-known graduates

According to FEEC graduates, an average delivery courier spends about 80 % of time by searching for the right entrance. Their suggested solution are autonomous vehicles

Photo: Tereza Kadrnožková

Jan Najvárek (on the left), Matúš Kašuba and Jan Zbořil.

Are you expecting a parcel and you get a text message that the courier arrives some time in 6 hours? After his arrival he can't find the right entrance and he loses some more minutes by waiting for you to find your slippers and a wallet. FEEC graduates invented, created and programmed a vehicle which will be able to deliver on time and if possible, there will be no driver. Autonomous vehicles are being tested in industrial areas in Ostrava, but as well they can be used for selling refreshment in city parks or for disinfecting buildings.

"I have been working in the field of autonomous vehicles for a long time in the Roboauto software company. We could see some advancement in this field happening elsewhere but the Czech Republic. As we didn't find a partner, we decided to set up our own team," Jan Najvárek, the cybernetics FEEC graduate, remembers the beginnings about 8 years ago.

Photo: Tereza Kadrnožková

He and his colleagues had the skills and technology, but they did not have the opportunity to use them. They got inspired by international startups and thus they focused on Last Mile Delivery, i.e. delivery of goods to final users. Even though the current legislation does not allow autonomous vehicles to drive through the cities, Najvárek wants to be prepared for the time when the possible sci fi scenarios become reality.

"Now we are making sure that autonomous traffic is sensible, offering goods delivery without communication with the driver. The courier himself does not spend 80 % of time by driving, but by communicating with a client and searching for him. At the same time, he represents 80 % of the delivery cost service. We do not try to get rid of drivers, but we are trying to minimise the time between the arrival and goods

delivery," Najvárek summarizes the advantages of BringAuto. Their vehicle could be driven by a man, but the communication with the client would be provided for by a computer. A client would thus get an accurate time of delivery, or the time of arrival would get more accurate based on the current location and, at best, it would also show the exact location of the delivery on the map. Even the final delivery could be contactless, as it is possible to mount self-issue boxes on the vehicle accessible by entering a client's code.

BringAuto creators are getting ready for the possible future scenario when there will be no drivers in cars. This vision is partially fulfilled by the so-called teleoperation, i.e. remote control operation, when the driver does not sit in the car, but in the operation centre. "One operator can control approximately 5 robotic cars in 5 different places of the republic or world. The company may need the robot only half an hour a day, so the operator will connect to the operation centre, drives it and then he can switch elsewhere. It is financially much more efficient than to pay 5 drivers. Teleoperation is a vanguard of the autonomous vehicles," Jan Zbořil explains.

A device discovers immediately in the surgery, if a patient has a sepsis or has just gone through a heart attack

Waiting for laboratory results is lengthy for patients and logistically complicated for doctors. The time between a blood draw and getting the results for deciding whether to apply the antibiotics or not can take even several days, as the samples are often taken to distant laboratories and they are evaluated only in large quantities. The solution could be moving the laboratories tests right to the General Practionioners' or specialists' surgeries.

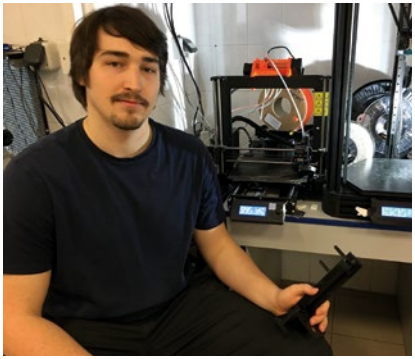


Photo: Tereza Kadrnožková

Jan Zítka, a winner of the Brno Ph.D. Talent Award, is working on a prototype of such device "We want to develop a device ready to perform immunochemical diagnostics in vitro. It should be a relatively small device used in the so-called point of care. The aim is to shift the immunochemical examination from large laboratories closer to patients, ideally to the GP's surgeries. Even though it may seem a relatively easy task, there is a wide range of issues to be solved, such as price or the operation time needed. A GP cannot afford a costly device, so we must try to cut the production costs to the lowest, so that it could be reflected in the final price. It should also be very easy to use, but efficient the same way as the big laboratories are," Jan Zítka explains his motivation for creating the prototype.

He started as a FEEC student, then moved to the CEITEC BUT to study nanotechnologies and then he cooperated with the Department of Chemistry and Biochemistry at the Mendel University in Brno where his brother Ondřej Zítka leads an important research group into biomarkers. They both are very satisfied by their cooperation. "We started with the basic research creating 3D printed microfluid chips. There we checked that it is usable in this field as well. Honza brought a very cheap technology which is easy to use and precise enough for individual particles."

Photo: Tereza Kadrnožková

Almost all the device was printed in the 3D printer

Except some details, Jan Zítka used a 3D printer to create almost all the black box resembling two shoe boxes by size. "For us the 3D print is a natural thing. As a routine, I create a part, I test it and find out if it works or not. Rapid prototyping is the best technology nowadays."

The main goal is to make the usage as user-friendly as possible. "The best possible solution would be if a patient could operate it by himself, with or without the doctor's supervision," Jan Zítka comments on the advantages. "If the device was cheap enough, a person could buy it for home use. They would only need to buy a special filling for a particular test to be performed."

A longish box designed to be inserted to the device could be labeled as e.g. sepsis diagnostics and a warning that a blood draw is needed for the test. The equipment needed for the blood draw would be added as well and the blood draw would then be inserted in the device and a person would only wait for the positive or negative response. Then he or she would know whether to consult the doctor or not. "One of the potential usages would be the oncological markers," Ondřej Zítka adds, and says that the tests for finding a bodily inflammation are easily accessible in pharmacies.

Jan Zítka, a FEEC power engineering graduate, took a long way to get to prototyping complex laboratory devices. "I found a 3D printer in my workplace and I was the first to use it. At first I started with printing external parts and improved much more expensive devices with them. Thank to 3D printing I started a cheap innovation service for other researchers. Cooperation with colleagues from nanotechnologies made me a real enthusiast and now I work at CEITEC with them. Sometimes I work as a programmer too and at other times I design devices, which is more suitable for a construction designer. But it doesn't matter for me any longer." Jan Zítka comments.

"I managed to construct a magnetic particles mixer for DNA isolation, which is quite a unique device nobody makes as it is extremely difficult to manufacture it. Another device is an automatic manipulator which shifts electrodes for electrochemical analysis and it tests hundreds of electrodes at once. Until now a chemist had to do it manually, which made the process erroneous," Jan Zítek names some other laboratory devices, explaining that automatisation has been his hobby since the secondary school.

Electrical engineers with surnames starting with last letters of the alphabet wanted to start business together, now they are making and programming juggling equipment

Vojtěch Vladyka needed a help in a technical competition and was looking for a partner to his team. He found Jan Žlebek and a couple of years later they started business together. Nowadays, the FEEC graduates make juggling equipment. The development of their own hardware as well as launching their flagship, i.e. the programmable poi for light shows, was stopped by the coronavirus crisis.

"I have my own juggling group and current equipment for light shows did not match our requirements. As an engineer, I saw a problem and a solution to it as well, that is why we started it," Vojtěch Vladyka explains the reason why they started to develop their own equipment for jugglers. When he started with juggling, he did not expect that his hobby would make him start own business with friends. "What was good for me as an author and user, was not ideal for a customer. I was not satisfied with the quality. A prototype was one thing, but a product for sale is another thing. Three years of development may seem long, but it is actually not."

On the Foxyco website they offer juggling fans and buugeng made from plyboard. However, the best part, i.e. the LED equipment for light show, is still not ready for sale. "There are not many jugglers in the Czech Republic, some hundreds at maximum, so we cannot afford to make mistakes. I must not make a bad quality product, as it is an expensive thing and if it's bad, the members of the juggling community will learn it soon. And this would mean the end of the brand. That is why we are taking our time to finish it," Vladyka says and adds that postponing the launch of poi which makes flashing pictures in the dark is also influenced by the bad situation in the market. However, they have managed to release training equipment made of plyboard. "Now we are thinking of switching to plastics. We are producing in small numbers, mainly on request." They both keep improving their products. Based on the feedback they changed the shape and width of the handle. They are having their equipment prototypes tested by a top juggler from Holland.

Pois used in jight shows are the most difficult to produce, as the result should be equipment able to draw a picture based on the juggler's movements. And this is where Jan Žlebek's part comes: "The principle is known as persistence of vision. Light stays on a retina for some time and thus, if you move the light source, you will create a line, not single points. A point can turn off or change colour." His task was also to think up how to enable technically non-skilled people make random pictures by pois. Available products were not much user-friendly and it soon turned out that it would be necessary to develop not only an application, but also own hardware inside the poi. "Now we are finishing a mobile application to operate it. We found out that people do not want to turn on a computer to programme it, they prefer a mobile phone or a tablet," Vojtěch Vladyka explains.

Both agree that studying an electrotechnical university gave them more than just learning the automatisation. Jan Žlebek says that the biggest asset at the university was that he learnt to see things from a different perspective. "The university gave us the technical skills and it showed us the possibilities, but it also taught us how to change from a person blindly following instructions to someone creative and innovative."

Photo: Foxyco archive

Well-known employees

Smart light bulbs and sockets by various manufacturers operated by voice. A solution for an Austrian operator originated at FEEC

A smart household should learn on its own when to start heating the snowy access road, Pavel Mašek and Kryštof Zeman from the Department of Telecommunication say. They are on their halfway to a smart system making life easier. Even this milestone is worth attention: not only did they manage to unite smart system household from more manufacturers, but they also managed to find a partner, an Austrian mobile operator. Modems based on their design will thus soon start to function in Austrian houses. "We offer an opportunity for all who do not want to choose only one supplier of smart appliance, such as light bulbs and sockets, but they want to combine devices from more suppliers based on their personal preferences. Our universal smart household can operate devices from different suppliers. For example, the Apple company makes appliances able to communicate and work only in its own Apple system, which is exactly the opposite we want to achieve. Our goal is to be as universal as possible and not limit the customer with only one brand," Pavel Mašek explains the biggest advantage of the project which he has been researching for more than 7 years.

Photo: Igor Šefr

So far, if someone bought a smart light bulb from one manufacturer and a remote control socket from another manufacturer, they had to have two applications installed in their mobile and to operate each of them separately. This is now no longer needed according to Kryštof Zeman: "We designed a web application for a user to access and to add an appliance. The user chooses which room he or she adds it to and names it and from that moment everything runs automatically. You can operate eveything from one place." A remote access control enables people to check whether they had really switched off the cooker before they left for holiday and to solve any possible problems from distance. It also enables the proprietors to watch surveillance cameras, to shut the blinders or close

windows. Everything depends on what smart household appliances you have at home. However, the technicians did not want to limit their control mechanisms only to mobile or web applications. A household equipped by their modem can be operated by a TV remote controller or by a voice operator.

Every solution leads to maximum simplicity and user friendliness. "It is very simple. You just buy a smart light bulb, plug it in and connect it to your network by one click. We reduced about six steps into a single one," Kryštof Zeman explains and Pavel Mašek adds: "This is an example of future not too distant for common users, not just for technical geeks. If it is the first experience for you, you will be satisfied just by turning on the light or shutting the blinds. If you manage to do that, then you might become more interested and you may want to learn something about dynamic learning." By dynamic learning they mean a really smart household, i.e. a household that would learn the individual habits of its members. "For example, after a month the household would learn that the members get up at 6 A.M., so at 5.45 it would start making coffee and heating so that the members would get up in the warm.

Photo: Jakub Rozboud

When the people leave the house, it would shut the heating and close windows. Before their arrival, the household would melt the ice and snow from the access road to the house and it would offer a movie if it recognizes that anyone is in the room, based on the individual voice," Zeman comments on the possible visions of the future technologies. Nevertheless, they both add that people might not like such invasion of smart appliances because of its possible misuse and security hacking. "Of course we considered the security crucial and that is why we chose the principle of containers where each of the services runs individually and in case of security breach only the hacked service will cease working. Which means that for example the smart household will stop working, but the Wi-Fi will still go on," Mašek describes the functioning the modem which they recently handed to their customer, the Austrian A1 Telekom Austria.

The cooperation with a big telecommunication partner is another guarantee of security for them. Nevertheless, they still see the necessity of raising awareness of data security. A complex model of a smart household including a router from BUT, a smart appliance and control application is still not available in the Czech Republic. However, authors add that with the operator's consent the project data are public and light bulbs changing colours can be bought in many shops today. The only obstacle now is just mistrust, insufficient technical skills and also a high price.

Electroporation device from FEEC thrives for a European patent. It should help cardiologists and hepathologists

An electroporation generator developed by FEEC researchers could be awarded with a new international patent.
The device can be used for treatment of heart arrhythmia or clearing the bile ducts. Thank to the new technology the treatment will be more secure and gentler to the patients.
Dalibor Červinka from the UVEE department came up with his prototype of the electroporation device about four years ago. During an electroporation a tissue is exposed to a series of electric pulses. The power of high voltage causes small pores to appear in the cell wall, thus the name electroporation, and this makes the cell die gradually. The first generations of the device used direct voltage.
"The first device applied direct rectangular pulses which caused muscle contractions that could be eliminated just by strong muscle relaxants and a general anaesthesia. The electrolyse then caused microbubbles to appear which could be potentially dangerous for patients," Červinka explained why he decided to develop a completely new generation of the device.

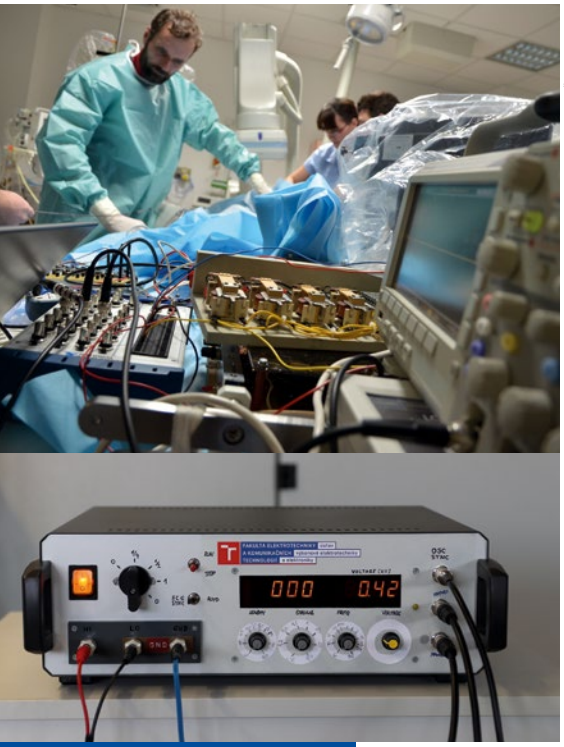


Photo: Dalibor Červinka archive

"The new device uses high frequency alternate voltage which has the same therapeutical effect as the direct pulses, but it does not cause any muscle contractions," Veronika Novotná, the collaborator, said and added: "We also expect the treatment to take shorter time and the patient to recover sooner. Even though a relatively high voltage and current are applied, thanks to its high frequency character it is much safer and gentler for the patient compared to the previous direct electroporation." The researchers want to make their device available to various medical and researching teams. Their generator offers a great variability in setting, it is thus suitable for experiments on living organisms. Doctors may also try out various applicators, such as ballon catheter or needle applicators and so on.

"Our generator is sufficiently compact, it is easily constructed and operated, which makes it accessible for many medical teams. Nowadays they use it on cardiology or hepathology, but in the future it could be potentially used in other medicine areas," Červinka suggested the wide potential of usage. The new electroporation generator from the FEEC has already been awarded with a Czech patent and the so-called utility model. Pre-clinical studies in heart arrhythmia treatments were tried out in cooperation with the ICRC research centre of the St. Anne's University Hospital.

Photo: Lenka Gumulec

Karel Katovský and his Ph.D. students at the new experimental loop

FEEC device will help to nuclear research. The researchers want to increase nuclear safety and to prevent emergency breakdowns similar to Fukushima

Reseachers from the Department of Electrical Power Engineering started a new experiment loop designed for the research in nuclear energetics. Thanks to that they can get more information about potential breakdowns in a nuclear reactor. It can help them, for example, to simulate the so-called boiling crisis when a high rise in temperature occurs and it may result in burning the fuel rod in which contains the nuclear fuel. The device with such parameters is unique in the Czech Republic, other similar devices are only available to researchers in Japan, Sweden or South Korea. "A single nuclear reactor contains thousands of fuel rods. In the fuel fission chain reaction occurs which causes strong heating of the rods. There are only milimetr gaps in between them through which water circulates to cool them. In case of insufficient cooling they can overheat and it can result in boiling crisis. This is obviously not common, but it is considered a part of the safety evaluation of the nucelar reactor. Theoretically, a cooling system can fail, that is why we need to know when such situation can occur and how the fuel rod cover behaves," Karel Katovský explained the necessity of experimental loops. In the experiments the researchers gradually heat the loop to 110 °C. At the moment of critical heating of the fuel rod the hot spot starts to flash and the device automatically switches off. "While in the primary circuit we expose the device to boil, in a real hydropower nuclear plant they do not want to let it boil at all, as this would be considered a breakdown," Katovský warned. Apart from that the FEEC researchers can examine various materials for fuel rod production. "In the world there are

now 444 nuclear reactors and most of them use zirconium alloy for covering the fuel rods. The alloy in general has good properties, but in the emergency breakdown the zirconium reacts with heated steam and hydrogen is created. Someone might remember the spectacular blow-ups of the reactor halls in Fukushima 9 years ago, which were caused by the accumulated hydrogen," Karel Katovský suggested another area of research. Many scientists now search for ways to prevent the zirconium reaction from happening and come up with new materials and surface coverage innovations.

"In the first round of experiments we studied critical heat flows on a nickel superalloy which is a very expensive and stable material suitable for various extreme environments. Our experiments with this material under the set parameters were the first of that kind in the world," Kamil Ševanka, Ph.D. student focusing his dissertation on this experimental loop research, added.

Researchers from the Department of Power Electrical Engineering collaborate in the long run with the Texas A&M University which is the largest nuclear university in the USA and also with the Joint Department of Nuclear Researches in Dubna, Russia. Czech power engineers also celebrate the 35th anniversary of the Dukovany nuclear reactor power plant.

Photo: Igor Šefr

The system also checks the service life of individual protective aids

FEEC security frame automatically detects right protective clothing

A safety helmet, gloves and safety harness are immediately recognized as the right protective equipment and thus the employee can enter the production area. As the chip card beeps, it automatically recognizes whether the clothing an employee is wearing is suitable or one of the protective tools has expired. This is the newest innovation produced by the Department of Telecommunications. A security frame can be used not only in heavy industry, but also for example in health care services.

"Our system can match particular equipment with an employee who is supposed to wear it. After the card beeping the frame automatically detects the equipment due to the labels at individual parts of the protective gear, such as a helmet, a mask or a shield," Petr Dzurenda from the Department of Telecommunication, who has worked on frame development for 3 years, explained. Apart from the security frame there is also a manual reader in case it would be necessary to have some staff to scan employees personally.

Important awards and merits

Ministry of Education Award

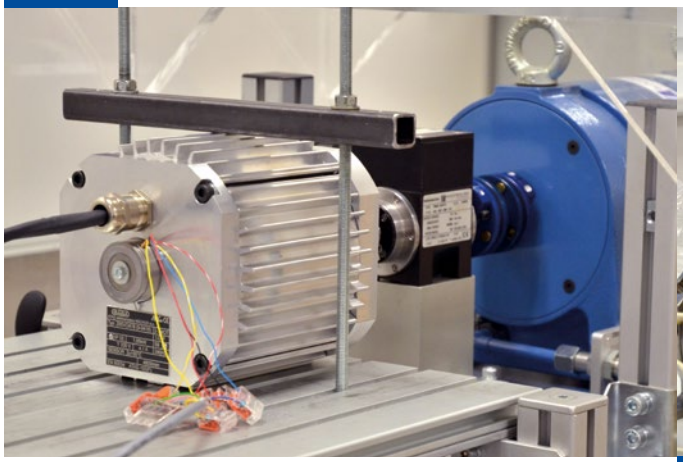
Ministry of Education, Youth and Sports awarded 10 students with prizes for special deeds, e.g. volunteering and other activities related to the COVID-19 pandemic. One of the awarded was Veronika Kamenská, the author of No Panic! application which offers for free fast psychological help to people suffering from anxiety or suicidal thoughts. Nowadays, it is currently available to people in more than 150 countries of the world and during the worldwide pandemic situation it has been extremelly wanted. The application has saved more than a hundred lives and it registers about 120.000 users from 151 countries of the world. The student also received for her work a Gratias Tibi 2020 award for her civil activity and she also appeared in the Forbes 30 under 30 list of young talents. Even the BUT rector awarded her with the Rector's Prize. She cooperated on the application development with Tomáš Chlubna from the Faculty of Information Technology at BUT.

The Learned Society of the Czech Republic Award

A secondary school student Anna Maxová, under Pavla Šabacká from the Department of Electrical and Electronic Technology's supervision, was awarded with the Learned Society of the Czech Republic Prize in the her secodary school category. Her work focused on mathematical-physical analysis which served as a background for the development of experimental chamber for measuring critical flow in low pressures.

Photo: Oto Jandušek

Ministry of Education, Youth and Sports awarded Veronika Kamenská for the successful application No Panic!



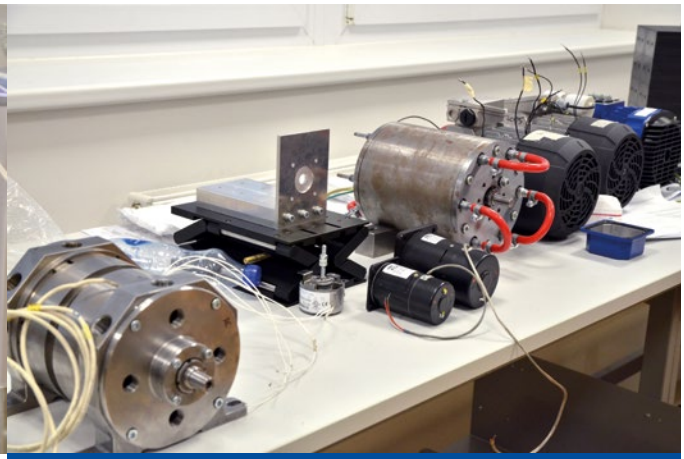


Photo: UVEE archive

Ph.D. Talent Award

Iveta Lolová, a Ph.D. student at the UVEE, was awarded in the Brno Ph.D. Talent competition financed by the Brno City in order to support Ph.D. students. The 'Topology optimisations of the line-start synchronous machines' project was supported by the competition jury. The project focuses on optimisation of electric engines, expecially on raising their efficiency, which leads to electric energy consumption decrease. This perspective makes the project very up-to-date and essential for international measures demand higher and higher standards on electric engines efficiency. The optimisation of the line-start synchronous machines uses the topology method which enables finding unique topologies leading higher electric engines efficiency.

Siemens Healthcare Award for the Best Student Research

Siemens Healthcare awarded a prize and financial reward for the best student research project to a biomedical student Jakub Nemček who focused on intracranial hemorragies detection in MRI scans.

BUT Rector's Golden Medal

During the 21st Academic Assembly which had to be held without the official ceremony the BUT Rector Prof. Petr Štěpánek awarded a Golden Medal prize to Prof. Jan Chvalina from the Department of Mathematics for his excellent pedagogical and scientific research activities.

Photo: Václav Kaczmarczyk

Protective half-mask printable on a common 3D printes is available in many sizes including children ones

BUT Rector's Silver Medal

A group from industrial automatisation at the Department of UAMT and students developed a protective mask printable on a common 3D printer without using any special materials.

The half-mask is used as an improvised protection and it helped to overcome the problems with sealing the imprint by a very original way. To create this half-mask no special equipment is needed. This activity was awarded with the BUT Rector's Silver Medal.

UAMT employees together with the CEITEC research centre developed protective shields, which was also awarded with the Silver Medal.
Prof. Ivo Provazník was awarded with the Silver Medal for his exceptional merits in biomedical engineering development of the university.

BUT Rector's Honorable Mention

BUT Rector awarded an Honorable Mention to Assoc. Prof. Tomáš Götthans and Jakub Götthans from the Deparment of Radioelectronics for their activities in the BUT Helps initiative.

The Rector also awarded the employees from the Deparment of UTEE with an Honorable Mention for the development of UVC steriliser suitable both for large and small environments for the RACIO company.

RESEARCH AND DEVELOPMENT AT THE FEEC

Photo: Jakub Rozboud

Projects

Faculty of Electrical Engineering and Communication Technologies is a leading institution of applied research in all areas of electrical engineering and electronics as well as other fields such as biomedicine. Most of the projects are solved in cooperation with other research institutions, universities or renowned industrial partners. However, number of projects is solved by research teams consisting of faculty staff only. The faculty is successful in winning national and international grants in EU calls as a part of larger consortiums.

Fields of Research

The faculty has achieved several remarkable successes in a wide range of branches of electrical engineering. In each of these fields there are several research teams solving various applicational projects with industrial partners as well as with a great number of commercial contracts.

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

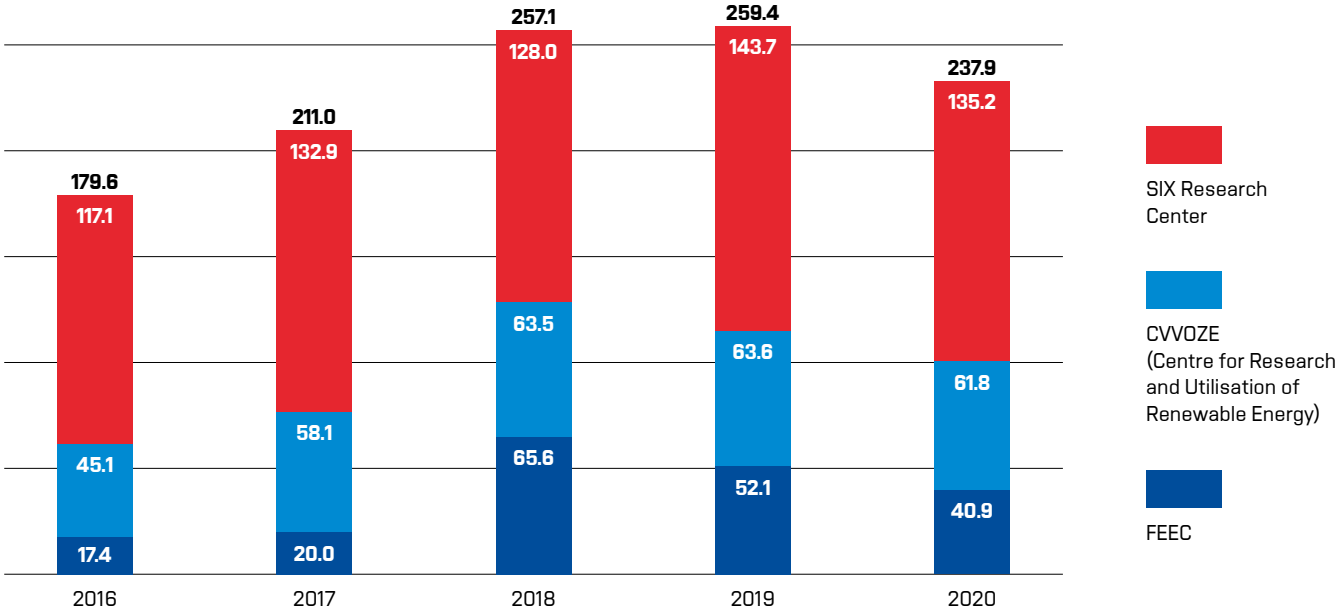
Photo: Jakub Rozboud

Research and development in 2020

In 2020, the FEEC researchers solved over 180 projects either on their own or in cooperation with foreign industrial partners. The total amount of financial support exceeded 237 mil. CZK.

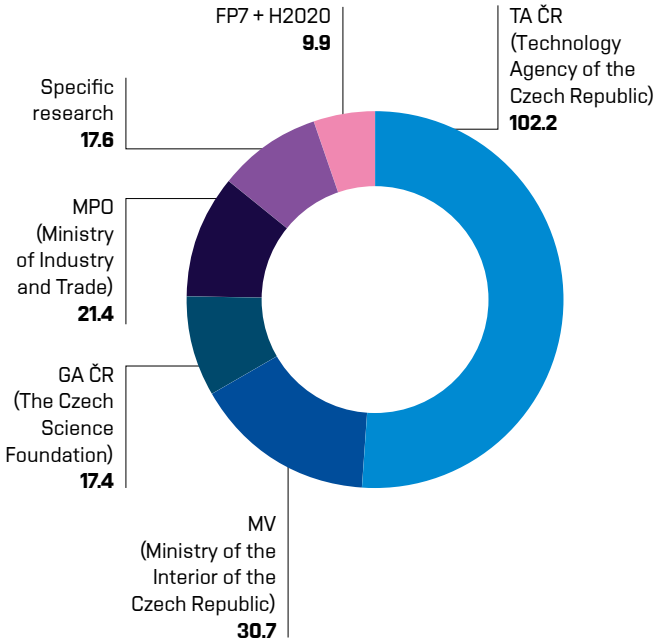
The most important providers included Technological Agency of the Czech Republic (TA ČR), Ministry of Internal Affairs of the Czech Republic (MV ČR), Grant Agency of the Czech Republic (GA ČR) and Ministry of Education, Youth and Sports of the Czech Republic (MŠMT). The biggest grant projects allow FEEC researchers to continue their research of e.g. high frequency machines for cooling circuits of fusion reactors, development of active elements of high-speed networks, communication networks enabling deep detection of transmitted structure of data, research of intelligent systems for control and monitoring of energy scheme of critical infrastructure facilities or research of integrated radio frequency subsystems for minimization and elimination of sources of indeterminacy in the process of fabrication of integrated circuits.

The distribution of financial support of research and development between research centers and faculty departments
(mil. CZK)



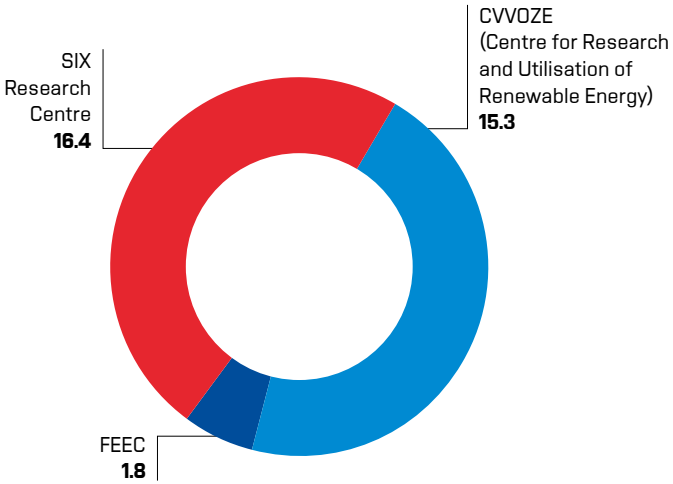
Main providers of R&D financial support in 2020

(mil. CZK, sum total 199.2)



Commercial contract research at the FEEC in 2020

(mil. CZK, sum total 33.5)



Commercial Contracts Research

Financial revenues from commercial contracts in 2020 were almost 34 mil. CZK, including regional research centres CVVOZE and SIX.

The research was based on both direct business contracts and students' diploma and dissertation theses.

Numbers of final works with a topic related to industry in 2020:

Bachelor theses:	74
Diploma theses:	96

Important projects

National Competence Centre – Cybernetics and Artificial Intelligence – NCK KUI (UAMT)

The National Competence Centre – Cybernetics and Artificial Intelligence project focuses on the creation of a new platform uniting excellent research and application oriented centres in robotics and cybernetics for the Industry 4.0, 'smart cities', intelligent traffic control systems and cybernetics, e.g simultaneous detection of pedestrians and bikers using machine learning, etc. Uniting the innovation leaders (i.e. research centres and industrial partners) leads to enhacing the potential and effectivity of applied research for key national branches such as advanced technologies for globally competitive market (Industry 4.0), the development of communication and information technologies or transportation system of the 21st century. The NCK KUI is closely connected to application sector and thus it will enable close interdisciplinary cooperation, new innovations and technology transfer. The NCK-KUI closely cooperates with other BUT centres such as CEITEC and Faculty of Civil Engineering.

Provider:	TA ČR
Principal investigator:	prof. Ing. Pavel Václavek, Ph.D.
Start date:	1. 1. 2019
End date:	31. 12. 2022
Total funding:	approx. 300 000 000 CZK

Photo: UTEE archive

Starlings shooing away system based on passive optical locator (UTEE)

The project aim is to protect vineyards against starlings'raids and to minimise the losses which birds cause every year. The system will be based on a passive optical locator. Cameras will gather visual data to be analysed subsequently by modern algorithms. The best algorithm for the correct starlings detection will be chosen. After a positive detection a signal to shoo away the starlings will be given.

The designed model will have three modules:

- passive optical locator with cameras,
- action module securing the frightening away,
- power module for the locator enabling it to be both plugged in or to use a battery powered by photovoltaic pannel.

In the vineyards acoustic shooers are used to protect the grapes from starlings (e.g. gas guns) which has a negative disturbing effect on neighbouring houses as well as on wild animals. Our suggested shooer will either use a laser beam or a narrow-directed loudspeaker which will be active only when the sparlings will approach the vineyard. Thus, it will not disturb the surrounding area around the vineyard. The guarantor of the project is the Winemakers' Union which protects the interests of wine growers and producers by a united organisation.

Provider:	TA ČR
Principal investigator:	MSc. Anna Širůčková
Start date:	1. 5. 2020
End date:	30. 4. 2022
Total funding:	3 226 049 CZK

Qualitative and numerical analysis of continuous and discrete dynamical systes (UMAT)

The project focuses on research in the following areas:

- description of response of systems described by differential equations to input information provided by control functions,
- finding optimal control of systems with numerical algorithms,
- description of behaviour of systems with memory dependent on constant, state or proportional delay.

Provider:	Brno University of Technology
Principal investigator:	doc. RNDr. Zdeněk Šmarda, CSc.
Start date:	1. 3. 2020
End date:	28. 2. 2023
Total funding:	692 000 CZK (2020)

Design and development of a smart electronic lock (UMEL)

In 2020 the development of a cylinder lock system securing an enlarged functionality of the TOKOZ ePRO system. At the Department of Microelectronics the whole electronic part was realized using current development trends in IoT including firmware essential for the system running. An inherent part of the project is the preparation of the whole production process for the subsequent serial manufacture.

Provider:	Contract research project
Principal investigator:	doc. Ing. Pavel Šteffan, Ph.D.
Start date:	1. 1. 2020
End date:	31. 12. 2020
Total funding:	1 590 000 CZK

Photo: UMEL archive

Complex physiological monitoring of a driver with respect to psychological factors influencing behaviour during driving (UBMI)

Driving is an activity demanding attention, but at the same time it requires minimum physical activity which results in fast mental exhaustion. During driving many stressful situations occur. This then influences driver's attention and reaction time, which can lead to fatal results.

Current fatigue and stress detection methods are very unreliable, as they very limitedly, if ever, make use of physiological signals the driver sends by biosignals which can be monitored. The project thus combines psychology, biomedicine and forensic engineering knowledge with the aim to analyse deeply the relationship between stress, fatigue and reaction time. It thus analyses selected biosignals, videorecordings, driving data and a driver's psychological state. The analysis uses modern procedures based on deep learning combined with advanced technologies used for monitoring a driver and his/her activities. The project cooperates with the Institute of Forensic Engineering and the Department of Psychology at the Faculty of Arts, the Palacký University in Olomouc.

Provider:	Technologická agentura ČR
Principal investigator:	doc. Ing. Radim Kolář, Ph.D.
Start date:	1. 2. 2018
End date:	31. 12. 2020
Total funding:	approx. 7 700 000 CZK

Photo: Jakub Rozboud

Development of a system for V-dip asymmetric failures localisation (UEEN)

The aim of the project is to develop a whole system for asymmetric failures localisation in high voltage network (V-dip system) using distributed measuring units (DMU) placed at secondary sides of the distribution HV/LV transformers. The system is designed to enable the failures localisation autonomously while respecting the current configuration and topology of the distribution network without a controller's intervention. Taking into consideration such condition it is connected with controlers'systems which secures fast and accurate failure location in HV network. In order to increase the benefits of the V-dip system the distributed measuring units are also equipped with analysers of class A electricity quality, measuring the signal up to 9 kHz. Apart from HV failures localisation, the V-dip system thus enables a complex voltage quality monitoring in the area with DMU. Piloting stage of the V-dip system was started in September 2020 in compensated network powered by Vimperk grid under the application guarantor EG.D. (formerly EON). In this piloting stage 17 DMUs are installed at one selected place. The information about a potential failure location is shown in the geobackground of the monitored network part with exact GPS coordinates and recorded to a controller's diary. User interface enables the view on current or historical data of typical quantities in individual measurement places.

Provider:	TA ČR
Principal investigator:	doc. Ing. David Topolánek, Ph.D.
Start date:	1. 7. 2018
End date:	30. 6. 2021
Total funding:	approx. 22 000 000 CZK

Photo: UEEN archive

Development of a system for testing maraging steel welds by acoustic emission method (UETE)

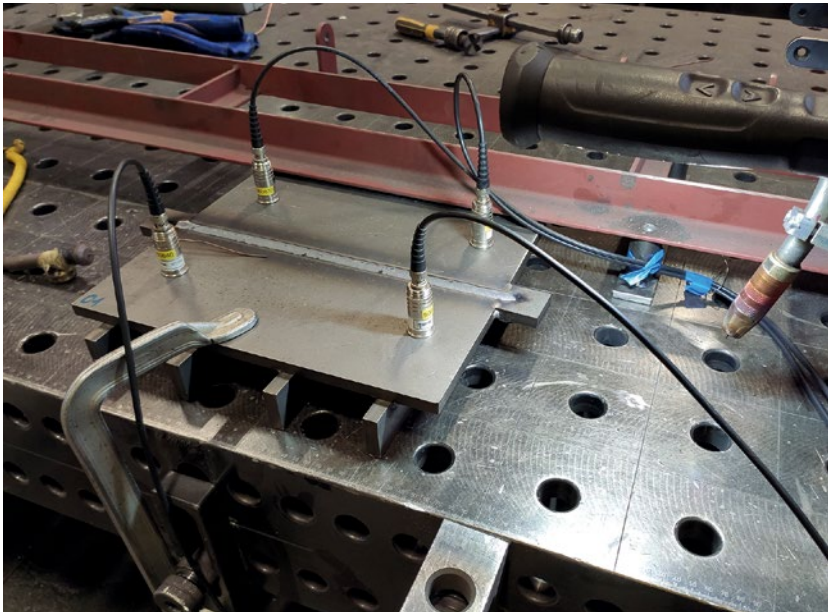
The project's primary goal is to create a control system of the process and quality of maraging steel welding which will save time and raise the welding quality by using the acoustic emission method.

The principal investigator is a fresh Ph.D. graduate at the UETE and the project thus fully complies with the ZETA operational programme intended to support cooperation between the academic sphere and the industry by employing master and doctoral students as well as young researchers under 35 years of age.

The VOP CZ company as the principal investigator is strongly oriented at material and maintenance of army technologies. The co-investigator UETE is skilled in material research knowledge, simulations and analytical techniques. The ZETA programme not only supported an interesting cooperation between young generation of researchers and industry, but it will also help to make new research findings quickly applicable to real life and vice versa. The project also aims at documentation preparation for the subsequent system certification. Furthermore, it will result in acoustic emission database of the faultless weld benchmark, defect weld benchmark and acoustic emissions characterising properties of heat sensitive areas.

Another goal of the project is to make simulations of material behavior during welding. The simulations will determine the conditions of material degradation, heat transfer and welding properties. These partial results will lead to the development of a device for detection of defects during the welding process.

Photo: UETE archive



The new machine-created weld and connected 4 sensors recording acoustic emission

Provider:	TA ČR
Principal investigator:	Ing. Jana Zimáková, Ph.D.
Start date:	1. 7. 2020
End date:	30. 6. 2022
Total funding:	4 613 819 CZK

Development of an integrated concept for the deployment of innovative technologies and services allowing independent living of frail elderly (niCE-life) (UTKO)

The niCE-life project aims to foster social inclusion and care coordination of frail elderly with focus on persons with cognitive medium/low deficits including Alzheimer's and Parkinson's diseases and other chronic diseases through development of transnationally applicable model of health and care services for frail elderly (based on e-Care Network developed in Bologna, IT) by using progressive key enabling technologies (i.e. sensor technologies, ICT and data analysis techniques) to prevent frailty, enhance quality of care and support their independent living, social contacts and assistance continuity after hospital discharges.

Provider:	European Union
Principal investigator:	doc. Ing. Radim Burget, Ph.D.
Start date:	1. 7. 2019
End date:	30. 6. 2022
Total funding:	2 117 581 €

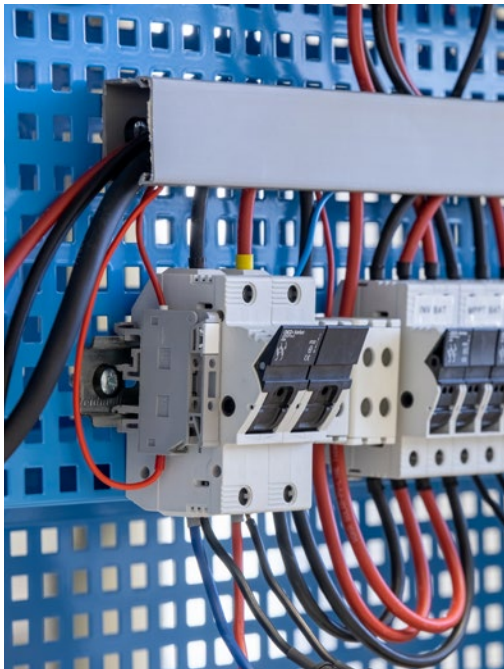


Photo: StockSnap from Pixabay

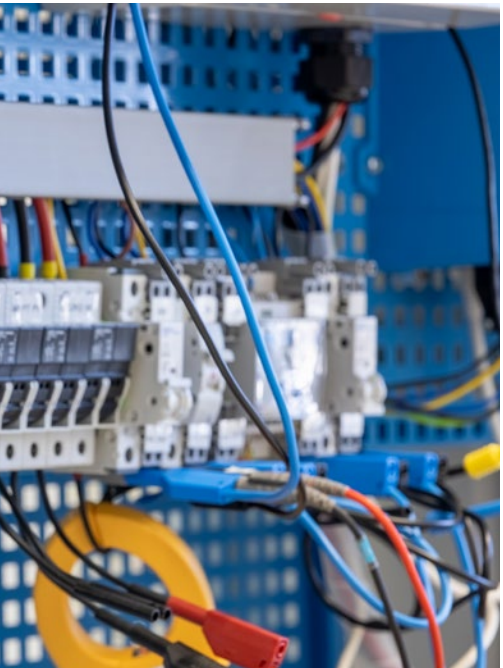


Photo: Jakub Rozboud

Advanced characterisation of materials used for sensors and electric power generators (UFYZ)

The project aims at advanced characterisation of modern materials designed for sensor applications or electric power generators, such as piezo energy harvestors and solar batteries. It focuses mainly on optimised preparation of selected materials (e.g. thin layers of multiferroelectric Bi-Fe-O aluminium nitride, or perovskite solar batteries) and their characterisation based on morphology, chemical contents and electric charge transportation.
The project also deals with recording the sample degradation by aging or by exposing to conditions causing aging.

Provider:	BUT
Principal investigator:	doc. Ing. Petr Sedlák, Ph.D.
Start date:	1. 3. 2020
End date:	28. 2. 2023
Total funding:	728 000 CZK

Photo: Jerzy Górecki from Pixabay

Harvestor prototype with a multifunctional carriage and hybrid drive (UVEE)

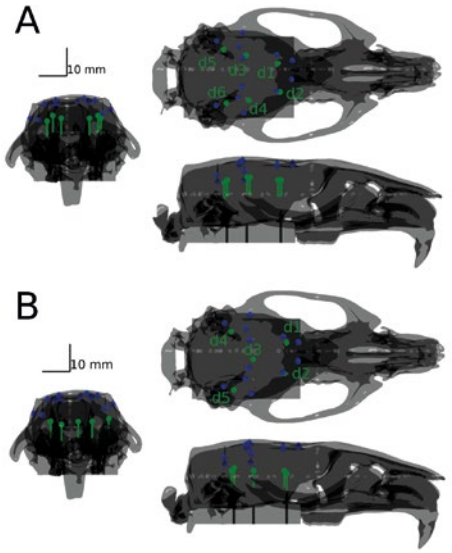
The aim of the project is industrial research and an experimental development of a harvestor with a multifunctional carriage and a hybrid drive for educational logging equipped by GPS/Glonas navigation system. It includes testing and harvestor trials on site. The harvestor is capable of working on slopes and water-soaked grounds. The principal researching activity aims at finding a new principle of harvestor hybrid drive enabling a sophisticated use of energy flow from the combustion engine to the multifunctional carriage alternating it with the energy accumulated in batteries for covering the energy needs. The aim is to decrease the fuel consumption, cut down the cost and improving ecological parameters. Internal processes were researched by an electron microscope and selected analytical methods.

Provider:	TA ČR
Principal investigator:	Ing. Petr Procházka, Ph.D.
Start date:	1. 1. 2018
End date:	30. 4. 2021
Total funding:	19 176 000 CZK

Electromagnetic models of animal brains (UREL)

The project cooperates with the National Institute of Mental Health in Klecany and the Nencki Institute of Experimental Biology in Warsaw.
The project focuses on the development of a brown rat brain model which serves to calibrate methods of inversion display calculating the position of source currents inside the brain from electric potentials on its surface. The source current position determines the related brain activity and its potential impact by psychoeffective drugs. Physical models are created in 3D print of an enlarged skull filled by agar gelatines as an equivalent of brain tissue.
For source current excitation small dipoles are used. The potentials on the brain surface are scanned by the same electrode as with living brown rats. Thank to the knowledge of the location of the exciting dipole we can determine whether the inversion display method works correctly or not.

Provider:	GA ČR
Principal investigator:	prof. Dr. Ing. Zbyněk Raida
Start date:	1. 1. 2018
End date:	30. 6. 2021
Total funding:	7 240 000 CZK



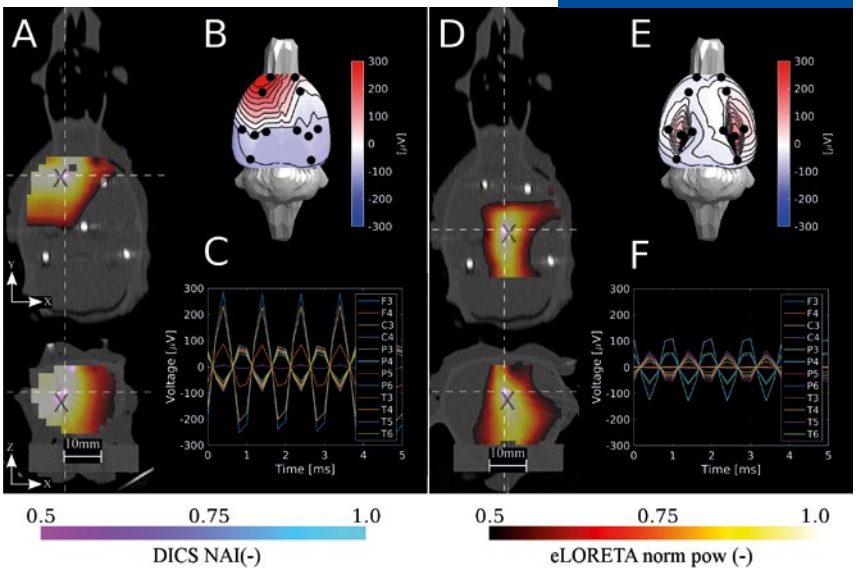
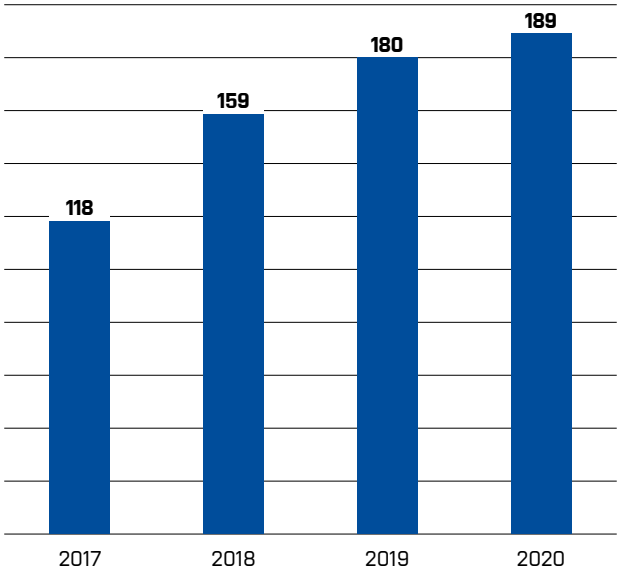


Photo: archiv UREL

PUBLICATIONS

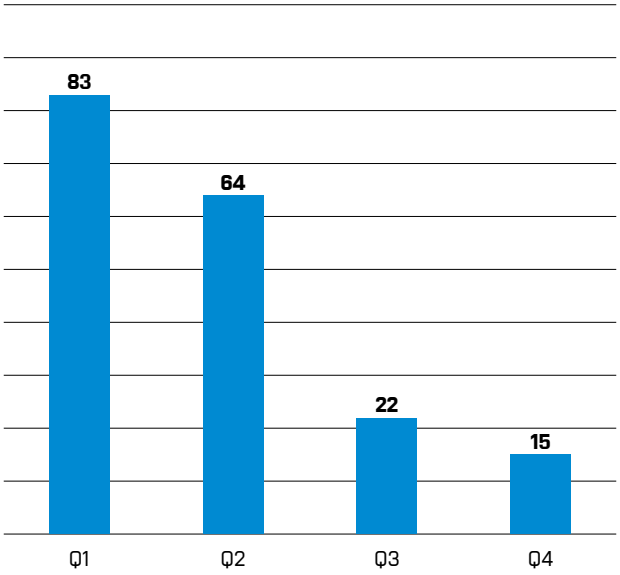
Number of WoS journal publications

(Without quartile specification)



FEEC publication profile in 2020

(Number of WoS journal papers)



Note: unsorted publications (5 pcs) not included

10
books or book chapters

239
papers in Web of Science Core Collection (WoS)

374
conference proceedings indexed by WoS or Scopus

86
prototypes, software or functioning samples

4 utility models or industrial designs

- Connection of a broadband communication unit with increased reliability
- Power transconductance amplifier with switch-mode end stage
- Simulator of distribution networks for personnel training and certification
- Rotor of a synchronous machine with permanent magnets

Photo: Jakub Rozboud

FEEC DEPARTMENTS AND RESEARCH CENTERS

Photo: Jakub Rozboud

Department of Control and Instrumentation (UAMT)

Department of Control and Instrumentation focuses on instruction, research and development in control, measurement, industry automatization, artificial intelligence, robotics and computer vision. In 2020, the instruction provided by the department had mainly the form of distance courses in the bachelor study programme Automation and Measurement and master and doctoral study programmes Cybernetics, Control and Management. In control measurement the department focused mainly on robust and predictive electric drive control and nonlinear estimators for sensorless drive control. Activities in control measurement focused on the issue of electrical and electronic measurement, virtual instrumentation in LabVIEW, sensors and measurement methods and evaluation of nonelectrical quantities. Industry automatization activities were aimed at Industry 4.0, in-built real time systems, industrial Ethernet with focus on function security and safeguarding. The research in computer vision continued with development of industrial, transportation and experimental visual systems. In AI and robotics the department continued its research in mobile robotics service, mobile robots control in difficult terrain, self-localisation inside and outside buildings and development of terrestrial and aerial robotic systems. The department actively participated in preparations and performance of ROBOT 2020 exhibition at the Technical Museum in Brno for which it provided a number of exhibits including two brand new robots Karel and Auanema.

Head:	doc. Ing. Václav Jirsík, CSc.
Number of research tems:	5
Number of employees (recalculated):	24.73
Average age of employees:	44.80 years
Ratio of women employees:	8 %

Photo: Jakub Rozboud

Department of Biomedical Engineering (UBMI)

The Department of Biomedical Engineering worked on preparations for launching a newly accredited master study programme Bioengineering and doctoral study programme Biomedical Technology and Bioinformatics.
Their pilot courses were launched in September 2020. In the course of preparations, a great number of machinery and equipement was acquired and brand new workplaces for practical instruction were constructed.
The department was preparing an important conference Computing in Cardiology which will be held in 2021 on faculty premises thanks to the organizational committee of the department staff members.

Head:	prof. Ing. Ivo Provazník, Ph.D.
Number of research tems:	4
Number of employees (recalculated):	28.91
Average age of employees:	38.00 years
Ratio of women employees:	39 %

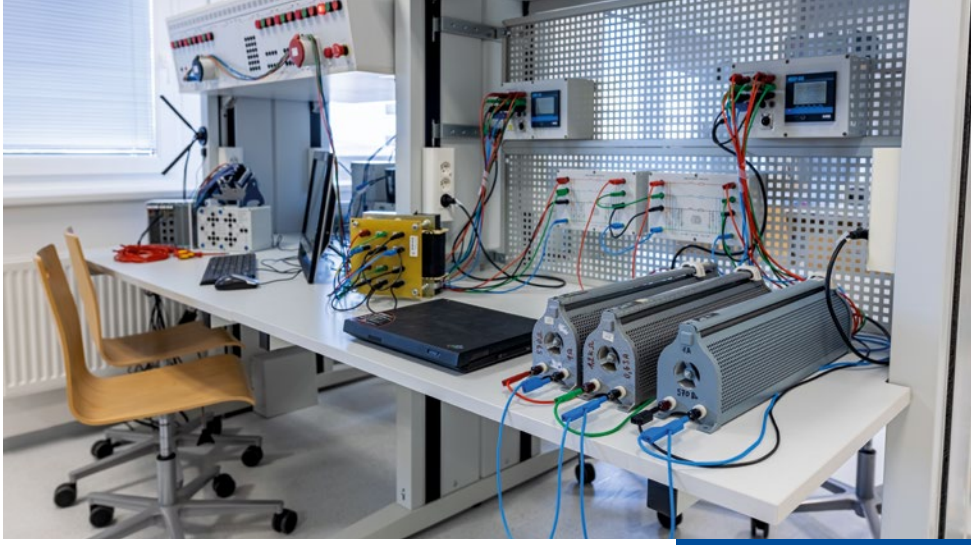


Photo: Jakub Rozboud

Department of Electrical Power Engineering (UEEN)

The Department of Electrical Power Engineering provides instruction in bachelor study programme Power Electrical and Electronic Engineering, in master study programme Electrical Power Engineering and doctoral study programme Power Systems and Power Electronics.

In 2020, instruction in the new inter-disciplinary master study programme Electrical Power Engineering and Communication Technologies started.

A donation of 2.3 mil. CZK has been obtained to support instruction in the above mentioned areas by covering scholarships and costs of innovation of laboratory equipment.

In research the department focuses on production, transmission, distribution and usage of electric power. The most important activities of 2020 include the issue of integration of diffused sources including current inverter properties and their parametrisation to support the grid, security of the power network during failures, accumulation hybrid systems design and optimisation, luminescence distribution analysis and the negative influence of lightning and controlled nuclear reactor accelerators. The department has also become a part of 70 partners' consortium created for solving H2020 One Network for Europe – OneNet project.

Head:	doc. Ing. Petr Toman, Ph.D.
Number of research tems:	5
Number of employees (recalculated):	34.46
Average age of employees:	37.74 years
Ratio of women employees:	18 %

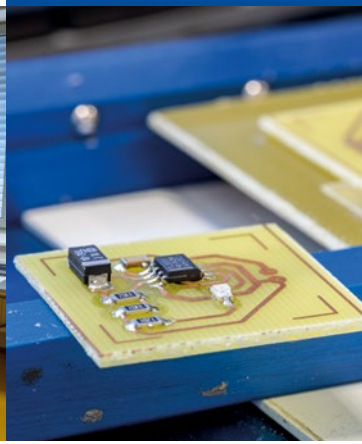
Department of Electrical and Electronic Technology (UETE)

Department of Electrical and Electronic Technology provides instruction in courses related to electrotechnical materials, their manufacturing processes, diagnostics, testing engineering, management and quality control. For example, technologies of printed circuits and surface assembly including their design are taught in both bachelor study programme Microelectronics and Technology as well as in master study programme Electrotechnical Manufacturing and Management. Apart from courses related to materials, the department provides instruction in courses on alternative sources of energy and ecology.

The research of the department focuses on electron microscopy, photovoltaics and electrochemical sources of power. In electrochemical sources the department continued its design and development of new materials in Li-Ion bateries, electrocatalysts and ionchange membranes for fuel elements. Regarding photovoltaic systems the department studied the issue of non-destructive diagnostics of defects and quality, reliability and service life of solar cells.
The department was developping a system of detection of signal electrons and methods of environmental rastering electron microscopy and microscopy of atomic powers for the use in electron microscopy.

Head:	doc. Ing. Petr Bača, Ph.D.
Number of research tems:	6
Number of employees (recalculated):	24.10
Average age of employees:	45.09 years
Ratio of women employees:	18 %

Photo: Jakub Rozboud



Department of Physics (UFYZ)

In its educational activities the department provides instruction of basic courses in physics in bachelor and follow-up master studies. The Department of Physics guarantees instruction in courses 'Nanotechnology', 'Modern Physics', 'Solid State Physics', 'Non-Destructive Diagnostics and Physics of Dielectrics' and 'Physical Optics'. In doctoral studies it provides instruction in courses 'Junctions and nanostructures', 'Spectroscopic methods for non-destructive diagnostics' (for FEEC) and 'Optics' (for FIT). In research, the department focused on basic and applied research of physical parameters of semiconductor and dielectrical materials and components and on nanosensorics.

The main areas included noise spectroscopy, local characterization with nanoresolution, measuring nonlinearities, dielectrical spectroscopy and designing indicators of quality and reliability of components.
The department obtained several results in research of properties of sensors of acoustic and electromagnetic emission.

Head:	prof. Ing. Lubomír Grmela, CSc.
Number of research tems:	3
Number of employees (recalculated):	20.60
Average age of employees:	44.56 years
Ratio of women employees:	22 %

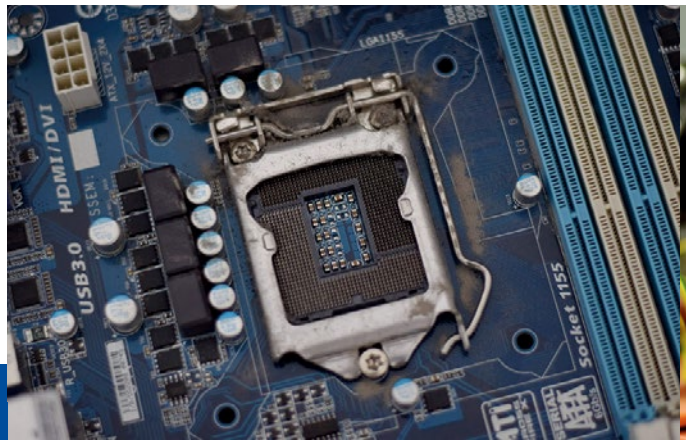


Photo: FEEC archive

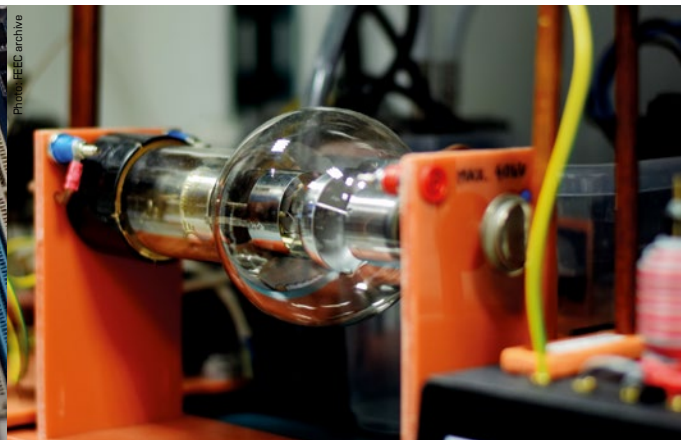


Photo: Oto Janoušek

Photo: Jakub Rozboud

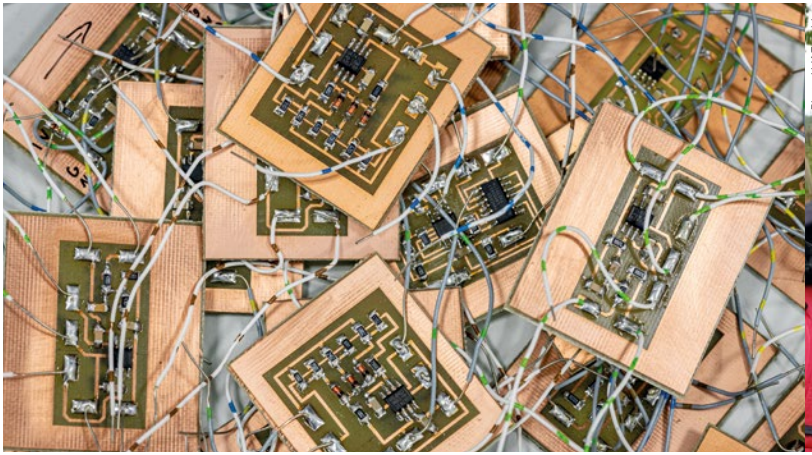


Photo: UJAZ archive

Department of Languages (UJAZ)

In 2020, Department of Languages provided and guaranteed linguistic and popular sciences courses at the bachelor, follow-up master and doctoral levels at three faculties of BUT: the Faculty of Electrical Engineering and Communications, the Faculty of Business and Management and the Faculty of Information Technology. In the study programme English in Electrical Engineering, guaranteed by the department, 28 students successfully passed their final state exams. The study programme provides its graduates with skills and competences useful for experts in numerous specializations of electrical engineering and information technology Apart from instruction in its own study programme, the department continued to offer courses for all other technical bachelor, master and doctoral study programmes of three faculties. Transition of a huge amount of instruction to the online world (due to COVID-19) was both an obstacle and a challenge. Unintentionally, instruction of many courses was substantially innovated by the transformation to LMS Moodle. The department continued to offer optional courses in law or economics (accounting, taxes, financial services), psychology, pedagogy or soft skills. Students can also acquire, after completing an accredited supplementary pedagogical study (new accreditation valid till 2023), a Certificate of Pedagogical Competence enabling its graduates to perform pedagogical activities at all secondary schools in the Czech Republic.

Head:	Ing. Martin Jílek
Number of research tems:	3
Number of employees (recalculated):	19.30
Average age of employees:	50.25 years
Ratio of women employees:	70 %

Photo: Karolina Grabowska from Pixabay

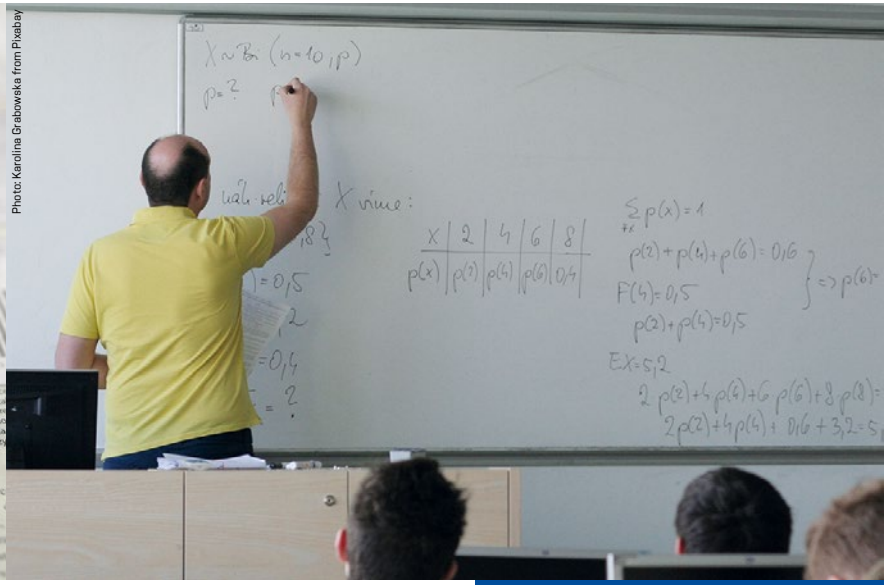


Photo: UMAT archive

Department of Mathematics (UMAT)

In 2020, Department of Mathematics provided instruction in mathematical courses in bachelor and master study programmes. Moreover, it provided instruction in two doctoral courses and instruction in mathematical courses in bachelor study programmes at the Faculty of Information Technology, Institute of Forensic Engineering and Centre of Sports Activities.

In its research activities the department continued its long term bilateral cooperation with mathematical institutes at universities of Beer-Sheva (Israel), Nova Gorica (Slovenia) and Serbian Academy of Science in Belgrade. Research at the department focused at the study of qualitative properties of delayed dynamical systems, applicability of algebraic and topological structures in description operator systems, numerical methods of solution based on semi-analytic approach as well as on statistical processing of data sets.

Head:	doc. RNDr. Zdeněk Šmarda, CSc.
Number of research tems:	3
Počet zaměstnanců přepočtený):	12.34
Average age of employees:	53.67 years
Ratio of women employees:	27 %

Department of Microelectronics (UMEL)

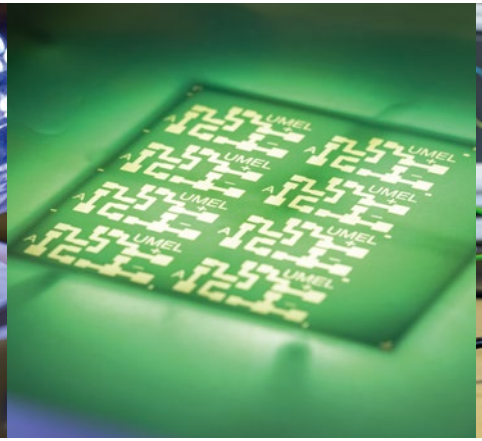
In 2020 the department celebrated 40 years of its existence.
Despite difficult situation caused by the COVID-19 pandemic, the department was successful in preparing students for practice (using online courses) as well as solving numerous projects and commercial contracts.

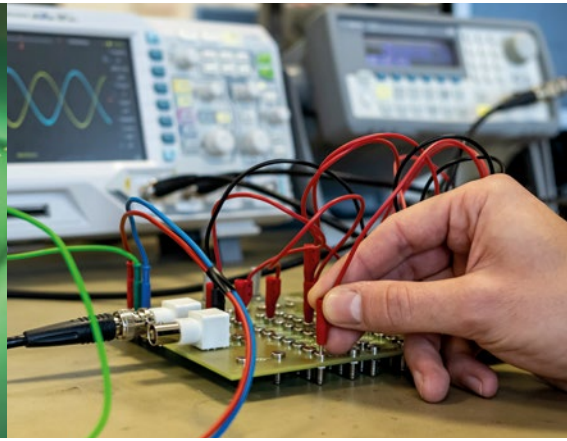
Department of Microelectronics provides instruction in bachelor and follow-up master courses in electronic components and electronic circuits and specialized courses in the area of designing integrated circuits and microelectronic technologies.

In research, 2020 saw the department focusing especially on applied research in integrated circuits, specialized electronic systems, sensors and microelectronic technologies.
Main areas of research included methods of designing circuits in voltage, current and mixed modes, systems for space applications or complex Smart systems, MEMS and NEMS structures, methods for evaluating signals from sensors, advanced technology for components, surfaces and sensors, reliability of connecting systems of 3D and lead-free solders, methods of connecting and encasement of semiconductor chips or non-conventional application of thick layers (scanning converters, attenuators, antenna shielding, etc.).

Head:	doc. Ing. Jiří Háze, Ph.D.
Number of research tems:	4
Number of employees (recalculated):	22.92
Average age of employees:	47.70 years
Ratio of women employees:	13 %

Photo: Jakub Rozboud



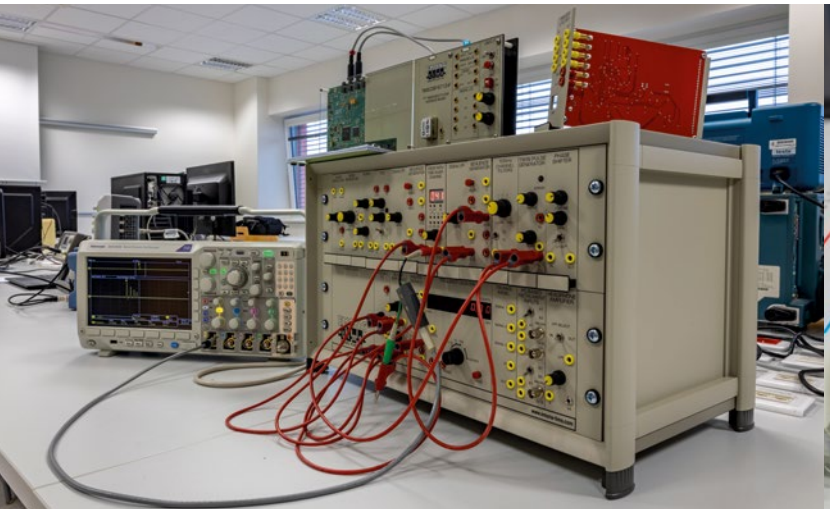


Department of Radioelectronics (UREL)

Department of Radioelectronics specializes in instruction, research and development in modern electronic circuits, new methods of signal processing, new solutions for microwave circuits and antennas and wireless communication.

The department studied mobile, satellite and optical communications. It also focused on analogue and digital systems, microprocessors, low frequency and audio electronics, digital television and radio as well as electromagnetic compatibility. In 2020, the research activity of the department was financed using the support of 4 grants of the Grant Agency of the Czech Republic and 7 projects of the Technological Agency of the Czech Republic. At the department, 3 more projects of the Ministry of Industry and Trade of the Czech Republic, 1 project of the Ministry of Interior of the Czech Republic and 3 internal BUT grants of specific research. Members of the department participated also in 2 H2020 European projects, 2 bilateral AT-CZ Interreg projects and 1 EU COST project. The cooperation of UREL covers numerous professional organizations.

Head:	prof. Ing. Tomáš Kratochvíl, Ph.D.
Number of research tems:	5
Number of employees (recalculated):	44.59
Average age of employees:	42.40 years
Ratio of women employees:	13 %



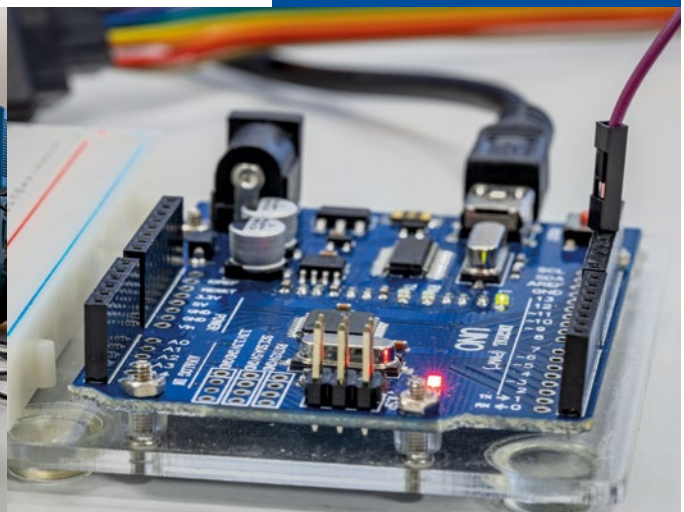


Photo: Jakub Rozboud

Photo: Jakub Rozboud

Department of Telecommunications (UTKO)

Department of Telecommunications specializes in instruction and research especially in information and communication technologies, cybernetic safety, processing of visual and speech signals, big data processing and hardware development. In instruction it guarantees 3 bachelor, 4 master and 4 doctoral study programmes. In research it is an important partner of national and global enterprises including AT & T, AVAST, CESNET, NÚKIB, Konica-Minolta, Paolo Alto, Vodafone, etc. In 2020, the department launched a new CyberGrid Laboratory (cyber-physical environment for Industry 4.0) in which e.g. a show room of smart household, developped for A1 Telecom Austria Group, was presented. Moreover, works on a new research laboratory for 5G networks, which will be a part of a new Cyberarena, were started in cooperation with Vodafone.

Head:	prof. Ing. Jiří Mišurec, CSc.
Number of research tems:	8
Number of employees (recalculated):	79.40
Average age of employees:	37.62 years
Ratio of women employees:	12 %

Department of Theoretical and Experimental Electrical Engineering (UTEE)

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

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

In 2020, the department prepared a project for a system for sequencing and detection of coronavirus from the air (in cooperation with Institute of Animal Physiology and Genetics of the Czech Academy of Sciences and Military Health Institute of the Ministry of Defense). It is also developing new devices for assessment of influence of surface conditions to cave environment (in cooperation with Faculty of Sciences, Masaryk University). In cooperation with ENBRA, a.s. it is developing a device for fluid heating, in cooperation with University Hospital Brno it analyzes power load of deformed spines, is cooperating in a research of atmospheric plasma blast tube, or is modeling nanomaterials on organic basis with Czech Technical University in Prague.

Photo: Jakub Rozboud

Head:	prof. Ing. Pavel Fiala, Ph.D.
Number of research tems:	6
Number of employees (recalculated):	20.35
Average age of employees:	43.07 years
Ratio of women employees:	23 %

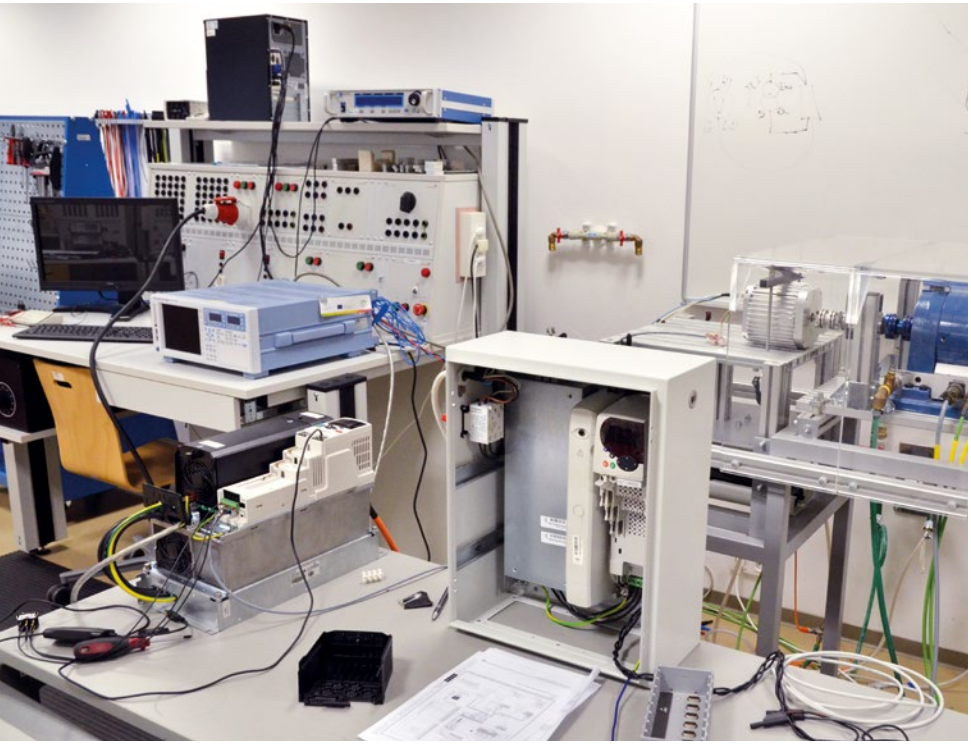


Photo: UVEE archive

Department of Power Electrical and Electronic Engineering (UVEE)

In 2020 the UVEE participated at the development of working machines hybrid drive and low voltage drive units with modules combining power and control circuits in a single silicon substrate. In power electronics the department carried on in development of a multilevel DC/AC switch 3x6 kV with output power 300 kW for high revolution engines. In internal research two trial samples of resonance DC/DC switches with a transformer (about 2 kW) of unusual topology were designed and realized.

The department carried on research in electric machines focusing on high revolution engines development, including the ones containing magnetic bearings. In 2020 they started the development of electromechanics actuators operating primary control desks in CS-23 aircraft and means of Urban Air Mobility. The development of synchronous engines for direct plugging in went on further and in 2020 they focused on raising power efficiency in households and buildings with one phase only.

Head:	doc. Ing. Ondřej Vítek, Ph.D.
Number of research tems:	4
Number of employees (recalculated):	32.25
Average age of employees:	39.60 years
Ratio of women employees:	8 %

Photo: Jakub Rozboud

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

The CVVOZE centre focuses its activities on research, development and innovation capacities in renewable energy resources. Centre research teams deal with problems related to chemical and photovoltaic energy sources, electric mechanics, electrotechnologies, electric drives and industrial electronics in 5 basic research fields:

- optimalization of electromechanics energy transformation,
- chemical and photovoltaic energy sources,
- production, transmission, distribution and usage of electric energy,
- automatization and sensoric technologies,
- research in switching-off mechanism in switching-on devices.

In 2020 the centre solved 43 projects of applied research, in cooperation with industrial sector (TA ČR and MPO projects). We can name some important projects such as TK01030094 – Intelligent energetic networks or TK02030119 – Technologies of high revolution systems in thermonuclear fusions. A great centre's success is winning more than 15 mil. CZK from nonpublic sources in contractual research for industrial companies. Laboratory of high currents is traditionally the most successful in this area, as it usually wins contracts in low voltage switching-on devices research and development.

Head:	prof. RNDr. Vladimír Aubrecht, CSc.

Centre of Sensor, Information and Communication Systems (SIX)

SIX Centre started in 2010 as a common initative of FEEC BUT departments engaging in research and development of sensoric systems and information and communication technologies.

The aim of the initiative was to interconnect departments' common research interests to create vast complex research projects. Participating departments offered their laboratories to SIX for common cooperation. In recent years we can already see an increasing share of applied research in research activities of the SIX, which gives a clear signal that the centre dutifully fulfils its role in leading regional research centre linking the academic activities with industry. In 2020 the researchers had to overcome the difficulties caused by home office and limited possibilites of personal contact in order to keep the current projects running and be ready for designing new projects.

Thanks to centre staff's high commitment the running projects and contracts were not hit by the circumstances, even though in many situations it meant changing homes in development workplace.

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

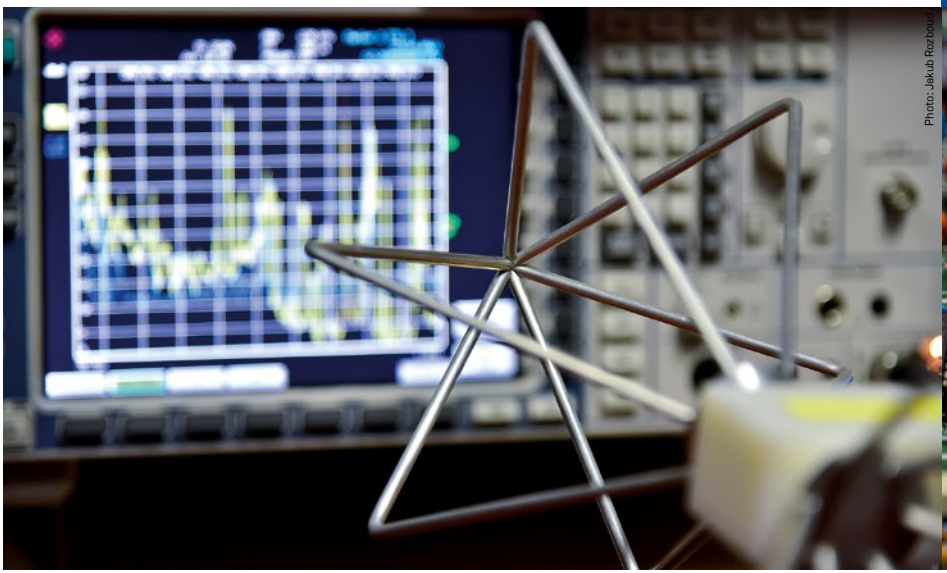


Photo: Igor Šefr

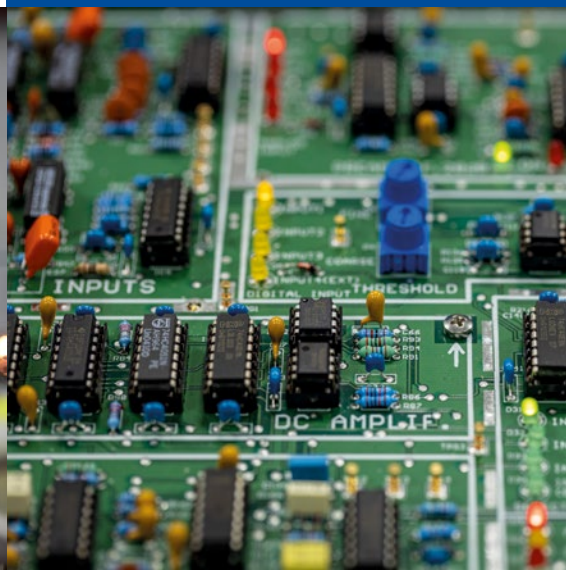


Photo: Jakub Rozbour

SOME HISTORY

Photo: FEEC archive

Faculty of Electrical Engineering and Communication is, and has always been, an integral part of Brno University of Technology, that is why its history is firmly joined together. It is a history full of renaming, dividing, joining and moving all around Brno. Nevertheless, all this made FEEC what it is now and it is worth refreshing it.

Brno University of Technology was founded on 24 January 1849 when the Moravian Diet approved foundation of a technical school. The school was bilingual with languages of instruction both Czech and German. Its students could study technical, agricultural and commercial areas. Due to the course of history, however, Czech language gradually disappeared, that is why in 1899 Czech Technical University was founded. After the First World War it was united with German Technical University and thus originated the Technical University in Brno.
On 24 July 1956 Brno University of Technology was founded with three faculties: Faculty of Construction

Engineering (FCE), Faculty of Architecture and Building Construction (FABC) and Faculty of Energy (FE). The Government Act no. 58 of 12 August 1959 divided the Faculty of Energy into Faculty of Mechanical Engineering and Faculty of Electrical Engineering. This is the beginning of an independent electrical engineering faculty in Brno. In 2002 an independent Faculty of Information Technology (FIT) was established and the original Faculty of Electrical Engineering and Information Technology was transformed into the current Faculty of Electrical Engineering and Communication (FEEC) on 1 January 2002.

Photo: Jakub Rozboud

LIFE AT FEEC

FEEC BUT campus ‘Pod Palackého vrchem’

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

Normally full of life, the faculty is now an abandoned place due to the pandemic. Corridors usually full of mingling students are now empty and silent, and the lonely atmosphere is rarely interrupted by an employee passing by. This is the current picture of the faculty.

5,368 m²
area of lecture halls

12,085 m²
area of laboratories

25,850 m²
other areas: corridors and elevator hatchways

Photo: Igor Šefr

PerFEECt year 2020

Duirng the academic year conferences, competitions and events for public are traditionally held and organised by the university or with cooperation with partners. Unfortunately, events, as well as the instruction, were impacted by the COVID-19 pandemic. Some events which did not require present participation were held online, others had to be cancelled, for example the Hudba z FEKTu students bands festival.

JANUARY

24.

53th representation and 19th joint FEEC and FIT faculties 2020 ball

Photo: Jakub Rozboud

The ball was traditionally held in the Hotel Voroněž premises and hosted by Marek Kolář. It was accompanied by Kapela Kolorez and Cimbálová muzika Jaroslava Čecha musical bands, including a pole dance performance.

28.

7th round of the Merkur perFEKT Challenge Superfinals

Photo: Oto Janoušek

A popular competition for secondary school students organised superfinals at the faculty premises. Having succeded in the autumn round, the teams were to construct a vehicle from the Merkur construction set which would be able to carry a piece of LEGO kit by a robotic hand within a time limit. The team Autonomní MerKůrovci from the Vocational school of informatics, electrotechnics and crafts in Rožnov pod Radhoštěm became an absolute winner.

29.

‘Open Doors’ day for prospective FEEC students

Photo: Jakub Rozboud

The January term of Open Doors Day is the most frequented out of all three terms in the academic year, with 350 prospective students interested mainly in the bachelor study programmes. In the opening introduction students and their parents will learn all the important information about the entrance exams and the variety of study programmes. Then they are offered to see high-tech laboratories of the selected study programmes.

FEBRUARY

24.

Faculty round of the EBEC 2020 technical competition

Faculty round of the largest international technical competition called EBEC (European BEST Engineering Competition) for university students was held at the FEEC. The competition is intended for four-member teams in Team Designs and their task is to create a functioning prototype or a Case study suggesting a theoretical solution.

APRIL

23.

26th Student EEICT 2020 Conference and Competition

Photo: Jakub Rozboud

Due to the coronavirus the 26th EEICT student conference was held in distance form, but unfortunately, the 11th round of job opportunities fair, the PerFEKT JobFair , had to be cancelled for the same reason. Despite the unfavourable situation the atmosphere of the contest was still preserved and it presented 164 papers of the FEEC students and secondary school students who could win both financial and material prizes. This was also the first year when selected papers (52 altogether) were indexed in the Web of Science database.

MAY

15th Anniversary of the SPS foundation

Photo: Jakub Rozboud

In May the SPS celebrated 15 years of its existence. Nevertheless, great celebration ceremonies of the event had to be postponed.

JUNE

23.

60 years from founding the Department of UAMT

Photo: UAMT archive

In 2020 60 years passed from the foundation of the Department of Measuring Technique and Automatisation (UAMT today). Two celebrating events were planned. One of them was an off-site stay of the department staff and doctoral students from 10 to 11 September in the conference hotel Luna in the Czech-Moravian Highlands. Another event was an Open Doors Day for the department graduates and public, but unfortunately due to the quarantine it was cancelled. The department is working on an almanach which will cover the whole history of the department including all staff and graduates.

JULY

7.–9.

43rd International Conference on Telecommunications and Signal Processing (TSP)

43rd year of International Conference on telecommunications, network technologies and signal processing was held online. The conference is organised by the Department of UTEE with cooperation of IEEE Region 8.

13.

FEEC suburban camp

Photo: Eva Řezáčová

A suburban camp for kids between 8–11 years of age in the Brno Technical Museum was organised by the Lužánky Leisure Activities Centre and it offered a visit to the UAMT Department.
The camp theme was robotics with respect to the autumn's 100th anniversary of Karel Čapek's R.U.R. play. The 21 kids attending the camp were introduced to the mobile robotics and the 4.0 Industry concept. They were also shown some robots developped at the FEEC BUT. Moreover, as a part of the camp, they could also participate at three contests.

AUGUST

4.–6.

41st NZEE Conference (Non-conventional sources of electric energy)

Photo: UETE archive

41st year of the NZEE Conference was a bit untypical, as well as any other activities, due to the coronavirus pandemic. Thanks to the participants who refused to cancel their active participation the conference term was moved from traditional May to August. The conference focuses mainly on renewable resources such as photovoltaics, wind and hydro energy, as well as the less frequent, such as geothermal energy or energy from the biomass, etc.

13.

FEEC suburban camp

Photo: Eva Rezáčová

The second camp session was intended for kids from 11–15 years of age. The program was very similar to the first session, but accustomed to fit the age of the children.

SEPTEMBER

1.

40 years of the Department of Microelectronics

Photo: FEEC archive

1st September 2020 is the 40th anniversary of the founding of the Department of Microelectronics. The planned celebration had to be rescheduled and postponed for some unspecified time due to the coronavirus. Nevertheless, a comprehensive almanach was issued, covering the history and contemporary situation of the department.

4.–6.

BUT training meeting

Photo: Jakub Rozboud

The first year students entering the FEEC on the 21st September had the chance to meet new colleagues thanks to the BUT training meeting. The official four-day event organised by students themselves together with students groups such as BEST Brno, 'Students for Students' Club, IASTE or ESN BUT was held for the 10th time.

4.–11.

Summer school of nuclear engineering 2020

Photo: UJEN archive

The 13th year of the Summer School of Nuclear Engineering was organised as usual by the Department of Energetics of the Faculty of Mechanical Engineering at the Czech Technical University in Prague together with the Department of Power Electrical Enginering, under the supervision of the CENEN (Czech Nuclear Education Network) union. The event was focused on an intensive all-day training and unusual topics from nuclear energy area were discussed. 19 students from 7 different faculties at 5 Czech universities participated there. 6 tutors, both the organisers and well-known figures from the Czech nuclear energy area, taught them and shared their knowledge.

18.–20.

PerFEECt start

Photo: Jakub Rozboud

This is a traditional introductory event for the first year students of the bachelor study programmes organised by the 'Student for Students' Club (SPS). Despite the sanitary precautions such as students being divided into smaller groups and wearing masks, the new students had the opportunity to get introduced to the faculty premises and their new colleagues. They got a lot of valuable advice from their older peers about the registration of courses as well as the study at the FEEC in general.

OCTOBER

5.–7.

12th International Congress on Ultra Modern Telecommunications & Control Systems

12th international conference on telecommunication, control technique, automation and robotics was organised by the Deparment of Telecommunication in cooperation with IEEE Region 8, this year online.

15.

Microcontrollers are in!

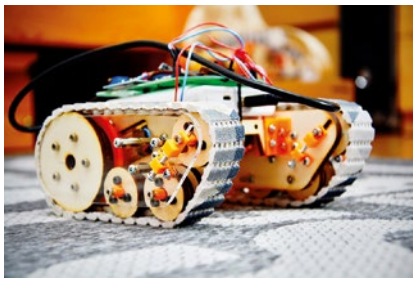


Photo: UTEE archive

Every year, the UTEE holds a popular amateur creative competition for secondary school students as well as university students who like to play with microcontrollers. Individuals as well as teams can participate. The aim of the competition is to design and create a functional device including a microcontroller. The competition was finally held online.

19.–21.

21st International Scientific Conference on Electric Power Engineering (EPE) 2020

The Department of Power Energy Engineering staff together with their colleagues from the Czech Technical University in Prague organised a traditional 21st International Scientific Conference on Electric Power Engineering (EPE) 2020.

Photo: Jakub Rozboud

The conference was held online with more than 100 European scientists. The key topics discussed were electric power production from traditional and renewable resources and transmission and distribution of electric power including its diagnostics. Many papers focused on smart grids, smart cities and electric mobility.

22.

AT&T Techcon 2020

Technological conference was organised by the JA Czech company together with AT&, BUT, Microsoft and DigiDetox to inspire secondary school students with IT. The Department of Telecommunication represented the FEEC by papers on 5G network and the Internet of Things.

23.

IMAPS flash Conference 2020

The Department of Microlelectronics together with IMAPS CZ & SK, a magazine DPS from A to Z and other partners organised the 6th IMAPS flash Conference. Its primary focus was microelectronic mounting, especially on the PCB desks and SMT technologies. The conference offered not only interesting research papers, but also it presented practical and valuable examples of trends in DPS simulations, digital 3D inspection, conductive glueing in microelectronics, supercondensers, laser soldering, etc. by industrial partners and other universities.

NOVEMBER

24.

The first online Open Doors Day for prospective students

Unfortunately, the situation at the faculty did not allow the usual Open Doors Day, but the faculty did not want to let down the prospective students and wanted still to enable them to see the laboratories and to ask questions about study and individual study programmes.

Photo: FEEC archive

Finally, an online meeting was organised, starting with a short online broadcast introducing the faculty management, study programmes and students' life at the faculty. Later, discussion groups on MS Teams followed, accompanied by pre-recorded videos from laboratories and school premises. The recording of the live event on Facebook was followed by 3 500 spectators.

27.

The Night of Scientists online

Photo: Oto Janoušek

The faculty together with the whole BUTparticipated at the all-European science festival: The Night of Scientists 2020 with the topic A Man and a Robot. The audience could enjoy the atmosphere by commented videorecordings from the most interesting laboratories which presented the novelties at the FEEC.

DECEMBER

8.

ROBOT 2020 exhibition started

Photo: UAMT archive

Technical Museum in Brno presented an interactive exhibition ROBOT 2020. During the past two years Luděk Žalud's team from the Department of Control and Instrumentation also participated at the preparation of the exhibition by preparing one of the main exhibits: robots of a humanoid type who are having the so-called hundreds' year dialog with each other. The exhibition should be available until 31 May 2021.

11.

Second online Open Doors day for prospective students

Photo: FEEC archive

The second term for the Open Doors day online was identical with the first online term format. Prospective students also had the opportunity to see the introductory presentations and videos of individual bachelor study programmes and to participate at the discussions with the representatives of the study programmes.

15.

ISOLDE Collaboration workshop at UEEN FEEC BUT

UEEN organized a workshop which was intended to discuss options for the Czech researchers to participate more in ISOLDE experiments and, potentionally, to enable the Czech Republic to enter the ISOLDE collaboration.
The event was held in a hybrid form. Some researchers participated in person, respecting all sanitary measures against the spread of COVID-19, and and some researchers participated via a videoconference. Among the participants of the whole day event we can name e.g. Dr. Gerda Neyens, the leader of ISOLDE physical programme, and Dr. Karl Johnson, the leader of ISOLDE scientific programme who joined the event right from CERN.
The ISOLDE (The Isotope mass Separator On-Line facility) is a unique experimental source of accelerated radioactive nuclide bundles and it is funded by the European Centre for Atomic Research CERN in Geneve.

Photo: ISOLDE

INTERNATIONAL RELATIONS AND FEEC

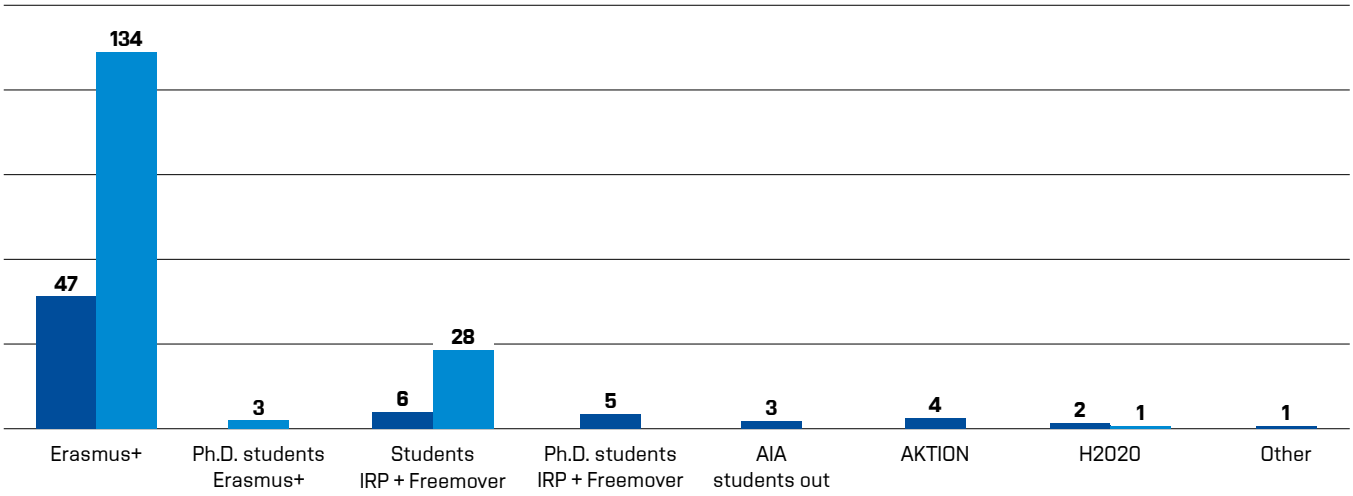
The faculty is trying every year to strengthen its position in internationalization. Unfortunately, with respect to the COVID-19 pandemic, all international travels and stays were cancelled, both for students and for academics, which resulted in a dramatic drop in all mobility activities. Some activities were able to be moved to the online environment. Unfortunately, personal contact is irreplaceable.

For the same reason the new international summer school for foreign students, Brno International Summer School on Electronics and Communication Technologies – BISSECT, had to be cancelled. It was postponed to 2021, if the situation allows it. On the other hand, our faculty is very successful at contracting new study programmes for double/joint degree. In 2020 another double-degree programme Microelectronics was accredited. It will be the first programme at the BUT to be realized with the cooperation with the Northern Illinois University from the USA. Currently, our faculty offers 5 double/joint degree study programmes.

Photo: FEEC archive

Number of FEEC students on research stays in 2020

Incoming and outgoing students by programmes

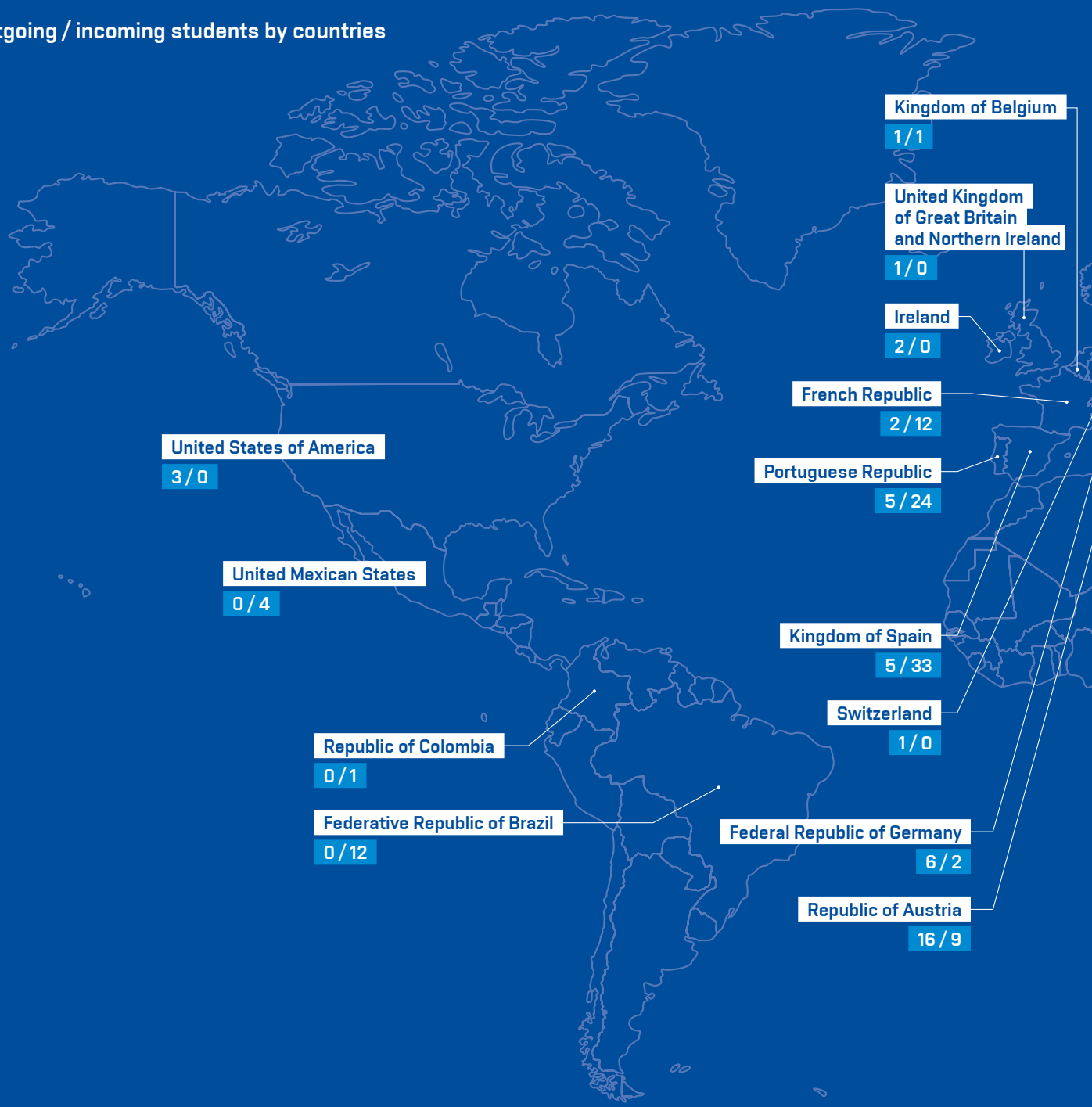


Number of outgoing students:	68
Number of incoming students:	166
Number of outgoing academic staff and researchers:	12
Number of incoming academic staff and researchers:	5

Number of outgoing students

Number of incoming students

Outgoing / incoming students by countries




Kingdom of Norway
1 / 0
Republic of Finland
4 / 0
Kingdom of Sweden
2 / 0
Republic of Estonia
3 / 1
Republic of Lithuania
4 / 13
Kingdom of Denmark
0 / 2
Republic of Poland
3 / 3
Russian Federation
0 / 3
Republic of Slovakia
0 / 2
Republic of Kazakhstan
0 / 1
Republic of Korea
2 / 3
Romania
0 / 2
People's Republic of China
2 / 0
Republic of Turkey
0 / 13
Republic of Bulgaria
0 / 2
Taiwan
0 / 4
Republic of Kenya
0 / 1
Hellenic Republic
0 / 13
Republic of Slovenia
3 / 1
Italian republic
2 / 4

INDUSTRIAL PARTNERS

The faculty is an important partner for many international as well as Czech companies in joint research and pedagogical projects.

How to cooperate with us

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

If you are interested in cooperation with us, see our webpage or contact Vice-Dean for International and Public relations.

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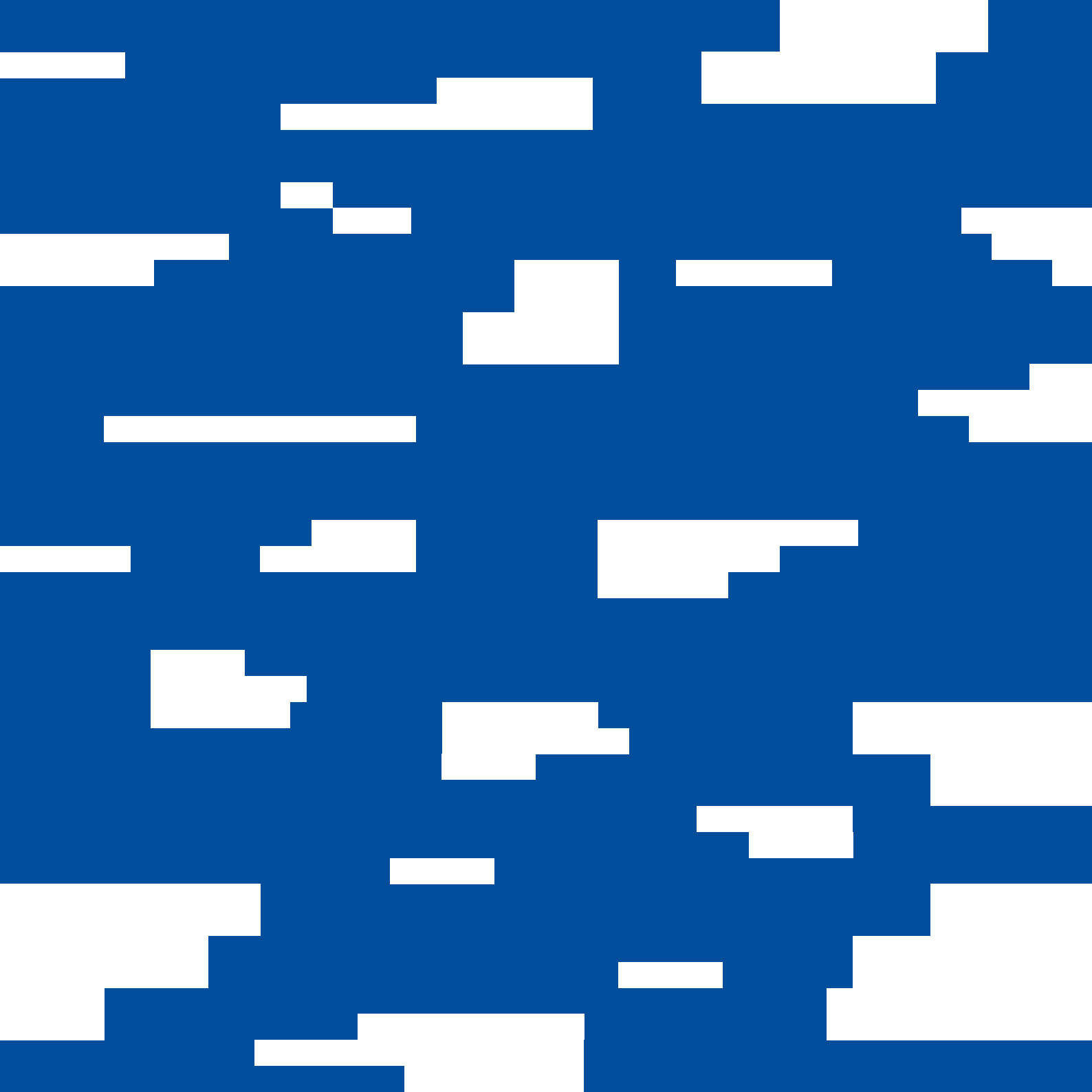

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