UNIVERSITY OF ŽILINA

FACULTY OF ELECTRICAL ENGINEERING AND INFORMATION TECHNOLOGY

ANNUAL REPORT 2023

UNIVERSITY OF ŽILINA

Foreword

The Faculty of Electrical Engineering and Information Technology is an essential part of the University of Žilina – a modern university providing a full range of technological, economic, management, and a limited range of humanistic and natural science education at under-graduate, graduate and post-graduate levels.

During its more than 60-year existence the University has become a reputable institution with the firm position in the system of the Slovak higher education institutions. It was originally established in 1953 as the College of Railways in Prague. In 1959 the College changed its name to the University of Transport and in 1962 it was moved to Žilina. Afterwards, as a result of the increasing role of communications, the title was amended to the University of Transport and Communications. A series of transformation steps that brought essential changes into the academic life of the University and its Faculties and Institutes started in 1989. They proved effectiveness on the way towards a modern institution, featuring a character of a full-value university, named the University of Žilina since November 1996.

Nowadays, the University of Žilina consists of 7 Faculties (important dates of their establishing and/or transformation are indicated in parentheses):

- Faculty of Electrical Engineering and Information Technology (1953; 1992; 2019),
- Faculty of Mechanical Engineering (1953; 1992),
- Faculty of Operation and Economics of Transport and Communications (1953),
- Faculty of Civil Engineering (1990),
- Faculty of Management Science and Informatics (1990, 1996),
- Faculty of Security Engineering (1952, 1998, 2014),
- Faculty of Humanities (1998, 2010).

In addition to the Faculties, the University also involves the following 10 Institutes:

- Institute of High Mountain Biology,
- CETRA – Centre for Transportation Research,
- Institute of Forensic Research and Education,
- Institute of Competitiveness and Innovations,
- University Science Park,
- Research Centre,
- Institute of Physical Education,
- Institute of Lifelong Education,
- Aviation Training and Education Centre,
- Institute of Information and Communication Technologies.

PROFILE AND STRUCTURE OF THE FACULTY OF ELECTRICAL ENGINEERING AND INFORMATION TECHNOLOGY

As mentioned above, history of the Faculty of Electrical Engineering and Information Technology of the University of Žilina goes back to the year 1953 when the College of Railways in Prague was founded. Another milestone in its history is the year 1959, when the College of Railways was renamed to the University of Transport and a joint faculty was created by the Faculty of Mechanical Engineering and the Faculty of Electrical Engineering.

In 1962, the College of Railways moved to Žilina. Along with the College, important representatives came to Žilina, who had rich experience from practice, scientific research activities and especially university pedagogical practice. In 1992, after the split, the Faculty returned to its previous original name. The Faculty of Electrical Engineering was renamed in January 2019 to the Faculty of Electrical Engineering and Information Technology. It became the first technically oriented faculty and generally the second Faculty in the Slovak Republic awarded the Quality Certificate for quality control system according to ISO 9001 (in 2003). Since that time further three successful re-certifications were realized (2007, 2010, 2013 and 2016). Due to the introduction of an internal quality system, the implementation of which results from complex accreditation, the Faculty decided in 2019 not to continue with the quality management system according to ISO 9001, and the recertification of the quality management system according to this standard was not carried out.

Structure of the Faculty

From a structure point of view, the Faculty of Electrical Engineering and Information Technology (FEEIT) consisted of seven departments (six departments located directly in Žilina and one institute established at the satellite work place in Liptovský Mikuláš), the Service centre and the Dean's office.

Scientific and research activities, properly projected to educational activities, are dynamically developing as a response to floating markets seen within both national and pan-European context. From the solution of classical topics of electrotechnical engineering in transport focused on electric traction, railway safety technology, or technical operation of telecommunications, the main emphasis is currently placed on information and communication technologies applied in the field of safe process management in transport and industry, modern telecommunications technologies, development of power electronic systems and modern management of electrical networks. Interdisciplinary fields are also developing, namely mechatronics, biomedical engineering and multimedia technologies. Through targeted education, the students of the Faculty acquire competencies that will enable them to succeed in the labor market not only on a national but also on an international level. Many graduates of FEEIT work in lucrative positions in many spheres of society with traditional and new employers.

The FEEIT's Departments are listed below:

- Department of Physics (DPh)
- Department of Electromagnetic and Biomedical Engineering (DEBE)
- Department of Mechatronics and Electronics (DME)
- Department of Power Systems and Electric Drives (DPSED)
- Department of Control and Information Systems (DCIS)
- Department of Multimedia and Information-Communication Technology (DMICT)
- Institute of Aurel Stodola situated in Liptovský Mikuláš (IAS)

The following table 1 shows the distribution of the pedagogical and the research positions at particular FEEIT's departments as of 31. 12. 2023.

Tab. 1: Number of pedagogical and research employees at the departments of FEEIT as of 31. 12. 2023

Department	Pedagogical staff		Research staff	
	Full-time	Part-time	Full-time	Part-time
DPh	16	2	2	1
DEBE	11	-	2	1
DME	15	2	4	15
DPSED	10	2	4	4
DCIS	12	1	-	-
DMICT	23	4	2	-
IAS	4	-	-	-
Total	**91**	**11**	**14**	**21**

Number of employees at FEEIT according to the categories can be seen in the table 2.

Tab. 2: Number of employees at FEEIT according to the categories in 2017 - 2023

Year	2017		2018		2019		2020		2021		2022		2023	
Full-time / Part-time	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT
Prof.	18	-	15	-	16	-	15	-	16	-	16	-	17	-
Assoc. Prof. in the position of Prof.	-	-	-	-	-	-	1	-	1	-	-	-	-	-
Guest Prof.	-	4	-	1	-	1	-	3	-	4	-	4	-	3
Assoc. Prof.	28	3	32	1	29	1	29	1	32	2	30	3	29	2
Senior Lecturer in the position of Assoc. Prof.	-	-	-	-	-	-	-	-	-	-			3	-
Senior Lecturer	57	6	53	9	53	8	48	10	42	9	39	9	41	7
Lector	2	3	2	2	1	2	-	2	-	3	-	3	-	3
Tech. Admin. Staff	27	2	22	2	25	2	23	2	23	1	20	2	20	2
Research Staff	16	6	18	8	13	14	13	15	12	17	13	19	14	21
Total	**147**	**24**	**142**	**23**	**137**	**28**	**129**	**33**	**126**	**36**	**121**	**40**	**124**	**38**

The most important events

The most important events at the faculty in 2023 can be summarized as follows:

Based on the submitted application for an assessment of the compliance of the internal system of assuring the quality of education and the documents sent to SAAVŠ (Slovak Accreditation Agency for Higher Education), an on-site assessment was carried out by the SAAVŠ working group in November 2023 (Assessment of compliance of the internal system and its implementation at the university) for harmonized study programs FEEIT with SAAVŠ quality standards – 6 study programs in the bachelor's degree, 6 study programs in the master's degree and 5 study programs in the doctoral's degree in three fields of study – electrical engineering, cybernetics and informatics. A meeting was also held with the persons responsible for the habilitation and inauguration proceedings in the fields of telecommunications (field of study informatics), automation (field of study cybernetics) and electrotechnologies and materials and power electrical engineering (field of study electrical engineering).

From the point of the implementation of foreign projects, the implementation of the project within the call DIGITAL-2022-CLOUD-AI-02 called TEF-HEALTH - Testing and Experimentation Facility for Health, has started. TEF-Health will provide standards for certification and quality control to facilitate the access of trusted AI to the market and ensure its simple and effective evaluation. In 2023, the scientific project APRIORI (Advanced technologies for Physical ResIlience of Critical Infrastructures) started to be solved, financed from the resources of the NATO organization. The project aims to provide innovative technologies for the entire management cycle of critical infrastructures. The consortium consists of 5 members, the coordinator of the project is the Università degli Studi del Sannio from Italy. The implementation of the project focused on the European space program continued, within the ESA (European Space Agency) scheme, in cooperation with industrial partners SPINEA Technologies (SK) and THALES Alenia Space (FR), which deals with the development of advanced electronic systems for powering building blocks of space robotic arms. The Erasmus+ project A lexicon of educational films on the subject of STEM for primary and secondary school students - Films4edu: no. 2020-1-PL01-KA226-SCH-096354, was successfully completed in cooperation with 5 other foreign institutions.

A research project aimed at optimizing the process of production and use of hydrogen was solved in cooperation with the UNIZA Research Center. The main aim was to achieve maximum efficiency values of the production process. The goal of this project, financially supported by the PONTIS Foundation of SEPS, a.s., was to obtain relevant information on the current state of research in the field of electrolytic hydrogen production.

At FEEIT, a strategy was set with building two top teams in the field of electrical engineering and IT. The areas of research in electrical engineering are: efficient conversion, supply and transfer of energy, use of unconventional sources, promising technologies, materials, thermal management, sustainability, space applications, energy storage and lighting technology. In the field of information technology, it will be about smart systems, localization in 5G and B5G networks, the field of optical and radio communication networks, the field of machine learning and computer vision. The implementation of projects for scientists (No. 1/2021/FEIT/VP) and young scientists (No. 1/2021/FEIT/MVP) created as part of calls for submitting projects from R&D support funds according to MU 9/2020 continued.

The faculty has been successful in solving UNIZA grant projects: UNIZA grant competition - call no. 1/2022 in the categories: projects of young scientific and teaching staff under 35 years of age: FEEIT 1st place (Ing. Štefan Hardoň, PhD., DPh), 2nd place (doc. Ing. Štefan Borik, PhD., DEBE), 3rd place (Ing. Maroš Šmondrk, PhD., DEBE), doctoral projects: shared 1st place (Ing. Boris Cucor, DMICT) and 2nd place (Ing. Patrik Prôčka, DEBE).

On the occasion of the Teachers' Day, the Rector of UNIZA awarded the best teachers of the university for their pedagogical activities. The rector presented J. A. Comenius plaques to two FEEIT teachers - prof. Ing. Karol Rástočný, PhD. and doc. Ing. Marek Roch, PhD.

The Rector's award was won by the diploma thesis of Bc. Samuel Kršek (2nd degree of the study program multimedia engineering) entitled "Textile keyboard" as one of seven best diploma thesis at the university. Miriam Zemaníková (1st degree of the study program biomedical engineering) and Bc. Daniel Mrena (2nd degree of the study program biomedical engineering).

Cooperation with industrial entities in the field of contract research and marketing activities continues to develop successfully. The marketing strategy is implemented through a number of supporting events, such as competition for secondary school students the Technical Idea of the Year, active participation in the event MyMachine, organizing Open Days at FEEIT, UNIZA Masters 2023, Children's University 2023, Physics and Mathematics Course for first-year students of FEEIT and FMI UNIZA, and more. In 2023, for the first time, we participated in the Girl's Day event, which is intended for secondary school students with the aim of motivating them to study IT. On the occasion of the 70th anniversary of the founding of UNIZA, an Exhibition documenting the history of the development and production of electronic components in Slovakia was organized at FEEIT UNIZA.

On November 30, 2023, the event DROP OF BLOOD took place at FEEIT, in which actively participated 29 donors - employes and students of FEEIT, as well as other UNIZA units.

On March 17, 2023, the ŠVOS for the doctoral degree students was held at FEEIT.

On the occasion of the 70th anniversary of the establishment of UNIZA, a seminar entitled Cooperation lasting 33 years was organized in cooperation with the partner university Università degli Studi di Catania (UNICT). During the seminar, the key moments of the aforementioned cooperation were presented, and the dean of FEEIT also awarded commemorative medals to long-term collaborators from UNICT.

On September 21, 2023, on the occasion of the 70th anniversary of UNIZA, a commemorative meeting was held with graduates of our faculty. Graduates received commemorative diplomas on the occasion of the 50th anniversary of their graduation (1973).

EDUCATIONAL ACTIVITIES

- The courses in social sciences, psychology, economics and law are offered to the students in all study programs at Bachelor and Master degree study.
- In all study programs at Bachelor and Master study students are also offered courses focused on project teaching form through which students better acquire theoretical and practical aspects of their education.
- Based on the processes of harmonizing study programs with SAAVŠ quality standards and the introduction of the internal quality system at UNIZA, changes were made in the study plans and provision of courses in most study programs with regard to student-oriented quality of education. The basis for the actual changes were mainly the results of surveys and interviews of students, graduates and representatives from practice.
- From the academic year 2022/23, it is mandatory to complete an individual internship in the chosen organization according to the focus of the study program, or specializations of the study program, in the scope of min. 60 hours.
- FEEIT supports the development of interdisciplinary, multidisciplinary, distance and lifelong learning; and education of foreign languages mainly for young employees and doctoral students.
- New structures were created at FEEIT for the purpose of ensuring the quality of education at the faculty, consisting of teachers, students, graduates and representatives from practice (Council of study programs, Council of faculty guarantors).
- FEEIT increases the attention given to the adaptation of new 1st degree students to the university environment (information sessions, detailed monitoring of study results, support of mutual communication between students – teachers, support for solving common student activities, the introduction of courses to support their adaptation to study, e.g. subject Introduction to studies, etc.).
- In 2023, a successful generational exchange contunued in the position of guarantors and staffing in several study programs at all three levels of higher education.
- Considerable attention is paid to students of the 3rd degree study. FEEIT supports them mainly in preparing high quality publication outputs, fulfilment of curricula, preparation and defending the dissertation thesis in the standard length of study, not only through targeted meetings with students, but also through the introduction of the compulsory course "Fundamentals of scientific work" in the 1st year of study.
- The FEEIT is using complex software system for supporting e-learning, which enables access to electronic materials supporting the traditional form of teaching, testing and examination of students, and organizational provision of study. FEEIT claims from pedagogical staff and students to actively use the e-learning system and at the same time creates conditions for the development of e-learning, not only within FEEIT but also within the University. Due to the established preventive measures to reduce the spread of the coronavirus and the Covid-19 disease, face-to-face teaching at FEEIT during the academic year 2021/22 summer semester switched to a distance learning form, which made it possible to fully use the complex software system to support e-learning and to improve in the creation of teaching materials for this form of teaching.
- FEEIT has a developed student mobility system. Student mobilities to foreign universities, as well as mobilities to the industrial environment, are long-term supported by FEEIT and fully integrated into the students' educational process. Thus, students can complete part of their studies at important foreign educational institutions or in important industrial enterprises or corporations. For 3rd degree students, completing a mobility or internship is a mandatory part of their studies.
- FEEIT has an established study credit system in all degrees of study provided at FEEIT. The system enables uniform assessment of study results in the frame of EU and markedly makes the realization of mobility and acceptation of achieved results simpler.

- At FEEIT there is a contact person (vice-dean for education) for students with specific needs, who is responsible for creating optimal conditions for studying.

Tab. 3: Overview of accredited study programs (1st degree - Bachelor study programs, 2nd degree - Master study programs, 3rd degree - Doctoral study programs)

Field of study	Study program	Form of study	Duration of study	Title awarded	Guaranteed by
1st study degree					
Cybernetics	Control Engineering	FT	3 years	Bc.	Aleš Janota
Electrical Engineering	Biomedical Engineering	FT	3 years	Bc.	Ladislav Janoušek
Electrical Engineering	Electrical Engineering Specializations: - autotronics, - electric power systems, - electric traction and drives, - power electronics	FT	3,4 years	Bc.	Michal Frivaldský
Electrical Engineering	Electrooptics	FT	3 years	Bc.	Dušan Pudiš
Informatics	Multimedia Technologies	FT	3 years	Bc.	Roman Jarina
Informatics	Communication and Information Technologies	FT	3 years	Bc.	Peter Počta
2nd study degree					
Cybernetics	Process Control	FT	2 years	Ing.	Aleš Janota
Electrical Engineering	Biomedical Engineering	FT	2 years	Ing.	Ladislav Janoušek
Electrical Engineering	Photonics	FT	2 years	Ing.	Dušan Pudiš
Electrical Engineering	Power Electronic Systems Specializations: - autotronics, - electric power systems, - electric traction and drives, - power electronics	FT	2 years	Ing.	Michal Frivaldský
Informatics	Multimedia Engineering	FT	2 years	Ing.	Róbert Hudec
Informatics	Telecommunication and Radio-com. Engineering	FT	2 years	Ing.	Peter Brída
3rd study degree					
Cybernetics	Process Control	FT, PT	3, 4 years	PhD.	Aleš Janota
Electrical Engineering	Electrotechnologies and Materials	FT, PT	3, 4 years	PhD.	Dušan Pudiš
Electrical Engineering	Power Electrical Engineering	FT, PT	3, 4 years	PhD.	Pavol Špánik
Electrical Engineering	Power Electrical Engineering	FT, PT	3, 4 years	PhD.	Pavol Špánik

Informatics	Telecommunications	FT, PT	3, 4 years	PhD.	Peter Brída
Electrical Engineering	Theory of Electrical Engineering	FT, PT	3, 4 years	PhD.	Ladislav Janoušek

Tab. 4: Number of the faculty students (as of 31. 10. 2023)

Field of study/Study program	Number of students			
	Full-time study		Part-time study	
	Nationals	Foreigners	Nationals	Foreigners
1st study degree				
Control Engineering	86	7		
Biomedical Engineering	57	6		
Electrooptics	8	0		
Electrical Engineering	180	2	24	0
Multimedia Technologies	135	39		
Communication and Information Techn.	81	5		
Total	**547**	**59**	**24**	**0**
2nd study degree				
Biomedical Engineering	40	0		
Photonics	4	0		
Multimedia Engineering	96	5		
Process Control	59	0		
Telecomm. and Radio-comm. Eng.	26	1		
Power Electronic Systems	85	6		
Total	**310**	**12**		
3rd study degree				
Electrotechnologies and Materials	1	0	0	2
Process Control	5	0	2	0
Power Electrical Engineering	11	2	3	0
Telecommunications	10	0	0	0
Theory of Electrical Engineering	4	1	2	0
Total	**31**	**3**	**7**	**2**

Tab. 5 and 6: Overview of the faculty students' number since 2018 (as of 31. 10. 2023)

Full-time study				
2019	**2020**	**2021**	**2022**	**2023**
1st study degree				
639	741	785	688	606
2nd study degree				
295	288	263	272	322
3rd study degree				
53	54	52	37	34
Part-time study				
2019	**2020**	**2021**	**2022**	**2023**
1st study degree				
18	8	0	30	24

2nd study degree				
			0	0
3rd study degree				
4	3	9	7	9

Admission for study

a) Form of the admission procedure in 2023 and a brief assessment:

The basic condition for admission to bachelor study (1st level study programme) was the acquisition of a full secondary education or completed secondary vocational education. The admission procedure takes place in two forms: without an entrance examination and with an entrance examination. Applicants (except for applicants for the study program of *Multimedia Technology*) were admitted to the study without an entrance examination, if they meet the basic conditions for the bachelor's study, and at the same time, during their secondary school studies, they were successful solvers of subject Olympiads in mathematics, physics and computer science, or placed in 3rd place, including at least at the district level, in international and national competitions related to the content of the study program, SOČ or FEEIT UNIZA's Technical Idea of the Year. All study applicants who did not meet the condition for admission to study without an entrance exam, passed the entrance exam. The entrance exam was conducted in the form of a test of knowledge from the secondary school curriculum. When creating the list of admitted applicants who passed the entrance exam, the order of applicants determined by the respective number of points that the applicants obtained from the test of knowledge of the secondary school curriculum was accepted, as well as the decision of the dean of the faculty on the final number of admitted applicants.
Applicants for study in the *multimedia technology* study program completed an entrance exam consisting of three parts: presentation of the applicant's motivation to study the study program, evaluation of the applicant's academic results and general overview of the applicant, presentation of the applicant's multimedia activities and secondary school knowledge, including clarification of the procedures and techniques that were used.
The selection process for the 2nd study degree is based on results from previous Bachelor study of an applicant. Those applicants who completed the Bachelor degree with honours, or reached the required weighted average are accepted without the selection procedure. The other applicants took the entrance exam, which consisted of a test from state exams for bachelor's studies at FEEIT UNIZA according to individual study programs.
The selection procedure for the 3rd study degree takes the form of a personal interview with each applicant individually in front of an admission committee. One part of the interview is focused on mapping the overview of the applicant in the professional field related to the chosen topic of the doctoral study. The next part aims to verify the knowledge of foreign languages and the assumptions for individual scientific work. The order of applicants is drawn up by the committee in the form of the secret voting.

b) Faculty activities that promote learning:

FEEIT devoted considerable effort to promote the study programs to students of secondary schools. Representatives of the Faculty participated in the Open Days at selected secondary schools. FEEIT organized for secondary schools its own Open Day, also organized special exercises for students of selected secondary schools. FEEIT representatives took part in various promotional events organized at university level (Researcher's Night, Christmas at the University, ...). At the same time, the online promotion of study opportunities intensified on social networks (Facebook, Instagram, Youtube, ...).

Number of applicants for study and number of enrolled students can be seen in the following Tables.

Tab. 7: Statistical review of the admission procedure in 2023

Field of study/Study program	Number of applicants for study					
	Full-time study			Part-time study		
	S	P	E	S	P	E
1st study degree						
Control Engineering	73	53	35			
Biomedical Engineering	50	37	20			
Electrooptics	7	6	5			
Electrical Engineering	134	102	68			
Multimedia Technologies	136	91	78			
Communication and Information Techn.	125	81	35			
Total	**525**	**370**	**241**			
2nd study degree						
Biomedical Engineering	30	26	24			
Photonics	3	3	3			
Multimedia Engineering	70	67	57			
Process Control	30	28	27			
Telecomm. and Radio-comm. Engeneering	26	20	17			
Power Electronic Systems	53	45	42			
Total	**212**	**189**	**170**			
3rd study degree						
Electrotechnologies and Materials	1	1	1	0	0	0
Process Control	2	2	2	2	2	2
Power Electrical Engineering	8	8	7	0	0	0
Telecommunications	5	5	5	0	0	0
Theory of Electrical Engineering	0	0	0	2	2	2
Total	**16**	**16**	**15**	**4**	**4**	**4**

S - Subscribers, P - Participation in the admission procedure, E - Enrolled

Tab. 8: Number of graduates of the Faculty in the academic year 2022/2023

Field of study/Study program	Number of graduates in 2022/2023			
	Full-time study		Part-time study	
	Nationals	Foreigners	Nationals	Foreigners
1st study degree				
Control Engineering	27	0		
Biomedical Engineering	26	0		
Electrical Engineering	53	0		
Electrooptics	2	0		
Multimedia Technologies	47	5		
Communication and Information techn.	21	2		
Total	**176**	**7**		
2nd study degree				
Biomedical Engineering	19	0		
Photonics	1	0		

Multimedia Engineering	21	0		
Process Control	10	0		
Telecomm. and Radio-comm. Eng.	7	1		
Power Electronic Systems	33	1		
Total	**91**	**2**		
3rd study degree				
Electrotechnologies and Materials	1	0		
Process Control	2	0		
Power Electrical Engineering	8	0		
Telecommunications	4	0		
Theory of Electrical Engineering	2	0		
Total	**17**	**0**		

Tab. 9: Overview of graduates of the Faculty since 2016/2017 (as of 31. 12. 2023)

Full-time study					
2017/2018	**2018/2019**	**2019/2020**	**2020/2021**	**2021/2022**	**2022/2023**
1st study degree					
165	140	134	102	156	183
2nd study degree					
163	153	124	112	131	93
3rd study degree					
17	13	14	10	17	17
Part-time study					
2017/2018	**2018/2019**	**2019/2020**	**2020/2021**	**2021/2022**	**2022/2023**
1st study degree					
4	0	9	1	0	0
2nd study degree					
0	0	0	0	0	0
3rd study degree					
2	1	1	0	0	0

Graduates' employment

BACHELOR STUDY PROGRAMMES

Control Engineering
(Field of study Cybernetics)
The graduate will acquire education in the field of control engineering and process control with the support of information and communication technologies. He/she has also practical experience in application of safety critical control and communication systems performed mainly based on PLC and industrial networks. He/she will successfully apply in the operation of control and information systems at the process and operative level. Theoretical knowledge acquired during the bachelor study will create good prerequisites for further education, either within the further forms of university study or within lifelong education.
Software skills: C language, C++, MATLAB, PLC, ATMEL, MS ACCESS, HTML, CSS, Tia Portal.

Biomedical Engineering

(Field of study Electrical Engineering)

The graduate will acquire knowledge in the subjects of theoretical and technical basis, as well as in theoretical basis of medical disciplines with emphasis on the structure and functioning of biological objects, biochemical, physiological and pathophysiological processes. He/she will gain knowledge of medical technique and its applications, modern tools of biomedicine, principles of their activities, conditions for operation and their safe for diagnostic and treatment purposes. He/she is able to evaluate functionality of technical and computer aided equipment under given conditions of a health care facility or other operations and laboratories and at the same time able to lead qualified communication with the health care staff. He/she will successfully apply as an expert in medical and biological laboratories, in the operation of biomedical technique, in business and service organisations.

Software skills: Jazyk C, MATLAB, EAGLE, TI-TINA.

Electro-Optics

(Field of study 2675 Electrical Engineering)

During the bachelor‘s degree studies, the graduate of the field of study Electro-optics acquired the basics of natural and technical sciences with regard to the field of optics, opto-electronics and electronics. The technical skills and knowledge are also complemented by knowledge of programming. The combination of technical knowledge and skills creates a basis for employment not only in the field of semiconductor and semiconductor technology production and control processing, but thanks to the knowledge in the field of optics and opto-electronics, the graduate of Electro-optics is able to navigate and apply in the processes of preparation and production of LEDs, LD, Lidar technologies or other processes of preparation of optoelectronic systems. Theoretical as well as practical knowledge of graduates in the field of applied optics also provides them with the opportunity to find employment in the field of preparation and production of optical fibres and photonic elements for the transmission, detection and processing of optical signals for industrial, automotive, biomedical or military systems.

Software skills: MATLAB, C-Arduino, LabVIEW

Electrical Engineering

(Field of study Electrical Engineering)

The graduate will acquire knowledge from the subjects of theoretical base applied in the fields of power electronics, utilisation of applied microprocessor technique and programming, electric drives, electrical traction, electric power systems and mechatronics. He/she will gain knowledge in the field of quality management and reliability in a production company, marketing and trade, electrical standards, rights and legal regulations related to the field of study. Graduates may further specialise in the field of automobile electrical engineering, electrical traction, electric drives, electric power systems, power electronic systems and mechatronics systems. Graduates obtain theoretical knowledge and practical experience in order to acquire the principles, installations, operations, functions, service and repairs of electrical products, devices and equipment in compliance with international standards. He/she will successfully apply in all fields of power electrical engineering, in the field of mechatronics, robotics, applied microprocessor technique, electronics, optoelectronics, power electronics, computer design and construction in organisations of administrative, production, operation or repair character.

Software skills: MS Office, MATLAB, SIMULINK, FEMM, MOTORSOLVE, SICHR, DIALUX, DSPACE, CODE WARIOR, LABWIEV, EMPT-ATP, MODES, GE-PSLF, RUPLAN, RS Logix, RS Link, RS View, Assembler, AVR Studio, EAGLE, OrCAD-PSPICE, PLECS.

Communication and Information Technologies

(Field of study Informatics)

Graduates of the bachelor's degree study programme - Communication and Information Technologies in the field of study - Informatics will acquire the ability to specialize and adapt to the latest and future needs and requirements of practice in manufacturing companies of network operators and in service companies in the

field of electronic communications. They will be prepared for a continuous deepening of knowledge from the field. They can work as qualified workers for the operation and design of technology of communication networks and services and will be able to solve the tasks of practice in team. They can work at the positions of executives, operators of electronic communications, network specialists in enterprises and institutions and developers of communication services and in companies developing technologies of Industry 4.0. Graduates can work as designers, system designers or specialists for various areas of ICT.

Multimedia Technologies
(Field of study Informatics)
The graduate will acquire knowledge in acquisition, processing and presentation of digital signal at an adequate technical, aesthetical, ethical and art levels. The synergy of technical and art education will make the graduate a specialist in creating multimedia presentations. The graduate will gain knowledge and practical experience in working with the screen and the sound element of multimedia that predetermines him/her for working in organisations focused on information technologies, advertising and counselling activities, in public administration institutions, in studios producing multimedia products.
Software skills: C language, C++, MATLAB, Java, JSP, Blender, Cinema 4D, Adobe Premiere, Adobe Audition, Adobe Photoshop, Adobe Illustrator, Adobe InDesign, Protools, HW, SQL, PSpice, Microsim, Corel Draw, QuarkxPress, LaTex.

MASTER STUDY PROGRAMMES

Biomedical Engineering
(Field of study Electrical Engineering)
The graduate has an overview of modern technical tools of biomedicine, diagnostic, medical and rehabilitation devices, their safe use and the most recent world trend in their development. The graduate acquired knowledge in theoretical and selected clinical medical disciplines in order to understand the purpose of application of technical tools, ability to assess functionality and ability to create conditions for qualified communication with medical doctors. He/she has a wide knowledge of existing information systems and technologies. The graduate can successfully apply in all fields of technical and information provision of health care facilities, in institutes and laboratories of biomedical research and development, in the field of information systems and in technical management, especially of medical facilities. He/she will also work as a senior executive in the management of medical facilities, in companies that work with biomedical technology.
Software skills: C language, HTML, PHP, MATLAB, Simulink, CST-studio suite.

Photonics
(Field of study Electrical Engineering)
The graduate of the study programme Photonics is very well prepared analytically and technologically to deal with the design, preparation and production of semiconductors, crystals, opto-electronics, applied photonics, sensors, or to deal with the proposal of optical design or optical modelling. Knowledge in the field of nanotechnology and nanophotonics enables the graduates of the study programme Photonics to find employment in the field of modern technologies focused on research and innovation throughout the EU. Technological progress thanks to photonic technologies and innovation provides the graduates of the study programme Photonics with the opportunity to further specialise and adapt to new advanced technologies. The interconnection of numerical tools and programming languages with photonics technologies already during their studies allows graduates to gain the necessary experience and to be able to analytically solve technical and information requirements and other practical tasks.
Software skills: MATLAB, LabVIEW, ANSYS-SPEOS, Lumerical.

Multimedia Engineering
(Field of study Informatics)
The graduate of the master´s (engineering) study programme Multimedia Engineering has deepened his/her knowledge of the theoretical basis of the field of study Informatics, including digital and analogue processing of video and audio signals, processing and transmission of multimedia streams through various types of communication technologies, networks and services, development of interfaces and applications. He/she is an expert with multidisciplinary overlap with artistic, technical and informational knowledge that he/she can apply in the field of multimedia application development. By selecting compulsory elective courses, he/she can specialise more narrowly in either image, graphic or audio information processing. Knowledge of web technologies and services, 2D/3D graphics and animation techniques, digital processing of multimedia content including machine learning methods, 3D design, game design, mobile applications, 3D applications for augmented and virtual reality are important components of the knowledge. He/she will have the ability to specialise and adapt at different levels according to the needs of practice, development and research, as well as the ability to continuously deepen knowledge of the field. The graduate has acquired the knowledge and skills that will enable him/her to work as a specialist, both independently as well as in teams, to solve projects integrating the technical and creative levels into a single entity, or to lead these teams. His/her employability on the labour market is mostly in positions as a multimedia application developer, web application developer, system analyst, data specialist and game designer.
Software skills: ADOBE package, HTML, PHP, MySQL, Blender, Unity 3D, Android studio, JAVA, Microsoft Direct3D, OpenGL, After Effect, ZScan, Matlab.

Process Control
(Field of study Cybernetics)
The graduate of the engineering study programme has acquired knowledge in the field of telecommunication and information systems and networks. He/she can explain and apply the basic approaches used in the case of planning and operation of communication networks and project management, together with knowledge of the principles of operation of second to fifth generation (2 – 5G) radio networks and microwave systems, in order to apply the knowledge gained in solving problems related to design, implementation and operation of microwave, radio, metallic and optical transmission systems, with a view to solving problems related to the optimal configuration of network nodes with respect to the guarantee of quality of service (QoS) for IP services, while possessing knowledge in the filed of measurement, design and management of transmission and operating systems, system components, and configuration of services. In addition, he/she has gained knowledge of design and verification and selected optical communication chain components and RF circuits used in radio networks through analytical and numerical tools. The graduate is prepared to adapt to the rapidly evolving modern ICT technologies and to 6 apply him/herself as a creative worker in technical development, telecommunication design and management, research as well as in all areas of application and development of telecommunication, radiocommunication and information and communication technologies and services.
Software skills: Phyton, C Language, C++, MATLAB, Java, HTML, CSS, SQL

Telecommunication and Radiocommunication Engineering
(Field of study Informatics)
The graduate of the engineering study programme has acquired knowledge in the field of telecommunication and information systems and networks. He/she can explain and apply the basic approaches used in the case of planning and operation of communication networks and project management, together with knowledge of the principles of operation of second to fifth generation (2 – 5G) radio networks and microwave systems, in order to apply the knowledge gained in solving problems related to design, implementation and operation of microwave, radio, metallic and optical transmission systems, with a view to solving problems related to the optimal configuration of network nodes with respect to the guarantee of quality of service (QoS) for IP services, while possessing knowledge in the filed of measurement, design and management of transmission

and operating systems, system components, and configuration of services. In addition, he/she has gained knowledge of design and verification and selected optical communication chain components and RF circuits used in radio networks through analytical and numerical tools. The graduate is prepared to adapt to the rapidly evolving modern ICT technologies and to 6 apply him/herself as a creative worker in technical development, telecommunication design and management, research as well as in all areas of application and development of telecommunication, radiocommunication and information and communication technologies and services. *Software skills: Phyton, C Language, C++, MATLAB, Java, HTML, CSS, SQL.*

Power Electronic Systems
(Field of study Electrical Engineering)
The universality of this study programme guarantees a very wide employment of graduates on the labour market in the field of autotronics, power engineering, electric drives, electronics. The acquired knowledge can be applied in the most lucrative areas of electrical, mechanical and energy industry as well as in transport. In the future, their application in the field of services is expected. These are mainly the areas of development, design, projection and application of power and control electronic systems, mechatronic and automotive systems, their control nodes, superior control systems, industrial automation machines and robots and means of industrial automation. Due to the significant representation of subjects focused on programming and development of control software, the graduate can successfully find employment in very interesting job positions. Graduates of this field of study can apply for jobs in companies dealing with design, production and application of power electronic and/or mechatronic systems and industrial automation. They can also work in specialised machinery companies operating in the areas of the automotive industry, chemical and petrochemical industry, gas industry, paper production as well as transport.
Software skills: Freescale ARM, Texas Instruments DSP, ANSI C Language, EAGLE, OrCADPSpice, PLECS, LabVieW, Simulink, COMSOL, VHDL ISE Desing Suite. dSpace, Texas Instruments Education Modules.

DOCTORAL STUDY PROGRAMMES

Electro-technologies and Materials
(Field of study Electrical Engineering)
The graduate of the doctoral degree study programme Electro-technologies and Materials masters scientific methods for the design and preparation of innovative materials and structures. He/she masters scientific advances in processing technology, photonic structures, electro-acoustic structures, solid state and electronic systems, diagnostics and physical property modelling. The scientific knowledge acquired enables the graduate to apply knowledge in a wide range of manufacturing technologies in electronics, photonics, or materials. The graduate is able to independently operate scientifically and implement new knowledge in the field of technology. He/she has the skills to lead scientific and engineering teams designed to provide technical and informational assignments in solving complex tasks not only in industry, but also in science and research. After graduation, the graduate is able to establish and implement innovative technological procedures for the production and preparation of electrical engineering elements, structures, systems and equipment, while being able to think critically and creatively for the design and implementation of innovations.

Process Control
(Field of study Cybernetics)
The doctoral degree study in the study programme Process Control is intended for graduates of the second degree of university study (Engineer/Master of Science or Art) who tend to have an original solution to engineering and scientific problems in the field of management and control of transport and technological processes. The aim of the doctoral degree study is to educate such an expert who will not only have comprehensive knowledge but will be able to enrich science and knowledge in the field of process control. To

solve these tasks, the doctoral student uses the latest knowledge of modern analytical and numerical methods, methods of mathematical and physical modelling, informatics, measurement of electric and non-electric variables, microelectronics, electrical power engineering, automatic and discrete control up to the level of artificial intelligence, including the implementation of control by appropriate processors, as well as knowledge from other fields. A prerequisite for successful completion of the doctoral degree study is the ability of the doctoral student to think abstractly and his/her ability to apply and implement acquired knowledge in solving technical problems. The graduate of the doctoral degree study in the study programme Process Control acquired knowledge based on the current state of scientific knowledge and by his/her own creative activity he/she will contribute to the development of this knowledge as well as to new findings in this field. He/she has a broad expertise in several areas of the field, which serves as a basis for conducting research, development and creation of new knowledge in traditional areas of the field such as: methods of modelling and process control, design of robotic and mechatronic systems control, new software and communication systems for control of complex systems. The student is capable of critical analysis, abstraction, evaluation and generalization of given problems and synthesis of new and complex concepts.

Power Electrical Engineering
(Field of study Electrical Engineering)

The doctoral degree study in the study programme High-voltage electrical engineering is intended for graduates of the second degree of university study (Engineer/Master of Science or Art) who tend to have an original solution to engineering and scientific problems in the field of heavy current electrical engineering, i.e. electric drives, power electronics, electric traction, electric machines and instruments as well as traction electrical power engineering. To solve these tasks, the doctoral student uses the latest knowledge of modern analytical and numerical methods, methods of mathematical and physical modelling, informatics, measurement of electric and non-electric variables, microelectronics, electrical power engineering, automatic and discrete control up to the level of artificial intelligence, including the implementation of control by appropriate processors, as well as knowledge from other fields. A prerequisite for successful completion of the doctoral degree study is the ability of the doctoral student to think abstractly and his/her ability to apply and implement acquired knowledge in solving technical problems. The doctoral student will learn to correctly characterize and understand physical phenomena and experimental knowledge of these phenomena, to look for adequate models and to implement new applications in the above-mentioned specific disciplines, in science, research and practice. The doctoral degree study will enable the doctoral student to acquire comprehensive theoretical knowledge, experimental skills and practical experience, as well as to master the methodology of scientific work and prepare him/ her for independent scientific work. The graduate of the doctoral degree study in the study programme High-voltage electrical engineering acquired knowledge based on the current state of scientific knowledge and by his/her own creative activity he/she will contribute to the development of this knowledge as well as to new findings in this field.

Telecommunications
(Field of study Informatics)

The graduate of the third degree study programme Telecommunications acquired deep theoretical and methodological knowledge and practical experience in key areas of information and communication technologies and multimedia at the current state of research in the world. He/she acquired the principles of independent and team scientific work, scientific research, scientific formulation of problems, solution of complex scientific problems and presentation of scientific results. He/ she is able to analyse and solve complex and non-standard tasks in the field of information and communication technologies and multimedia and provide original, new solutions. The graduate is able to use the acquired knowledge to evaluate and justify the suitability of the use of individual methods for solving research tasks in the field of metallic, optical and radio communication systems, using the analysis of different types of signals and the implementation of various machine learning methods. He/she can creatively apply acquired knowledge in practice. He/she will

find professional application in various fields of science, research, industry and services in the public as well as private sectors. In addition to the aforementioned theoretical knowledge, the graduate of the third degree of the study programme Telecommunications has acquired additional knowledge, abilities and skills and is able to lead smaller and larger teams of scientific, research and development workers, to lead large projects and to bear responsibility for complex solutions to scientific and research problems. He/she is able to follow the latest scientific and research trends in the field of information and communication technologies and multimedia and supplement and update his/her knowledge through lifelong learning process. The graduate has mastered the principles of managerial work, designing an experiment with a timetable, leading and controlling team members, he/she is able to communicate and cooperate with managers of scientific projects and specialists from other professions, is able to apply legal, social, moral, ethical, economic and environmental aspects of his/her profession in his/her work.

Theory of Electrical Engineering
(Field of study Electrical Engineering)
The doctoral degree study in the study programme Theoretical Electrical Engineering is intended for graduates of the second degree of university study who tend to have an original solution to engineering and scientific problems in the field of Theoretical Electrical Engineering and its applications. To solve these tasks, the doctoral student uses the latest knowledge of modern analytical and numerical methods, methods of mathematical and physical modelling, informatics, measurements of electric and non-electric variables, electronics, interdisciplinary methodologies, biomedical applications, as well as knowledge from other fields. A prerequisite for successful completion of the doctoral degree study is the ability of the doctoral student to think abstractly and his/her ability to apply and implement acquired knowledge in solving technical problems. The doctoral student will learn to correctly characterize and understand physical phenomena and experimental knowledge of these phenomena, to look for adequate models and to implement new applications in the above-mentioned specific disciplines, in science, research and practice. The doctoral degree study will enable the doctoral student to acquire comprehensive theoretical knowledge, experimental skills and practical experience, as well as to master the methodology of scientific work and prepare him/her for independent scientific work.

Tab. 10: Information about final thesis

Number of submitted thesis	Number of defended theses	Physical number of tutors of final thesis	Physical number of tutors of final thesis (without PhD.)	Physical number of tutors of final thesis (experts from practice)
Bachelor thesis				
162	155	79	13	8
Master thesis				
84	82	55	2	5
Doctoral thesis				
14	14	12	0	0

Students' awards

Awards of students within the university:

- Dean's price was in 2023 awarded to the following students of the 2nd degree study:
    - study program Biomedical Engineering: Jakub Kubíček

    - study program Process control: Ján Sivák
    - study program Power Electronic Systems: Ján Švec
- Rector's price was awarded in 2023 to:
    - Miriam Zemaníková (1st degree study – Biomedical Engineering)
    - Juraj Strych (2nd degree study – Biomedical Engineering)
    - Daniel Mrena – for diploma thesis (2nd degree study – Photonics)
    - Samuel Krško – for diploma thesis (2nd degree study – Multimedia Engineering)
- Student awards for works presented at ŠVOS:
    - 1st place: Ing. Patrik Prôčka (3rd degree study)
    - 2nd place: Ing. Radovan Korček (3rd degree study)
    - 3rd place: Ing. Marek Bujňák (3rd degree study)

Non-University Student Awards:
For the dissertation thesis (titled "Fusion of multichannel electromyography and photoplethysmography imaging to analyze the electrical activity of muscles and the perfusion of subcutaneous tissue"), Michal Labuda won 1st place in the international competition for the best thesis defended in 2021-2022 in the category "Health and Applications in Healthcare".

Support for students in 2023

a) Scholarships (motivation, faculty)

For excellent study results the Faculty provides the scholarships to students. These scholarships were allocated in 2023:

- merit scholarships - the number of students: 83, the amount paid: 53 109 EUR,
- special scholarships - the number of students: 17, the amount paid: 1 453 EUR,
- social scholarships - the average number of recipients/students: 21, the amount paid: 38 175 EUR,
- trade scholarships - number 379, the amount paid: 158 185 EUR,
- from own resources - the number of students: 67, the amount paid: 15 650 EUR.

b) Consultation and advice

Students have the opportunity to consult issues related to the study with student advisors and the vice dean for education, what they are actively using.

c) Level of students' satisfaction with the services (accommodation, food, availability of administrative staff, library, learning environment, ICT ...)

Students expressed their satisfaction/dissatisfaction with the services through the questionnaires that are continuously processed and evaluated. Positive suggestions are used for improving the quality of the services.

SCIENTIFIC RESEARCH ACTIVITIES

Research focus of the departments

Research activities of the **Department of Physics** are carried out by three main research groups. They are focused on the development and application of optic and photonic elements on a chip and in optic fibres, polymeric composite materials for electrical engineering, application of acoustic wave processes for the investigation of condensed matter and theoretical studies of elementary particles. Results are published in impacted journals in databases WOS and SCOPUS. Research is performed in six laboratories. There is also a significant collaboration with the University Science Park.
The section of Acoustics and Materials exploits a wide range of acoustic methods and techniques as well as acoustoelectric, acoustooptic and acoustomagnetic phenomena to investigate semiconductors, metals, ion glasses and magnetic liquids. Acoustic group has reached important results in the areas of semiconductor MOS layers, magnetic fluids on the basis of the transformer oil or water, studies of LiPON type ion glasses as well as in the research of liquid crystals doped with magnetic nanoparticles and carbon nanotubes. Recently, important results have been obtained in the study of nanocomposite polymeric materials.
The section of Optics and Photonics studies physical properties of the conventional telecommunications optic fibres and special fibres such as capillary fibres and photonic fibres and photonic elements and sensors. The latest results are in the area of sensors on a chip and fibres for the laboratory on a chip. The group has extended its activities to laser technologies of preparation and analysis of photonic structures for integrated optics and optoelectronics. The cutting edge photonic elements for applications on a chip and optic fibres are developed using 3D laser litography. The group also studies the influence of external physical fields on the optical properties of selected polymeric and crystalline solids. The most important results were achieved in the field of special optic fibers and fiber devices for sensor applications. In the field of active devices, the new types of light emitting diodes with patterned surface using photonic structures and polymeric membranes with photonic structure were developed. The development of these devices is based on the latest 3D laser lithographies with submicrometer resolution.
The section of General physics and elementary particles is active in the pedagogical research and in the area of particle physics.

The **Department of Mechatronics and Electronics** has realized and provided research and development, expertise and contracts, and develops publication activity in the field of electronics, control systems, mechatronics and power electronics mainly.
Professional activities of the department have been applied and disseminated on creation and operation of quality and reliable electronic devices and systems, application of programmable logic areas in the design of electronic systems, reconfigurable circuits study as well as diagnostics and analyzing of the failures using image analysis. Topology optimizing for power semiconductor converters and their electromagnetic compatibility belongs to main activities of the department.

The scientific-research and development activities of the **Department of Control and Information Systems** are focused on the area of control tasks algorithmisation, automation of control on process, operational and management levels, while utilising modern artificial intelligence approaches, and on the area of reliable, safe and secure communication and information processing in control of selected critical processes, above all the ones which imply the criterion of safety besides usual optimisation criteria. For reasons given there is a large number of research projects and cooperation projects with praxis and industry directed into the area of applied telematics and intelligent control and safety systems in transport and industry.

Research and Development activities are at the **Department of Electromagnetic and Biomedical Engineering** directed towards areas where the common factors are electromagnetic field and human body. The department has modern research infrastructure and means for realizing numerical simulation, measurements, and experimental analyses. A part of the scientific activities is focused on the electromagnetic non-destructive evaluation of biomaterials. Research methodology in this area combines numerical simulations and experimental investigations. The activities are oriented towards new excitation and detection of signals together with innovative approaches for signal processing and evaluation for the inspection of implants used in medical practice.
The human resources and the research infrastructure of the department create unique basis for the innovation activities in the field of technical and ICT support in medicine. The activities are focused on: electromagnetic biocompatibility, innovative biopotential sensing, photoplethysmography imaging, processing and evaluation of biomedical signals including graphical information and numerical modelling and simulations of dynamical physiological systems. In collaboration with partner institutions research in the field of design and implementation of intelligent textiles, with the system for data collection and processing and their implementation in specific industries, is realized.

Research activities of the **Department of Multimedia and Information-Communication Technologies** cover a wide area of topics related to information-communication and multimedia technologies. Research and development activities are realized by 8 specialized laboratories.
In the area of communication technologies, attention is focussed on problematics of communication networks, software-defined networking, the Internet of things, access technologies, a convergence of network technologies, with main activities focusing on the quality of multimedia services. From the fixed network technology point of view research and development activities are in the area of wideband fully optical networks and photonic systems. In the field of radio technologies research activities are aimed at mobile and satellite communications, localization systems as well as DVB-x distribution technologies.
In the area of information technologies, the department is focused on the development of applied informatics as a support for communication and multimedia technologies. Research and development activities are focussed on the area of digital signal processing, mainly from semantic analysis of audio and video point of view, machine learning including deep neural networks, computer graphics, semantic web and web applications, 3D modelling and virtual reality.
In the area of multimedia technologies, the main orientation is on technological aspects as well as creativity represented by the basics of image composition, direction and work with multimedia content. The main goal in this area is the complex support of future multimedia services, which are created by the inclusiveness of artistic creation and modern trends in the area of informatics. Research activities are focused on the area of an image and sound analysis as well as quality assessment of multimedia signals.

Research and development activities of the ***Electric Power System*** section at the **Department of Power Systems and Electric Drives** are focused on issues concerning electricity generation, transmission, and distribution. The research activities oriented on electricity generation are mainly focused on a modelling of the operation of renewable energy sources. Simulation results as well as acquired knowledge are used to design simulation models, which are thereafter applied in power system analyses as well as in the optimization of renewable energy sources' deployment within virtual power plants.
Scientific and research activities in the field of electricity transmission and distribution are focused on the modelling of electric power system operation, especially on an application of the concept of intelligent networks (Smart Grids) to the control of both power transmission and distribution networks.
An integral part of the research activities of the department is solving the issue of power quality in the distribution or transmission system. The issue is solved comprehensively. Attention is given to the causes of

poor quality of supply, EMC, statistics in different locations of the system, and of course, possibilities for improvement by the application of the appropriate devices or by the design of other feasible measures.

The section of Electric Drives and Electric Traction mainly focuses on control of all types of electrical drives such as DC motors, AC motors, and special drives with different types of rotors (SRM, RSM, BLDC, and Stepper Motor). Research focus can be divided into the following areas:

Sensorless control of electric machines allows increasing the overall drive reliability as well as reducing the drive size. This topic includes research of estimation algorithms and control techniques for DC and AC drives (IM, PMSM, BLDC, RSM, and SRM). Traditional estimation methods are usually applied for the higher speed range of the drive. For the low, even zero speed, there are methods and algorithms which require high-frequency voltage signal injection for the estimation. Currently, the sensorless techniques form the basis of some control systems characterized by system fault tolerance. This means that at least partial operation under any circumstances is ensured. The research results have been presented at significant international conferences.

Design of novel and progressive control methods – the research in this area has been focused on methods that use forced dynamic control or sliding mode control. These control structures do not require the use of PI controllers, which means avoiding the complications associated with their setting (often trial and error setting technique) and their dependence on changing of the controlled system parameters. This category also includes various support control algorithms providing a wider speed range, less torque ripple, and therefore less vibration and noise.

Design and implementation of control algorithms for linear motors drive applications – linear motors are very progressive especially for high dynamic applications. Research activities cover the designing of control methods that have the capability to avoid all adverse effects of linear motors such as non-linear friction, cogging torque, and other problems that need to be eliminated in the highly precise and dynamic applications.

Design of energy flow control in hybrid railway vehicles – hybrid vehicles are today considered as a very progressive type of railway vehicles. The most needed research issues in this area are primary source operation optimization (catenary or a diesel engine) or braking energy storage that is in conventional vehicles lost as heat. Hybrid vehicles assume utilization of modern energy storage systems, mainly supercapacitors or modern electrochemical cells (lithium-based systems). Research results have been published at several international scientific conferences and implemented in an international commercial project.

The scientific research activity of **Institute of Aurel Stodola** is focused on the formation and analysis of properties of semiconductor-dielectric systems, oxide and nitride layers, research of microstructure properties, investigation of electrical charge states and optical properties, the influence of formation and passivation of structures and nanotextured interfaces. Research is mainly focused on the field of semiconductor solar cells and thin-film solar energy conversion systems, on the formation and analysis of the properties of porous silicon structures for solar applications, and on optoelectronic applications. Problems of photoelectro-catalytic processes in water, problems of development of analytical methods based on statistical, Fourier and multifractal formalism, modeling of quantum charge states, transport processes and research of photon interactions are solved. Diagnostic techniques (scanning probe methods, optical spectroscopy in a wide spectral range, spectral ellipsometry, Raman scattering, electro-optical methods) are based on high-quality experimental equipment of the workplace. Microstructure formation processes on silicon and photoelectrochemical processes for hydrogen generation are investigated both experimentally and theoretically in the photoelectrochemistry laboratory. Numerical problems are solved using remote access to servers providing computing resources (Comsol) and other HPC resources.

In the research of linear and nonlinear optical phenomena of a deterministic and stochastic nature in a high-speed optical communication system, several numerical methods focused on the simulation of optical elements in the time and spectral domain were implemented.

Scientific research activity in the field of alternative energy sources is focused on the study of processes associated with hydrogen generation, charge generation and recombination processes in photovoltaic systems and applications of digital technologies in solar energy devices.

Grant projects and cooperation with practice

The most important types of projects are international ones together with projects financed from the Structural Funds as well as projects supported from national resources through the Slovak Research and Development Agency (SRDA), the Scientific Grant Agency of the Slovak Ministry of Education, Science, Research and Sport and the Slovak Academy of Sciences (VEGA) and the Cultural and Educational Grant Agency of the Ministry (KEGA). Cooperation with industrial partners in the field of applied research is also of high importance.

In total 93 projects were solved at FEEIT in 2023 (projects of international programs – 19, VEGA – 10 projects, KEGA – 8 projects, APVV – 15 projects, structural funds – 5 projects, FEEIT projects to support young researchers – 8 , FEEIT projects to support researchers – 4, UNIZA grant system – projects of Doctoral (PhD.) students – 8, UNIZA grant system – projects of young scientific-pedagogical employees under 35 years of age – 10, other national research projects – 3, other national non-research projects – 3).

The most important information about the projects is summarized in the following subsections.

Projects of International Programmes

HORIZON 2020

101100700 TEF HEALTH: Testing and Experimentation Facility for Health	
Summary:	TEF-Health will provide standards for certification and quality control to facilitate market access for trustworthy AI, ensuring easy and streamlined evaluation. Each node of TEF-Health combines Real World Testing facilities with Laboratory facilities and provides them with standardized certification processes by which AI developers demonstrate interoperability and functionality of their software or hardware in real world settings and scenarios, in addition to controlled environments.
Realization:	01/2023 – 12/2027
Coordinator:	Univ.-Prof. Dr. med. Petra Ritter, Charité – Universitätsmedizin Berlin
Sub-Coordinator from FEEIT:	Róbert Hudec (DMICT)
Co-operators:	Patrik Kamencay, Miroslav Benčo, Peter Sýkora, Martin Paralič, Martina Radilová, Slavomír Matúška, Róberta Hlavatá

101057029:OPTIMAL—HORIZON-CL4-2021-TWIN-TRANSITION-01, Automated Maskless Laser Lithography Platform for First Time Right Mixed Scale Patterning	
Summary:	The OPTIMAL project will integrate for the first-time different laser lithography technologies, quality monitoring systems and processes in one platform to improve the manufacturing of original structures, known as masters, needed for key-enabling replication techniques in optical, industrial, medical device fabrication.
Realization:	10/2022 – 09/2026
Coordinator:	Ladislav Kuna (JOANNEUM RESEARCH FORSCHUNGSGESELLSCHAFT MBH, Weiz, Austria)

Sub-Coordinator from FEEIT:	Dušan Pudiš (DPh)
Co-operators:	Matej Goraus, Daniel Jandura, Daniel Mrena

101071330: InCITIES - Trailblazing Inclusive, Sustainable and Resilient Cities	
Summary:	The project aims to accelerate the transformation and modernization of universities and their ecosystems with an emphasis on "widening" the country and the needs of the population. The goal of the project will be achieved through capacity building and strengthening the excellence of partner institutions by connecting them with knowledge hubs, which will be based on the cooperation of participating institutions and their ecosystems in the field of inclusive, sustainable and resilient cities.
Realization:	10/2022 – 09/2025
Coordinator:	Kováčiková Tatiana (OMVP-ERA)
Co-operators:	Vestenický Peter, Holečko Peter (DCIS)

COST projects

Action CA19121: Network on Privacy-Aware Audio- and Video-Based Applications for Active and Assisted Living	
Summary:	The aim of GoodBrother is to increase the awareness on the ethical, legal, and privacy issues associated to audio- and video-based monitoring and to propose privacy-aware working solutions for assisted living, by creating an interdisciplinary community of researchers and industrial partners from different fields (computing, engineering, healthcare, law, sociology) and other stakeholders (users, policy makers, public services), stimulating new research and innovation. GoodBrother will offset the “Big Brother” sense of continuous monitoring by increasing user acceptance, exploiting these new solutions, improving market reach.
Realization:	09/2020 – 09/2024
Coordinator:	Peter Počta (DMICT)

Action CA22104: Behavioral Next Generation in Wireless Networks for Cyber Security (BEiNG-WISE)	
Summary:	The always-connected world we are living in, gives us an unprecedented plethora of new advanced services and automated applications requiring, more and more, less human intervention due to the increased integration of Machine Learning (ML), Artificial Intelligence (AI) approaches and sophisticated emerging wireless technologies. On the other side, this connected world opens new breaches and creates new potential vulnerabilities for smart advanced cyber-attacks, namely attacks and offender relying on ML/AI and advanced wireless technology integration, to make their attack more effective and less detectable. If an increasing awareness by the users could help to contrast the security issues, it is not sufficient against the new generation of cyber-attacks. In this context, a drastic paradigm shift, putting human-being in the loop for the conception of novel and more effective cyber-security solutions, must be considered. Human-beings have a double role in the cyber-connected world: as potential offender and potential victim. The focus of BEiNG-WISE will be on how these different human-being features can be combined with the advanced technological characteristics, in order to conceive non-conventional, responsible by design, cyber-security solutions accounting for both these factors. In this complex connected system, another fundamental aspect that needs to be accounted to, is the legal one, related to the conception of solutions that can be effectively employed in the real

	world. Also, legal aspects should be considered at the design stage. The Action relies on cross-domains expertise, ranging from cybersecurity, wireless communication technology, data science, sociology, psychology and law.
Realization:	09/2023 – 09/2027
Coordinator:	Peter Brída (DMICT)

Action CA20120 INTERACT – Intelligence-Enabling Radio Communications Dro Seamless Inclusive Interactions	
Summary:	The Action aims to achieve scientific breakthroughs by introducing novel design and analysis methods for making future radio communication networks intelligent, meaning aware, adaptive and parsimonious, and contributing to the creation of intelligent environments.
Realization:	10/2021 – 10/2025
Coordinator:	Juraj Machaj (DMICT)

Action CA17124: Digital forensics: evidence analysis via intelligent systems and practices	
Summary:	The objective of the COST action is to form a network for the exploration of artificial intelligence and automated reasoning applications in the field of digital forensics and creating a synergy between these areas.
Realization:	09/2018 – 09/2023
Coordinator:	Jesus Medina (Facultad de Ciencias, Campus Río San Pedro, Spain)
Co-operators:	Peter Holečko (DCIS)

ERASMUS Projects

2020-1-PL01-KA226-SCH-096354: Erasmus + program: A lexicon of educational films on the subject of STEM for primary and secondary school students - films4edu	
Summary:	The goal is to create a set of physics educational videos for pupils of elementary and secondary/high schools in Europe.
Realization:	01/2021 – 12/2023
Coordinator:	Peter Hockicko (DPh)
Co-operators:	Martin Vaculík, Miroslav Uhrina, Juraj Bienik, Anna Holešová

KA220-HED-BF6DD07E: Teaching of Advanced Technology through Digital Additive Manufacturing, 3D printing and µ-printing	
Summary:	The main objective of the project is to broaden the access and early integration of students into high-tech manufacturing technologies and the process of development of electronics, with a particular focus on the implementation of digital additive manufacturing and advanced 3D and µ-printing technologies (APT/DAM) in the Electrical Engineering field and on the development of modern teaching instruments to foster students' skills in advanced and sustainable technologies
Realization:	09/2023 – 08/2026
Coordinator:	Dušan Pudiš (DPh)

Blended Intensive Programme – Smart Grids	
Summary:	A joint project aimed at educating students in the field of intelligent networks (Cracow University of Technology, Poland, Hanze University of Applied Sciences, Deutschland, Polytechnic Institute of Bragança, Portugal and University of La Laguna, Spain)
Realization:	03/2023 – 06/2023

Coordinator:	University of La Laguna, Spain
Co-operators:	Peter Braciník, Marek Höger, Martina Kajanová (DPSED), Peter Brída, Juraj Machaj, Slavomír Matúška (DMICT)

Action Austria-Slovakia

SK-AT-20-0012: Advanced 3D optical splitters for photonics	
Summary:	The goal of the ADOPT project is to develop a complete process of new polymer optical splitters with unique 3D geometry for photonic applications using a 3D lithographic system. The whole process consists of the design, preparation, simulation and optimization of the splitter, including its input, output and the slitting part itself. Depending on the achieved results, the ADOPT project will further focus on the analysis of the optical properties of the splitter, measurements of the optical field distribution in the near field (UNIZA Žilina), as well as on the optimization (Fachhochschule Vorarlberg, FHV). In the last part of the project, the parameters of the 3D optical splitter will be determined with regard to its integrability into the optical fiber. Depending on these results, a manufacturing process methodology will be developed to enable the initial prototyping of such 3D optical splitters.
Realization:	04/2021 – 12/2023
Coordinator:	Dušan Pudiš (DPh), Dana Seyringer
Co-operators:	Daniel Jandura, Peter Gašo, Tomáš Mizera, Matej Goraus, Ivana Lettrichová, Patrik Miček

Other International Research Projects

Advanced electronics with supercaps	
Summary:	Among other possible future space applications, rollable structures for AOCS may also benefit from advanced electronics with supercaps, as their performances to take advantage of air drag or solar radiation pressure is dependent from their agility (possibility to roll/unroll them quickly, or to rotate them in short times with adequate motor). Their study is on-going in TAS-F, and related requirements may come soon. Those different applications with supercaps have a common requirement. A single supercapacitor in general can be charged with various energy, which is projected as capacitor actual voltage. Here, capacitor voltage of 0 V means that no energy is stored. On the other hand, 2.5 V-3 V shows, that the maximum energy is stored. Therefore, regarding this high voltage variation, a bidirectional power converter is required between supercaps and the user to take the whole performance vs voltage benefit. Without the converter, the supercap is used in a too narrow voltage range. This study will demonstrate the interest of such a converter associated to supercaps.
Realization:	01/2022 – 09/2023
Coordinator:	Michal Frivaldský (DME)
Co-operators:	Pavol Makyš, Michal Praženica, Ján Morgoš

NATO SPS G6140 Advanced technologies for Physical Reslience Of cRitical Infrastructures (APRIORI)	
Summary:	The main objective of the project will be to implement new approaches to strengthening the solution in the sub-sector of heat supply and the sector of information and communication technologies based on real examples from practice. Expected outcome: The expected outputs will be focused in the area of planning, and preparation of training of experts in each country. The first step will always be the identification of relevant threats, and their prioritisation, followed by risk analysis and monitoring.

Realization:	Luca De Vito, Universita degli Studi del Sannio, Benevento, Italy
Coordinator:	Zdeněk Dvořák (FBI, UNIZA)
Co-operators:	Peter Brída, Juraj Machaj (DMICT)

22310108: Innovation of polymer nanocomposite materials for electrical engineering	
Summary:	The goal of the project are solutions for development of original electro-insulating materials for the market in the field of production ofhigh-capacity batteries for energy storage from alternative sources, encapsulation of electronic components used in e-car, encapsulation ofmotors, electro insulating materials for wide area of electrotechnology and resin for state-of-the-art technologies.
Realization:	07/2023 – 07/2025
Coordinator:	Štefan Hardoň (DPh)
Co-operators:	Miroslav Gutten, Jozef Kúdelčík

NUT-UNIZA 17040: Memorandum of NUT China – UNIZA SR on cooperation in education in the area of transport engineering and technology transfer	
Summary:	The research project is focused on trajectories of knowledge/education in the field of transport construction and engineering, as well as on other fields of study and courses aimed at the field of transport at the level of universities and CŽV. Part of the project is research into the possibilities of use and the use of patents from NUT by entities on the Slovak market.
Realization:	01/2021 – 06/2023
Coordinator for FEEIT	Aleš Janota (DCIS)

TAČR CK04000082: Modern methods of ensuring cyber security in tunnel systems as part of critical transport infrastructure	
Summary:	The research project is focused on trajectories of knowledge/education in the field of transport construction and engineering, as well as on other fields of study and courses aimed at the field of transport at the level of universities and CŽV. Part of the project is research into the possibilities of use and the use of patents from NUT by entities on the Slovak market.
Realization:	01/2023 – 12/2026
Coordinator:	Tomáš Tichý (ČVUT FD)
Coordinator for FEEIT	Rastislav Pirník (DMICT)

Other International Non-research Projects

EPPCN Agreement KE3202	
Summary:	The EPPCN Member (Ivan Melo) acts as CERN`s communications point of contact in the Member State or Associate Member State in which he/she resides and cooperates in the promotion of CERN`s mission and the demonstration of its importance at the national level.
Realization:	01/2021-12/2024
Coordinator:	Arnaud Marsolier, CERN
Co-operators:	Ivan Melo (DPh)

Project of the European physical society international physics MASTERCLASSES 2023	
Summary:	High school students spend one day with physicists of elementary particles during which they learn to evaluate real experimental data from the LHC accelerator

Realization:	01/2023 – 12/2023
Coordinator:	Ivan Melo (DPh)
Co-operators:	Gabriela Tarjányiová, Mikuláš Gintner, Jozef Kúdelčík

Visegrad funds: Research of the sustainable resins with high efficiency and using raw materials from renewable sources	
Summary:	Realization of the research project requires a whole range of experiments using actual research techniques applied for the research of the possible replacements of potentially hazardous raw materials with more environmentally friendly types for unsaturated polyesterimide and polyurethane resins and research of replacement of synthetic input raw materials for raw materials from renewable resources to reduce consumption and time for their production.
Realization:	09/2022 – 06/2023
Coordinator:	Štefan Hardoň (DPh)
Co-operators:	Pavel Trnka, ZČU Plzeň

Projects of National Programmes

Slovak Research and Development Agency (SRDA)

APVV-22-0423: Development of a modular car system for monitoring the driver's health and fatigue	
Summary:	The main objective of the interdisciplinary project is applied research in developing a modular monitoring system in the form of a vehicle assistance system to detect driver fatigue and health status. The present project proposal is intended to contribute to the advancement of basic knowledge in the field of non-invasive sensing systems and advanced materials based on smart electrically conductive textiles, special textile materials, composite materials, and biomedical sensors capable of sensing the basic vital functions of the driver in order to improve road safety. The project will result in a working prototype of a modular monitoring system embedded in functional parts of the vehicle interior, which will be tested by conducting laboratory and road tests on the EDISON electric vehicle. The project responds to the increasing accident statistics in Slovakia and Europe due to driver fatigue and consequent loss of attention or micro-sleep.
Realization:	07/2023 – 12/2026
Coordinator:	Branko Babušiak (DEBE)
Co-operators:	Ladislav Janoušek, Štefan Borik, Maroš Šmondrk, Michal Labuda, Michal Gála

APVV-20-0528: New semiconductors and catalysts for green hydrogen production	
Summary:	Photoelectrochemical hydrogen production has the potential to achieve efficiencies above 10-15 % and stability for more than 10 years. These goals can be achieved by several architectures of photovoltaic and photoelectrochemical systems for controlled splitting of water molecules. The n-type Eg semiconductor photoanode (1.8–2.4 eV) is used for oxygen evolution and the smaller Eg (1.0–1.5 eV) semiconductor photocathode initiates hydrogen production. This tandem configuration allows for more efficient utilization of solar radiation, leading to higher efficiency and better adaptation to fluctuations in lighting levels. In addition to the issue of electrode formation, the project also addresses the problem of long-term protection and stability of photoelectrochemical processes for hydrogen production.
Realization:	07/2021 – 12/2024

Coordinator:	Peter Čendula (IAS)
Co-operators:	Stanislav Jurečka, Gabriel Cibira, Martin Králik

APVV-19-0214: Biocompatibility and objectification of the grid frequency electromagnetic field in densely populated areas (LIFE)	
Summary:	The modern age is characteristic with rapid expansion of new technologies and increasing densification of specific geographic locations. These features result in increased demands pertaining to power energy grids that bring also negative environmental impacts. Rapidly increasing electromagnetic background in the living environment and elevated awareness of general public evoke reasonable concerns connected to the potential health risks. International Agency for Research on Cancer (IARC) classified electromagnetic field as carcinogen type 2B in 2013. European Union policies call on national governments to ensure simple and feasible public access to information regarding the potential risks of electromagnetic field and environmental impact thereof and to apply the principle of "reasonable prevention" according to the international standard ALARA - "as low as reasonably achievable". In Slovakia, up to this day, there do not exist any verified and publicly available information on the levels (magnitudes) of artificial electromagnetic fields, any assessment of possible biological effects and impact thereof on population health, and any effective preventive measures. Implementation of the present multidisciplinary project expressively contributes to the realisation of the European policies at national level. The activities are focused on: 1) objectification of the 50 Hz electromagnetic background levels in select, densely populated areas, also extending beyond the designated protection zones; 2) a qualitative and quantitative analysis of potential biological effects of grid frequency electromagnetic field and 3) suggestion of effective preventive measures for decreasing the effects. Keystone for the project realization is synergy of research capacities of partners' institutions, complementarity of their competences and unique research infrastructure. The main project outcome is creating a unique web portal that will provide information pertaining to the levels of artificial electromagnetic low-frequency background in selected densely populated areas, to the related potential health risks and to the recommendations for appropriate preventive measures.
Realization:	07/2020 – 06/2023
Coordinator:	Milan Smetana (DEBE)
Co-operators:	Ján Barabáš, Mariana Beňová, Daniela Gombárska, Ladislav Janoušek, Zuzana Judáková, Zuzana Pšenáková, Roman Radil, Maroš Šmondrk

APVV-19-0290: Research and development of lower limb prosthetic sockets manufactured by additive technologies (PSAMBS)	
Summary:	The aim of the present project is the digitisation and improvement of the current empirical procedure for the design of sockets in the technological process of the current orthopaedic practice using the digital of amputation stump, modelling of sockets in the system CAD/CAM, analysis of the performance of the socket at different settings in thickness and the fill and finally the manufacture of sockets of the lower limbs using additive technology of 3D printing.
Realization:	07/2020 – 06/2023
Coordinator:	Jozef Žifčák (Technical University of Košice)
Co-operators:	Ladislav Janoušek, Branko Babušiak, Štefan Borik, Michal Gála (DEBE)

APVV-20-0500: Research of methodologies to increase the quality and lifetime of hybrid power semiconductor modules	
Summary:	The presented project deals with a high-current topic in the field of power semiconductor systems, specifically power semiconductor hybrid modules. The penetration of these components within industrial applications is continuously more pronounced, to which the considerable development of electrification of transport systems also contributes. It is the power semiconductor modules that represent the basic building block that enables an increase in the degree of electrification of transport systems. At this point, it should be noted that the reliability, durability, and efficiency of the modules are primary aspects for achieving ecological mobility. From the above facts, the project deals with the problems of elimination of adverse phenomena related to the production of power semiconductor hybrid modules. The solution consists of research and development of progressive inspection systems for fault detection during the production process.
Realization:	07/2021 – 06/2025
Coordinator:	Michal Frivaldský (DME)
Co-operators:	Libor Hargaš, Dušan Koniar, Kristián Takács, Jakub Škorvaga

APVV-19-0602 3D photonic polymeric microsensors integrated with optical fibers	
Summary:	The main goal of the project is to acquire latest knowledge in design, preparation and characterization of polymer photonic microsensors, which will be designed to integrate with optical fibers for the preparation of optical fiber microsensors for measuring pressure, temperature, elongation, magnetic and electric fields. Utilizing innovative design approaches for specific 3D photonic structures, simulating their optical transmission properties and changing of the properties depending on changes in the structural parameters and properties of the external environment, in which the structures will be placed, will provide a competitive advantage and potential of commercial use.
Realization:	07/2020 – 06/2023
Coordinator:	Ivan Martinček (DPh)
Co-operators:	Daniel Káčik, Norbert Tarjányi, Matej Goraus, Daniel Jandura, Ľuboš Šušlik, Petra Maniaková

APVV-21-0462: Research of active performance management Smart Public Lighting Systems	
Summary:	The project is engaged in the research, design and development of a comprehensive performance system for management of public lighting management with implemented smart elements. The main objective of the project and the proposed system is to eliminate problems related to the implementation of smart elements in public lighting as well as their negative impact on infrastructure. The designed system based on advanced algorithms identification of individual public lighting nodes and its loads can eliminate most of the negative effects of smart elements on the network, as well as significantly improve reliability and energy efficiency.
Realization:	07/2022 – 06/2026
Coordinator:	Peter Drgoňa (DME)
Co-operators:	Peter Ďurana, Roman Koňarik, Dušan Koniar, Jozef Šedo

APVV-21-0449: Integrated System for Analysis of Transformers Status due to the effects of short-circuit and fastening currents	
Summary:	The project solves the current problems of analyzing the impact of short -circuit and fastening currents on power transformers, which is a key factor for reducing unpredictable shutdowns in the transfer and distribution of electricity to consumers.

	In addition, the most important effects of short -circuit and fastening currents are analyzed in the project, which significantly worsen the design and insulating state of transformers. Subsequently, the current and new methods of measurement for detecting possible disorders are set out and the integrated comprehensive diagnostic system is proposed to ensure trouble -free operation of performance transformers. In solving the project, it uses the latest knowledge of electricity, measuring technology, diagnostics and information and communication technologies.
Realization:	07/2022 – 12/2025
Coordinator:	Miroslav Gutten (DME)
Co-operators:	Milan Šebök, Štefan Hardoň, Jozef Kúdelčík, Daniel Korenčiak

APVV-20-0264: Nano-optical probes and sensors integrated on optical fiber	
Summary:	The goal is the research and development of nanostructures and their integration on optical fibers for probes with high resolution for the near-field characterization and optical scanning. Research is based on the preparation of semiconductor and conductor-dielectric nanostructures using 3D technologies, which will be in the end implemented on an optical fiber.
Realization:	08/2021 – 12/2024
Coordinator:	Dušan Pudiš (DPh)
Co-operators:	Matej Goraus, Daniel Jandura, Ľuboš Šušlik, Petra Maniaková, Jana Ďurišová, Ivana Lettrichová, Patrik Miček, Tomáš Mizera

APVV-22-0330: System research for active and optimal electricity management using battery storage	
Summary:	The project focuses on researching the active and optimal management system with the use of battery storage. The description of the project is research into the possibilities of implementing both performance topologies of the whole system of active energy compensation and battery storage, as well as the possibilities of modular solution, parallel cooperation or wider functional use. For all designed systems, simulation models will be implemented and the project will include the development of control algorithms for semiconductor inverters as well as for the superior control system. The proposed solution (in the selected power scale) will be subjected to experimental verification of activity in laboratory conditions.
Realization:	07/2023 – 06/2026
Coordinator:	Michal Praženica (DME)
Co-operators:	Michal Frivaldský, Slavomír Kaščák, Patrik Resutík, Jozef Šedo, Roman Koňarik, Peter Klčo, Jakub Šimčák, Juraj Šimko

APVV-21-0078: Research of the sustainable resins with high efficiency and using raw materials from renewable sources	
Summary:	In the presented project we want to focus on the research of the possible replacements of potentially hazardous raw materials with more environmentally friendly types for unsaturated polyesterimide and polyurethane resins and research of repleacment of synthetic input raw materials for raw materials from renewable resources to reduce consumption and time for their production. Part of the research is modification of selected properties of these materials, by using aditives in models of functional impregnants and potting compounds for the purpose of improvement of their properties. The result of the research will be improving quality of impregnation and service life of impregnated electric rotating machines and transformers. Another output will be solutions for the further development of original products for the market in the field of production of high-capacity batteries

	for energy storage from alternative sources, encapsulation of electronic components for e-car production and resin processing with state-of-the-art technologies..
Realization:	07/2022 – 06/2026
Coordinator:	Štefan Hardoň (DPh)

APVV-20-0626 HuDyM - Biofidelic human body surrogate to increase the objectivity within the forensic analysis of road traffic accidents	
Summary:	Forensic analysis of road traffic accidents (TA) within the expert department "03 03 01 Road traffic accidents" is complex and interdisciplinary problematics with potentially extensive volume of input parameters within the axis “vehicle-human-road”. Input parameters are often of partial character and with technical uncertainties. This has a negative influence with respect to unambiguity of technical reconstruction and analysis of TA, that serves as a basis for decision making in criminal justice system. Within the forensic analysis of TA with vulnerable road users (pedestrians, cyclists), influence of the element “human” is significant for reconstruction and analysis of this subset of TA. This is valid particularly regarding using the human body injuries as a basis for determining the course of TA. Suggested research deals with current problematics of virtual and real-world surrogates of human body that will serve primarily for interdisciplinary objective forensic analysis of TA with vulnerable road users, but with application in other fields that use knowledge of injury biomechanics. Mathematical-physical models and real-world surrogates of human body that currently exist do not provide level of commonly available and universally applicable tools for wide spectrum of applications. This argument is valid in international context. The goal of suggested project is integrated research and construction of simulation mathematical-physical model and real-world surrogate of adult human body with increased biomechanical fidelity for multidirectional mechanical loading with focus on dynamic impact loading of vulnerable road users within TA. Project outputs will be applied directly in traffic accident analysis, but also in analysis of human body movement in forensic reconstruction of criminal cases, analysis of other accident events (work injury) and biomechanical research of injury mechanisms in human body dynamic loading.
Realization:	07/2021 – 12/2024
Coordinator:	Eduard Kolla (UZVV)
Co-operators:	Peter Vestenický (DCIS)

APVV-21-0217: Nano-structured silicon photonics for energy-aware on-chip data communication links	
Summary:	The relentless demands of data-intensive applications, such as terabit communication and data centers or high-performance computers, servers and data clouds, place exponential demands on the transmission of signals by electrical means. Data overload in metallic links is a critical problem that hinders the start-up of the above-mentioned applications. Integrated silicon nanophotonics is an attractive solution for future interconnects that enable complex on-chip functions to be implemented while reducing manufacturing costs. This research proposal is aimed at addressing these challenges and will enable key advances in on-chip data communication links operating in the short/near infrared band. The main idea of the research proposal is to use non-resonant nano-structured photonic elements to develop essential building blocks using waveguide technology compatible with silicon chips. Furthermore, this library of nano-structured photonic devices will be built using modern machine learning algorithms. The combination of light-driven photonic integrated waveguides and progressive machine learning methods opens up many opportunities to change established concepts through electromagnetic tools and

	solutions, expands the scope for optimization in photonics, and accelerates development in the given scientific field. Last but not least, we will deal with the mutual coexistence of individual devices in a complex system of optical links through the design of new communication schemes and protocols, as well as the evaluation of performance aspects and metrics at the device and system level, which will ultimately enable the creation of high-performance photonic links. Data communication links based on nano-structured elements of silicon photonics open up new realms of research and will undoubtedly provide overwhelming advantages beyond the current state of science and technology.
Realization:	07/2022 – 06/2025
Coordinator:	Daniel Benedikovič (DMICT)
Co-operators:	Jozef Dubovan, Ján Litvik, Radovan Korček, Roman Jarina, Erik Sádovský, Gabriel Cibira

APVV-21-0502 BrainWatch: System for automatic detection of intracranial aneurysms	
Summary:	Aneurysm is a pathological dilation of the artery that affects about 5% of the population. The resulting bulge fills with blood, the artery weakens and can lead to rupture. It often occurs on the small arteries of the brain, and if it ruptures, the affected person often dies or has lifelong consequences. Early detection of intracranial aneurysms can save lives. For this reason, the main goal of the presented project is to create a tool capable of quickly detecting even small intracranial aneurysms. The developed tool using artificial intelligence methods will be based on deep learning neural network architectures, thus helping to increase the overall accuracy of aneurysm detection by doctors in their clinical practice.
Realization:	2022 - 2025
Coordinator:	Róbert Hudec (DMICT)
Co-operators:	Patrik Kamencay, Miroslav Benčo, Peter Sýkora, Silvia Šúchalová, Slavomír Matúška, Roman Jarina, Martin Paralič, Róberta Hlavatá, Peter Kasák, Adam Škrváň, Adam Štech, Roman Radil

APVV-22-0261 3PoCube: The role of support tools for early diagnosis and therapy in children with hearing and speech disorders	
Summary:	The aim of the project is to investigate aspects of the use of support tools for early diagnosis and therapy in children with hearing and speech disorders. In this context, we are dealing with software and web applications developed by the research team and their impact on the early diagnosis of hearing problems in children, problems with understanding, and also software and web applications aimed at the implementation of speech therapy exercises in the home environment. Among the basic goals of the project, it is possible include an effort to improve diagnostic and therapeutic tools that can be applied in the home environment, without the personal participation of specialized workers (audiologist, speech therapist), so that these tools are easily controlled by parents, or pedagogues who are in daily contact with disadvantaged children. The project also aims to create means (databases, tools, procedures and methodologies) in order to be able to define the correct way of introducing modern information and communication tools into the process of diagnosis, therapy and rehabilitation in children with hearing and speech disorders. In this area, the project aims to create speech and visual stimuli for the implementation of these diagnostics and therapies in Slovak and also in the Romani language, given the fact that these are often not available at all (e.g. for the Romani language) or are not available in in electronic form.
Realization:	07/2023-06/2027

Coordinator:	Stanislav Ondáš (TUKE)
Coordinator at FEEIT:	Roman Jarina (DMICT)
Cooperators:	Peter Kasák, Maroš Jakubec

Scientific Grant Agency of the Slovak Ministry of Education, Science, Research and Sport and the Slovak Academy of Sciences (VEGA)

VEGA 1/0563/23: Výskum a vývoj vizuálnych inšpekčných algoritmov pre zvýšenie kvality výrobného procesu výkonových polovodičových modulov	
Summary:	Výkonové polovodičové moduly (tranzistory/diódy/hybridné) sa v súčasnosti stávajú čoraz viac súčasťou výkonových elektronických systémov, čo podmieňuje rozmach elektrifikácie v priemyselných, dopravných, ale aj spotrebiteľských aplikáciách. Trendom vo výrobe je hľadanie konsenzu medzi výrobnými nákladmi a zvyšovaním bezpečnosti cez inšpekciu kvality. Na základe skúseností z praxe (referencia od partnera SEMIKRON) automatizovaný prístup vnáša do procesu určité nedostatky a chyby, ktoré znižujú spoľahlivosť, resp. životnosť samotného polovodičového modulu. Technológia montáže polovodičových čipov na dosku je sprevádzaná generovaním určitých artefaktov. Tieto artefakty sú rizikovými faktormi z hľadiska zlyhania samotného polovodičového modulu (teplotné a izolačné vlastnosti sa dostávajú mimo bezpečný interval). Perspektívnym riešením je diagnostika (materiálová a vizuálna) montážneho procesu, čím je možné analyzovať a neskôr eliminovať mechanizmus vzniku týchto artefaktov.
Realization:	01/2023 – 12/2025
Coordinator:	Dušan Koniar (DME)
Co-operators:	Michal Frivaldský, Libor Hargaš, Anna Simonová, Marek Paškala, Peter Klčo, Jaroslav Bulava, Jakub Šimčák

VEGA 2/0043/21: Self-assembly processes in soft hybrid mixtures of liquid crystals and nanoparticles	
Summary:	The goal is to study self-assembly processes in liquid crystals doped with various nanoparticles. We will focus on the self-assembly induced in these composites by electric/magnetic fields at micro and nano levels and on the investigation of this process in various phases – isotropic, nematic and cholesteric.
Realization:	01/2021 – 12/2024
Coordinator:	Natália Tomašovičová, Institute of Experimental Physics SAS
Sub-Coordinator from FEEIT:	Peter Bury (DPh)
Co-operators:	Jozef Kúdelčík, Marek Veveričík, Štefan Hardoň

VEGA 1/0223/23: Polymeric photonic structures for sensor applications	
Summary:	Project aims to apply theoretical knoledge towards the design, preparation and characterization of polymeric photonic structures integrated with optical waveguides or with optical fibres for sensor applications.
Realization:	01/2023 – 12/2026
Coordinator:	Martinček Ivan (DPh)
Co-operators:	Pudiš Dušan, Káčik Daniel, Tarjányi Norbert, Lettrichová Ivana, Ďurišová Jana, Gašo Peter, Jandura Daniel, Šušlik Ľuboš, Goraus Matej

VEGA 1/0768/22: Scientific research on switched reluctance shell motors for hybrid and electric vehicles	
Summary:	The presented project entails scientific research focused on a switched reluctance motor (SRM) concerning its suitability for traction applications with dedicated construction. The project's outcome aims to deliver a well-conceived design of the SRM for use as a traction motor in hybrid or electric vehicles. A novel traction drive featuring an optimized SRM design will be thoroughly analyzed within the project, to enhance the efficiency, range, and reliability of electric or hybrid vehicles where it may be employed. Notably, this SRM design is intended for direct integration into the wheel of an electric car or hybrid vehicle. Advanced design methodologies, utilizing the finite element method, will be employed to conceptualize the structural arrangement of this SRM. The research will extend to the development of new control algorithms for the specified drive, in collaboration with a power converter, aiming to achieve optimal efficiency across a broad operating spectrum. The research findings will culminate in recommendations to produce such engines, contributing to the advancement of propulsion systems for electric and hybrid vehicles.
Realization:	01/2022 – 12/2024
Coordinator:	Pavol Rafajdus (DPSED)
Co-operators:	Pavol Makyš, Vladimír Vavrúš, Lukáš Gorel, Pavel Lehocký, Michal Kováčik, Michal Vidlák, Marek Furmanik, Daniel Konvičný, Michal Staňo

VEGA 1/0363/22: Nano-optical probes and nanostructures integrated on optic fibre	
Summary:	R&D of nanostructures and their integration on optic fibres for high resolution probes for near field description. Metal-dielectric nanostructures will be prepared using 3D technologies and integrated on optic fibre.
Realization:	01/2022 – 12/2025
Coordinator:	Dušan Pudiš (DPh)
Co-operators:	Ivan Martinček, Ivana Lettrichová, Jana Ďurišová, Peter Gašo, Daniel Jandura, Ľuboš Šušlik, Matej Goraus, Petra Maniaková, Tomáš Mizera, Patrik Miček

VEGA 1/0085/21: Research of methods for increasing the efficiency of electric multiphase motor drive systems for automotive applications	
Summary:	The project is focused on the optimization of drives efficiency with multiphase motors in the field of automotive applications. The content will be an analysis of inverters and their control for multiphase motors. Firstly, it will be a specification of the converter in terms of efficiency. The classic solutions of multi-phase inverters are compared with prospective options such as matrix converters. The second area of research will be the investigation of minimizing the impact on the network. The basic parameter will be to achieve the power factor close to one. An important part will be the research of a suitable method of motor connection to the effective use of the input supply voltage. The primary research method will be computer simulations realized by circuit and block simulators. The result of the synthesis will be the converter and the control method. A real sample of the converter will be used for verification. Finally, the control of two multiphase motors with one inverter will be investigated.
Realization:	01/2021 – 12/ 2023
Coordinator:	Slavomír Kaščák (DME)
Co-operators:	Branislav Dobrucký, Michal Praženica, Jozef Šedo, Roman Koňarik, Jakub Kellner, Patrik Resutík, Richard Zelník

VEGA 1/0063/21: Research of methodologies to increase the quality and lifetime of hybrid power semiconductor modules	
Summary:	The presented project deals with a high-current topic in the field of power semiconductor systems, specifically power semiconductor hybrid modules. The penetration of these components in industrial applications is continuously more pronounced, to which the considerable development of electrification of transport systems also contributes. It is the power semiconductor modules that represent the basic building block that enables an increase in the degree of electrification of transport systems. At this point, it should be noted that the reliability, durability, and efficiency of the modules are primary aspects of achieving ecological mobility. From the above facts, the project deals with the problems of elimination of adverse phenomena related to the production of power semiconductor hybrid modules. The solution consists of research and development of progressive inspection systems for fault detection in the production process.
Realization:	01/2021 – 12/2023
Coordinator:	Michal Frivaldský (DME)
Co-operators:	Pavol Špánik, Peter Drgoňa, Michal Praženica, Jozef Šedo, Matúš Danko, Peter Ďurana, Marek Šimčák, Richard Zelník

VEGA 1/0795/21: Research of side effect of modern control techniques on efficiency of electrical drive	
Summary:	The presented project is focused on research in the field of electric drive control with application in the automotive industry, but not only in it, but in every area in which the implementation of electric drive places great emphasis on the overall efficiency of the drive. However, the uniqueness of this project will not be that it will address efficiency as such, but will address how other progressive algorithms of today's control techniques affect efficiency. These various algorithms include special techniques for reducing vibration and noise, sensorless algorithms, control techniques for various winding designs, algorithms requiring high sampling and switching frequencies. In its final evaluation, the project will clearly define what benefits but also negative impacts on the effectiveness of individual modern control techniques. Modifications of existing algorithms or new algorithms will be created, minimizing the impact on efficiency. This part will be the main benefit of the project.
Realization:	01/2021 – 12/2023
Coordinator:	Pavol Makys (DPSED)
Co-operators:	Pavol Rafajdus, Vladimír Vavrúš, Lukáš Gorel, Marek Štulrajter, Pavel Lehocký, Matěj Pácha, Michal Kováčik

VEGA 1/0113/22: Hybrid photonic-sensor systems for 'big data' communications	
Summary:	The appetite for large data transfers is increased by the era of the Internet, social networks and streaming services that require instant connection. In general, optical technologies, and especially conventionally separated photonic communication and physical sensing systems, will shape all aspects of our society for the foreseeable future. Therefore, it is important to study the possibilities of connecting both systems into a conceptual ecosystem where large amounts of data are processed using modern machine learning algorithms. In this project, we will focus on the mutual coexistence of photonic and sensing systems by solving the problems of stochastic damage of optical signals in the optical fiber environment on the side of photonic backbone networks, and also by improving the sensing infrastructure for the detection of physical quantities. We assume that the resulting scientific knowledge will open new opportunities for the implementation of complex photonic sensing systems on compact chips using semiconductor platforms.

Realization:	01/2022 – 12/2024
Coordinator:	Daniel Benedikovič (DMICT)
Co-operators:	Milan Dado, Jozef Dubovan, Ján Litvik, PhD., Patrik Kamencay, Miroslav Markovič, Ivan Dolnák, Matúš Vaňko, Michal Kuba, Gabriel Cibira

VEGA 1/0588/22 Research on a system using location information to ensure QoE in 5G and B5G networks	
Summary:	With the development of new generations of mobile radio networks, users have access to services with high demands on transmission speeds. The effort of providers to ensure sufficient quality of services is also reflected in the change in the architecture of mobile networks. With the arrival of 5G networks and new types of services, the requirements for localization solutions necessary for their implementation are also increasing. Location information will be important in streamlining network operation from the point of view of ensuring sufficient quality of multimedia services. The project will focus on the research of localization algorithms using signals from radio networks and available sensors in order to ensure the quality of service in mobile networks. The result of the project will be not only new localization solutions usable in the ecosystem of 5G and B5G networks, but also the design of a solution for optimizing network functions for managing multimedia flows with regard to ensuring the required QoE based on location information. 5G networks will require a new QoE paradigm.
Realization:	01/2022 – 12/2024
Coordinator:	Peter Brída (DMICT)
Co-operators:	Juraj Machaj, Erik Sádovský , Veronika Hromadová, Anna Holešová, Lukáš Ševčík, Juraj Bienik, Miroslav Uhrina, Darina Jarinová, Peter Počta, Bohumil Adamec, Peter Kasák, Roman Jarina, Gabriel Cibira

Cultural & Education Grant Agency of the Slovak Ministry of Education, Science, Research and Sport (KEGA)

KEGA 018ŽU-4/2021: Modern education methods in analysis, modeling and control of Power Semiconductor Systems	
Summary:	The project focuses on the use of state-of-the-art research and educational methods aimed at developing the issue of Power Semiconductor Systems (VPS) at technical schools specializing in electrical engineering to support the development of the knowledge and skills of technical school graduates. The priority goal of the project is the development of modern research and educational aids in the creation of study materials, university textbooks/lecture notes, and supporting educational resources for the needs of teaching VPS. An essential condition is the integration of the content of education into the real environment of the labor market, i.e., the connection of modern technologies from practice and the teaching process. Based on the results of the project, further innovative research in the given scientific field is expected.
Realization:	01/2021 – 12/2023
Coordinator:	Michal Praženica (DME)
Co-operators:	Peter Drgoňa, Anna Simonová, Marek Paškala, Slavomír Kaščák, Jozef Šedo, Roman Koňarik

KEGA 008ŽU-4/2021: Integrated Teaching for Artificial Intelligence Methods at the University of Žilina	
Summary:	Over the past few years, there has been a significant acceleration of development in the field of artificial intelligence and machine learning. We witnessed several

	groundbreaking discoveries that significantly increased interest in the entire industry. The methods of artificial intelligence and machine learning can no longer be considered a thing of the distant future - on the contrary, many of them are already commonly applied in practice and bring enormous added value. In view of these facts, related methods have recently been trying to integrate into their processes, services and products also companies in Slovakia, for which the long-term lack of highly qualified graduates of technical fields of study in general and fields focused on artificial intelligence and machine learning in particular represents a significant competitive disadvantage . The main goal of the proposed project is to create a joint integrated initiative in the field of teaching artificial intelligence and machine learning, which will be open to the wider community and ensure the effective joint use of educational and research capacities in order to achieve the greatest possible end benefit.
Obdobie riešenia:	04/2021-12/2023
Zodpovedný riešiteľ:	Gregor Michal (UKaI)
Spoluriešitelia:	Aleš Janota, Dušan Nemec, Alžbeta Kanáliková, Michal Skuba, Branislav Malobický, Emília Bubeníková, Roman Jarina, Peter Kasák, Erik Sádovský (DCIS)

KEGA 044ZU-4/2022 Expanding the technical possibilities of the laboratory of electrical machines to implement distance education	
Summary:	The project's objective is the integration of distance education into the laboratory of electrical machines at the Department of Electric Power Engineering and Electric Drives within the Faculty of Electrical Engineering and Information Technologies at the University of Žilina. The achievement of this goal involves technical adjustments to enable the potential implementation of a comprehensive distance learning format, alongside the traditional face-to-face study model, specifically in the realm of electrical machine measurements at all academic levels. The successful execution of this project extends beyond the mere technical enhancements of the laboratory. It encompasses the development of instructional materials tailored for remote measurement conditions, ensuring that laboratory measurements align with the requirements of distance learning. The incorporation of e-learning tools such as Moodle or Teams into the distance measurement process will play a crucial role in fostering the necessary knowledge levels among participating students. This holistic approach aims to enhance the educational experience and accessibility of electrical machine studies within the specified department.
Realization:	01/2022 – 12/2024
Coordinator:	Pavol Rafajdus (DPSED)
Co-operators:	Vladimír Vavrúš, Pavel Lehocký, Michal Staňo, Michal Kováčik, Ján Šteininger, Marek Furmanik

KEGA 015ZU-4/2023 Modernization of chip technology teaching with information technology elements based on networked virtual laboratories	
Summary:	The project centres around the integration of modern technologies into teaching within the domain of abrasive machining. The primary objective is to enhance students' proficiency in accessing information in this field through electronic education, incorporating elements of information technology and the potential utilization of networked virtual laboratories. Transforming educational content into multimedia courses, coupled with interactive learning, is anticipated to elevate the quality and expediency of knowledge and skill acquisition. This approach facilitates

	the transition of students from passive listeners to active participants in the educational process. The project's outcomes will manifest in the form of multimedia resources and an internet application through web pages. This online platform will feature connectivity to the educational process, including illustrative videos and links to virtual laboratories. The design aims to promote active learning not only within the university but also on a national scale, catering to both students and the public.
Realization:	01/2023-12/2025
Coordinator:	Dana Stančeková (Faculty of Mechanical Engineering, University of Zilina)
Co-operator for FEEIT:	Ivan Litvaj (DPSED)

KEGA 033ŽU-4/2022: Implementation of geometric product specification language in the field of 3D coordinate metrology	
Summary:	Information technology is now an essential part of new forms of the educational process. They provide new possibilities and tools in education, thus allowing to make the process of education more attractive and, above all, more flexible. The presented project is aiming at implementing the latest knowledge presented in the newest international technical standards in the field of Geometric Product Specification (GPS) into the content of courses such as Mechanical Metrology, Quality Management in Mechanical Engineering, Measuring Methods and Instruments, Machining, and Design. The project is multi-disciplinary and focuses on the issue of understanding the GPS language at the application level, which cuts across the phases from design and manufacturing to product verification (validation). The project will result in the definition of a new learning approach by linking real and virtual measurement systems. Given the reliability, reproducibility, and efficiency of measurement systems, it is very important that students and professionals become familiar with the limits of their applicability and the conditions that affect their metrological properties. The aim of the project is to introduce and implement new strategies and procedures for the verification of products using 3D measurement systems and to transfer them to the educational process using multidisciplinary technologies, thus helping students to reach the level of knowledge required by the industry.
Realization:	01/2022-12/2024
Coordinator:	Mário Drbúl (Faculty of Mechanical Engineering, University of Zilina)
Co-operators:	Ivan Litvaj (DPSED)

KEGA 1/0241/2022 Mobile robotic systems as support during crisis situations	
Summary:	The scientific project is focused on the research of methods and approaches in the field of mobile robotic systems for the needs of emergency services intervening in crisis situations, e.g. in case of fires, biological threats, etc. The aim of the project is to theoretically process and laboratory verify the methods of data acquisition, their processing and subsequent decision-making (control) of a mobile robot based on the information obtained during a crisis situation. In the first phase of the project, the critical parts of the robotic system are defined and the principles of their operation are proposed, taking into account the demanding operating conditions during a crisis situation. The second phase is the implementation of the proposed methods and the verification of their functionality with the help of team members from the FBI UNIZA faculty, who have direct influence on the creation of intervention plans of the rescue services of the Slovak Republic. It will be

	possible to apply the proposed methods in the development and construction of robotic systems for the support of rescue services intervening during particularly dangerous crisis situations.
Realization:	01/2022 – 12/2024
Coordinator:	Rastislav Pirník (DCIS)
Vice-coordinator:	Aleš Janota (DCIS)
Co-operators:	Gregor Michal, Nemec Dušan, Hruboš Marián, Šimák Vojtech, Bubeníková Emília, Kanáliková Alžbeta, Andel Ján, Bujňák Marek, Pavol Kuchár

KEGA 023ŽU-4/2021: Developing intellectual competences and manual skills in STEM education	
Summary:	The goal is to develop manual skills and intellectual competences of students at all levels of education via summer courses, creation of new labaratory exercises for university students, lectures and demonstrations in Physics for elementary, secondary and high school students.
Realization:	01/2021 – 12/2023
Coordinator:	Peter Hockicko (DPh)
Co-operators:	Jozef Kúdelčík, Gabriela Tarjányiová, Štefan Hardoň (DPh)

KEGA 053ZU-4/2021: Innovation of MSc. study programme Electric Power Engineering at FEEIT UNIZA in the context of new requirements for power network automation and management	
Summary:	However, nowadays the power systems have to face significant changes, mainly connected with a massive implementation of information and communication technologies and computer technology, which are increasingly coming to the forefront in the management of the electricity system. One of the key elements ensuring the operational safety of the power system are modern power substations equipped with digital protection relays. However, building and design of such complex systems requires from the future designers, technicians and operators of these systems not only a profound knowledge of the construction and functions of all the individual elements, but also, in particular, obtaining a comprehensive view of all aspects of the distribution system an it's operation as a whole - the interactions of individual power apparatus, intelligent control devices, control system and operators. This change requires a redesign of the method and especially the approach to education of future graduates of the study program electric power engineering. The main goal of future education must be education focused on the ability of graduates to connect the classic areas of education in power system engineering (such as power flow, equipment of power substation, power network management, electricity generation, ...) with their equivalents in cyberspace, which already creates and provides space and tools for more efficient and economical operation of physical energy facilities as well as more reliable realisation of electricity system management objectives. Therefore, it is necessary to bring this connection closer to the students of electric power systems in an understandable way and in a form that is close to the current generation of students.
Realization:	01/2021– 12/2023
Coordinator:	Peter Braciník (DPSED)
Co-operators:	Marek Höger, Martina Kajanová, Michal Reguľa, Alena Otčenášová, Marián Tomašov, Marek Roch

Projects of European Structural Funds

ITMS 313011V334 Innovative Solutions for Propulsion, Power and Safety Components of Transport Vehicles	
Summary	Industrial research into the service life of automotive components of the next generation of vehicles. Research and development of hydrodynamic converters for streamlining the hybridization of propulsion systems. Research of electric drive control methods and development of new topological arrangements of traction converters. Research in optimizing the dynamics and energy of electric traction. Research and development in the field of optimal operation of battery systems. Development of ICT for increasing the safety of operational characteristics and increasing intelligence through self-learning algorithms. Analysis of mechanical properties of modern systems for vehicles in the form of HIL and PIL simulations and through test benches.
Realization:	09/2019 – 12/2023
Coordinator:	Pavol Špánik, Michal Frivaldský (DME), Pavol Rafajdus (DPES)
Co-operators:	Pavol Rafajdus, Pavol Makyš, Vladimír Vavrúš, Pavel Lehocký, Michal Reguľa, Martina Kajanová, Peter Braciník, Marek Roch, Peter Čendula, Pavel Šimon, Daniel Káčik, Ivan Martinček, Branislav Mičieta, Peter Mačuš, Jozef Buday, Marek Franko, Ing. Lubomir Sooš, Luboš Magdolen, Andrea Fedorková, Igor Kister, Vojtech Šimák

ITMS 313010ASK8: Independent research and development of technological kits based on wearable electronics products as a tool for raising hygienic standards in a society exposed to the virus causing the COVID-19 disease	
Summary:	The main goal of the project is to bring new knowledge in the field of optimizing the integration options of selected sensory and informational elements and subsystems in the environment of wearable electronics that can be used in the fight against the spread of the SARS-COV-2 virus causing the disease COVID-19.
Realization:	06/2022 – 06/2023
Coordinator (UNIZA):	Peter Danišovič (SvF)
Co-operators:	Peter Brída Juraj Machaj, Roman Jarina, Slavomír Matúška, Lukáš Ševčík, Jozef Dubovan, Ján Litvik, Darina Jarinová, Maroš Jakubec, Juraj Bienik (DMICT), Aleš Janota, Karol Rástočný, Rastislav Pirník, Peter Holečko, Emília Bubeníková, Alžbeta Kanáliková (DCIS)

ITMS 313011BUK9 - Support of research and development capacities in the field of generating advanced software tools designed to increase the resistance of economic entities against excessive volatility of the energy commodity market	
Summary:	Through research and development activities, to design, analyze, test, and verify requested solutions in the context of the issue of volatility in the energy commodity market, all based on knowledge leading to the selection of risk indicators that are present in the given energy trading processes on the market. Using the standard scientific, research and development and engineering procedures of the applicant and the partner, create a basic software framework that could contribute in a tangible way to the management of risks present within the processes associated with the provision of in-demand energy raw materials on the market, while eliminating the negative elements of market price volatility.
Realization:	09/2022 – 11/2023
Coordinator at FEEIT:	Peter Brída (DMICT)
Co-operators:	Róbert Hudec, Juraj Machaj, Patrik Kamencay, Miroslav Benčo, Bohumil Adamec

ITMS 313011AFG4 – DIGIBIOBANK: Creation of a Digital Biobank to support the systemic public research infrastructure	
Summary:	The project is focused on the so-called digital banking of medical data that will be related to a specific sample of biological material.
Realization:	06/2020 – 06/2023
Coordinator:	Michal Janovčík (VC)
Co-operators:	Alena Otčenášová (DPSED), Miroslav Benčo, Róbert Hudec, Patrik Kamencay, Peter Sýkora, Martin Paralič (DMICT)

ITMS 313011AFG5 – BIOFORD: Systemic public research infrastructure - biobank for cancer and rare diseases	
Summary:	Expansion and completion of research and innovation infrastructure and capacities for the development of excellence in research and innovation through the establishment of a biobanking system for cancer and rare diseases and its integration into the international network of research infrastructures.
Realization:	06/2020 – 06/2023
Co-operators:	Róbert Hudec (DMICT)

FEEIT projects to support young researchers

17142: Research of progressive quantification methods for evaluation of biological effects of nonionizing electromagnetic field	
Summary:	The project focuses on the effects of non-ionizing electromagnetic fields (EMF) on biological objects. The main objective of the project is objectification of non-ionizing EMF biological effects quantification from the cellular level based on in-vitro conditions, up to the organ and tissue level, including the possible impact on implants or wearable electronics. The project proposal will address two main themes, which can be defined based on the frequency range of investigated EMF as: 1. Investigation of the effects of extremely low frequency (ELF) and low frequency (LF) EMF at the cellular level; 2. Investigation of the effects of radio frequency (RF) EMF on the human body and wearable electronics. Both themes involve the design and use of advanced quantification methods and experimental protocols that are capable to reasonably contribute to the problematics of objectification and evaluation of experimental results and increase the knowledge and information level regarding the potential risks associated with exposure to non-ionising EMF, for both the scientific and general public.
Realization:	02/2022 – 01/2025
Coordinator:	Roman Radil (DEBE)
Co-operators:	Zuzana Judáková, Daniela Gombárska, Zuzana Pšenáková

17149: Innovative sensors and methods of biological signal sensing	
Summary:	The project intention reflects long-term forecasts of demographic development and the health of the population in the Slovak Republic and the EU, from which it follows that due to the increasing proportion of seniors in the number of medical personnel and the growing trend of the prevalence of civilization diseases, there will be enormously increased demands on the capacities of medical facilities. Furthermore, current trends are towards relatively cheap sensor systems and intelligent IT solutions, which will significantly contribute to the development of personalized out-of-hospital medicine based on automated systems, through which it is possible to monitor the state of health regularly and systematically. The

	presented project builds on the long-term development activities of the research team in this area. It primarily focuses on innovative ways of sensing and monitoring health status, especially regarding longer-term records and their automated processing, aiming to identify problem sequences and anomalies in the context of prevention and prediction of chronic diseases.
Realization:	02/2022 – 01/2025
Coordinator:	Maroš Šmondrk (DEBE)
Co-operators:	Branko Babušiak, Štefan Borik

17138: Polymeric laboratory on fiber for the measurement of the intereference of light in the spectral region	
Summary:	The main goal is to obtain new results in R&D of the polymeric photonic microsensors for the measurement of pressure, temperature, magnetic and electric fields and other physical quantities.
Realization:	02/2022 – 01/2025
Coordinator:	Matej Goraus (DPh)
Co-operators:	Ivan Martinček, Daniel Káčik, Daniel Jandura, Peter Gašo

17118: Innovative solutions and services in IoT	
Summary:	The goal of the project is the development of innovative solutions in the field of IoT. The projected outputs of the project will be new solutions and services built on the IoT platform using sensor data as well as location information. The project will define the architecture of the integrated IoT system and the competencies of partial parts. The proposed integrated IoT system will have the task of processing information from IoT devices and representing them to users. The research will be focused on the development of localization algorithms suitable for positioning in IoT. These algorithms are the basis for the development of services using location information. The research will also be focused on the development of HW and SW solutions for the smart chair system, which will be used for testing and data collection. The proposed solutions will also be able to be implemented in other areas such as smart transport, smart buildings or housing applications with neighborhood support.
Realization:	2022 - 2025
Coordinator:	Juraj Machaj (DMICT)
Co-operators:	Slavomír Matúška

17147: Quality of Experience for 5G networks (QoEfor5G)	
Summary:	The project is designed in three stages. In stage no. 1, the research will be focused on the complex analysis of the localization of mobile objects in the environment of 5G and B5G networks. In stage no. 2, the research will be focused on evaluating and ensuring QoE in the environment of 5G and B5G mobile networks. The quality assessment will focus on the impact of mobile network degradation on multimedia content. In stage no. 3, a model will be proposed for the dynamic control of multimedia flows in the network based on QoE requirements, while the control will use information about the location of users and devices connected to the mobile network. Individual stages make up the entire project. Each stage contains achievable goals within the time horizon of the project duration. We assume a high scientific level of the project, since the proposed innovative solution will bring with it new scientific results. The main goal of the project will be the publication of these scientific results in renowned impact journals.

Realization:	2022 - 2025
Coordinator:	Lukáš Ševčík (DMICT)
Co-operators:	Miroslav Uhrina

O-22-103/0011-07 Robotic systems for the support of rescue services	
Summary:	In the project, we will focus on the research of inspection and rescue robots in an uncontrolled environment (SAR tasks, English Search and Rescue), especially for the applications of searching and mapping the space affected by a fire or other extraordinary event. The basic goal of the project is the design and construction of a rescue mobile robotic system with subsequent theoretical design and laboratory verification of data acquisition methods, their processing and subsequent decision-making (management) of the rescue mobile robotic system based on the information obtained during an emergency situation. The obtained information will subsequently be provided to members of the emergency services in real time, which will enable effective management of the intervention, and thus also the reduction of damage to health and property.
Realization:	02/2022 – 1/2025
Coordinator:	Dušan Nemec (DCIS)
Co-operators:	Emília Bubeníková, Vojtech Šimák, Peter Holečko, Marián Hruboš, Ján Andel, Branislav Malobický

17125 Intelligent control and support systems in transport	
Summary:	As part of the transport systems, today we observe a constant increase in the volume of traffic, which leads to the emergence of congestion and traffic collapses, which has serious consequences - e.g. increase in emissions, negative effects on the environment and human health, but also considerable economic damage: both directly caused by delays and as a result of the deteriorated economic environment. The increasing volume of traffic also has an impact on traffic safety, not only in the context of cities, but also more broadly - e.g. in the context of tunnel systems, crossing security systems, etc. The long-term goal of the project and proposed research activities is to contribute to the development of new approaches and methods in the field of intelligent transport systems. The activities can be divided into three parts: (i) intelligent traffic management systems; (ii) support systems for intelligent transport; (iii) ancillary research activities. Among the supporting goals of the project is also the creation of an ecosystem for other projects in the same area.
Realization:	02/2022 – 01/2025
Coordinator:	Hruboš Marián (DCIS)
Co-operators:	Michal Gregor, Michal Skuba, Pavol Kuchár, Marek Bujňák, Aleš Janota, Rastislav Pirník, Juraj Ždánsky, Jozef Hrbček

Research of methods for investigation of operating and fault conditions of drives with multiphase asynchronous motor	
Summary:	The project is focused on the issue of optimizing the properties of a multiphase drive in operating and fault conditions. The scope of the project is the research of various machine topologies (stars, pentagon and pentagram connection) in terms of the efficiency of the entire drive. The second area of research is the investigation of fault conditions during failure of one and more phases of the motor. The result of this analysis will be the design of an algorithm to optimize the operation of the drive. The main purpose of this point is to reduce motor torque ripple in the fault

	state. The last step is a hardware reconfiguration of the motor windings to increase drive efficiency during a fault condition.
Realization:	02/2022 – 01/2025
Coordinator:	Michal Praženica (DME)
Co-operators:	Slavomír Kaščák, Jakub Kellner, Patrik Resutík

FEEIT projects to support researchers

Innovative solutions of nanocomposite dielectric materials for use in the field of electrical engineering and electromobility	
Summary:	The project involves the research and development of nanocomposite materials based on a bio-based base, with the end goal of improving the dielectric properties of the materials through doping with inorganic oxide nanoparticles. The research will occur on new innovative solutions for the production of insulation materials in electric rotating machines, distribution transformers, and batteries used for energy storage. Methods of dielectric, conductivity, and ultrasonic spectroscopy in a wide frequency and temperature range, using electric and magnetic fields, will be used to investigate the basic dielectric parameters. The processes taking place in the vicinity of nanoparticles and their influence on the change of structural, relaxation, and transport properties of the investigated materials are analyzed. These techniques will also investigate doped liquid crystals and magnetic fluids.
Realization:	2/2022 – 1/2025
Coordinator:	Jozef Kúdelčík (DPh)
Co-operators:	Janek Marián, Hardoň Štefan, Hockicko Peter, Bury Peter

Smart systems, networks and services	
Summary:	The architectures of optical and radio communication systems are becoming more and more complex with basic requirements for energy efficiency of operation, direction towards ultra-high transmission speeds and, last but not least, greater flexibility and dynamic properties that will meet the requirements of advanced communication infrastructure with higher demands on its quality, reliability, security and complexity. Classical methods used so far in designing communication systems and monitoring their properties are beginning to be replaced in many areas by systems of sophisticated analysis that lead to applications of deep learning methods, thereby supporting their development towards fully optical communications with varying degrees of intelligence and flexibility. It will also be important to support the security of these networks against adverse external attacks. The importance of such an understanding of the development of individual subsystems and architectures of communication systems will grow with the development of IoT and new requirements for sensors and sensor networks, in the structures of new architectures of communication networks based on optical and radio technologies. Along with the development of technologies, the segments of the provided services are also developing, in which algorithms and methods of machine learning and artificial intelligence are implemented. From the point of view of the team's scientific focus, its contributions will be oriented to the areas of communication network technologies, IoT sensors, machine learning, personalized medicine using new sensors and computer vision, network security, human behaviour in real and online space, etc.
Realization:	2022 - 2025

Coordinator:	Róbert Hudec (DMICT)
Co-operators:	Milan Dado, Peter Brída, Patrik Kamencay, Veronika Hromadová, Miroslav Hutár

Research on hybrid inverters solutions with adaptive option for serial-parallel modularity using EV Charging and advanced distribution network management	
Summary:	The project will be concentrated on the issue of solving the active rectifier with the possibility of two -way energy flow and the function of the powerist correction. Due to the increased interest of the use of renewable energy sources (photovoltaics) and energy storage, the need for optimization of the main circuit of the performance semiconductor system is crucially due to continuous increase in voltage levels at the input sources. With the development of semiconductor technology, this problem is most up -to -date, as the technology of SIC and GAN is not currently used in the solution of technological challenges. Within the project, attention focuses on the analysis of multi -level topologies of active rectifiers, the possibilities of using technologically new semiconductor as well as passive elements, and the ways in which it will be possible to achieve advanced management of distribution networks also in terms of electricity quality.
Realization:	02/2022 – 01/2025
Coordinator:	Michal Frivaldský (DME)
Co-operators:	Miroslav Gutten, Peter Braciník, Pavol Makyš, Martina Kajanová, Matúš Danko, Jozef Šedo, Jakub Škorvaga, Kristián Takács

New semiconductors for the production of hydrogen from solar energy with higher efficiency and lifetime	
Summary:	The goal of the project is to significantly advance the research of hydrogen production by means of synthesis, characterization and modeling of $CuFeO_2$ semiconductor and MoN catalyst, consisting exclusively of chemical elements readily available in the earth's crust. To achieve high purity and quality of CFO samples, we will use magnetron sputtering, but at the same time we will also prepare CFO by cheaper and scalable sol-gel synthesis. Photoelectrochemical measurements of CFO in stationary and transient conditions will be used to verify a new analytical and numerical model of charge transfer in CFO, which we will implement in this project. A transition metal doped MoN catalyst will be used to enhance hydrogen production on CFO. Finally, we determine the essential parameters of the semiconductor and the catalyst for comparison between the measurements and the theoretical model.
Realization:	02/2022-01/2026
Coordinator:	Peter Čendula (IAS)
Co-operators:	Stanislav Jurečka, Gabriel Cibira

UNIZA grant system – projects of Doctoral (PhD.) students

17299: Geomagnetic shielding by Mu-Metal	
Summary:	In the current technologically advanced and progressive era, we are constantly exposed to extremely low-frequency electromagnetic fields (0-300 Hz according to the WHO). The currently introduced term Electromagnetic Hypersensitivity is associated with the pathological functioning of the organism in connection with long-term exposure of fields to humans. Recently, the Department of Electromagnetics and Biomedical Engineering has been dedicated to monitoring the effects of Extremely Low-Frequency Electromagnetic Fields with grid frequency parameters and action values of magnetic flux densities of fields according to the

	International Commission for Protection against Non-Ionizing Radiation (ICNIRP). The recommendations of the commission for determining action values were adopted by the European Union according to 1999/519/EC and valid according to regulation 2013/35/EU. The use of ferromagnetic Mu-Metal as a shielding film of the Earth's magnetic field in the incubator and in the laboratory for investigating the impact of exposure to electromagnetic fields on organisms will serve not only to verify the prevention of these limit values but also to understand the movement of ions in the eukaryotic cells of Saccharomyces cerevisiae according to the theory of Ion Parametric Resonance.
Realization:	09/2022 – 08/2023
Coordinator:	Marek Bajtoš (DEBE)
Co-operators:	Milan Smetana, Ladislav Janoušek

17338: Hybrid investigation of autonomic neural and thermoregulatory mechanisms	
Summary:	The project focuses on sensing thermoregulatory mechanisms on the skin surface using two non-contact, non-invasive imaging modalities. The proposed hybrid measurement setup will be composed of a photoplethysmographic imaging (PPGI) device, which allows sensing changes in tissue perfusion related to the activity of the autonomic nervous system (ANS) in the optical area of the electromagnetic (EM) wave spectrum and a thermal imaging device consisting of a thermal camera, which allows sensing changes in skin surface temperature. The proposed measurement setup allows to complementarily combine information from both imaging modalities to assess thermoregulation processes on the skin surface of the human body. The presented project offers a partial solution in an attempt to contribute to the elucidation of ANS and thermoregulatory functions in the skin structure with the implementation of the proposed hybrid measurement setup.
Realization:	09/2022 – 08/2023
Coordinator:	Patrik Prôčka (DEBE)
Co-operators:	Štefan Borik, Ladislav Janoušek

18737: Optimization of Electric Vehicle Charging Station Operation: Integrating Renewable Energy and Battery Storage in Accordance with Agreed Power Consumption from the Electrical Network	
Summary:	This project focuses on proposing an optimization strategy for the operation of an electric vehicle charging station equipped with a renewable energy source and battery storage following the agreed power consumption terms from the electrical network. The primary objective is to design a responsive mechanism capable of adapting to the superior electricity network's requirements for altering the power consumed or supplied. Throughout the project, a tailored mechanism will be developed to effectively respond to the superior electricity network's dynamic demands. This mechanism will oversee the management of electric car charging within the station, concurrently regulating the utilization of power from renewable sources and battery storage to meet the stipulated requirements of the superior electrical network. The proposed mechanism's efficacy will undergo thorough verification through simulation, and practical implementation recommendations will be derived from the simulation results. This research aims to contribute to the efficient and sustainable integration of electric car charging stations within the broader electrical infrastructure.
Realization:	10/2023 – 09/2024
Coordinator:	Matej Tkáč (DPSED)

18738: Investigating the Impact of Load Changes and Distribution Network Modernization on Reactive Power Flow	
Summary:	A decline in the quality of consumed electricity has the potential to compromise the secure and reliable functioning of the transmission system. One contributing factor to this issue is the flow of capacitive reactive power from the distribution system to the transmission system. Recent years have witnessed shifts in electricity consumption patterns and modifications in the cabling of 22 kV networks, consequently affecting the flow of reactive power. This project focuses primarily on investigating the influence of lower voltage-level networks, characterized by numerous consumers and electricity producers, where pinpointing specific issues related to the generation of capacitive reactive power proves challenging. The analysis will delve into the feed point on the primary side of the 110/22 kV transformers, scrutinizing the capacitive reactive power flows within the networks affecting this feed point. The findings will be instrumental in proposing specific measures aimed at mitigating the impact of these flows and ensuring the robustness of the electrical infrastructure.
Realization:	10/2023 – 09/2024
Coordinator:	Pavel Stanko (DPSED)

KOR/3095/2022: Lattice binding elements based on silicon nitride	
Summary:	With the exponential increase in the amount of data transferred, the demands on the connections inside the data centres are increasing. For these purposes, it is necessary to reduce the price, energy consumption and dimensions of the equipment used. Integrated photonics is a promising field that offers solutions for these requirements. However, due to the small size of the integrated chip, there is a challenge of how to efficiently couple the light between the optical fibre and the chip. Optical interfaces based on grating couplers represent an attractive solution to this problem. However, the challenge with this type of device is low bandwidth and polarization sensitivity. In this scientific research project, we will address these challenges through the design of a silicon nitride-based coupling element that will meet strict criteria for compatibility with industrial-oriented production. As a platform for passive devices, silicon nitride offers low transmission loss and greater bandwidth compared to traditional devices made of silicon.
Realization:	09/2022 - 08/2023
Coordinator:	Radovan Korček (DMICT)
Co-operators:	Daniel Benedikovič

17258 Control of a force-responsive robot based on visual inputs from the operator	
Summary:	The project deals with the expansion of the existing robotic workplace, where it will be possible to design and implement a method for controlling a collaborative robot using gestures and creating a robotic assistant for feeding tools.
Realization:	09/2022 – 08/2023
Coordinator:	Branislav Malobický (DCIS)
Cooperators:	Marián Hruboš, Aleš Janota

17296: Intelligent road traffic control	
Summary:	This project is focused on the design of a framework for the processing of various algorithms for traffic management.
Realization:	09/2022 – 08/2023
Coordinator:	Michal Skuba (DCIS)
Project leader:	Aleš Janota

17300 Safe identification of the number of passengers in vehicles	
Summary:	This project is focused on the design of a comprehensive system for detecting passengers in vehicles in road transport. During the deployment of the system, the passengers in the vehicles will be scanned non-invasively with the help of external sensors and the data will be processed using neural networks.
Realization:	09/2022 – 08/2023
Coordinator:	Pavol Kuchár (DCIS)
Cooperators:	Rastislav Pirník, Aleš Janota

UNIZA grant system – projects of young scientific-pedagogical employees under 35 years of age

17302: Functional mapping of dermal tissue perfusion in allergology	
Summary:	The project aims to link non-contact photoplethysmography imaging (PPGI) using the application of optical radiation to the subcutaneous region and the evaluation of spatial changes in tissue perfusion induced by cutaneous allergic reactions. PPGI using appropriate camera systems can be classified as a modern, non-invasive and non-contact method of cardiovascular system (CVS) diagnosis. Thus, in the form of a PPGI measurement system, we obtain a tool for innovative diagnosis of the body's responses to various external stimuli, where we can also include e.g. skin allergic reactions. The present project offers a partial solution in an attempt to contribute to the specific diagnosis of allergic reactions as manifestations of increased tissue perfusion in the form of the implementation of a PPGI system.
Realization:	09/2022 – 08/2023
Coordinator:	Štefan Borik (DEBE)
Co-operators:	Patrik Prôčka, Ladislav Janoušek

17313: Increasing credibility and equity of redemption of experimental results from electromagnetic radiation of biological cultures	
Summary:	The project reflects requirements of scientific community on increasing credibility of experimental results of non-thermal effects of extremely low frequency electromagnetic field (ELF EMF) on Saccharomyces cerevisiae cells in vitro conditions. The standard approach of cells counting on Burker chamber is very time consuming and the results are strongly influenced by a human factor. It is thus needed to compare results that are not influenced by several uncertainties in order to assure reliable interpretation of the ELF EMF biological effects. Aim of the project is to realise statistically important sets of the experiment and the cell counting would be done by an automatic cell counting instrument. This approach would significantly decrease experimental uncertainty an increase the results credibility.
Realization:	09/2022 – 08/2023
Coordinator:	Michal Labuda (DEBE)
Co-operators:	Zuzana Judáková, Ladislav Janoušek

17385: Device for monitoring gait dynamics	
Summary:	The project's goal is to respond to the growing trend in the field of wearable electronics monitoring various vital functions and physiological manifestations of the user during normal daily activities. Among the essential physiological manifestations of the human body is movement activity in the form of locomotion. The result of the project should contribute to relieving the burden on medical staff and increasing the diagnostic value of gait monitoring in the form of a sensory device that will be able to monitor the dynamic parameters of gait in real-time, thus enabling regular and systematic measurement of our movement activities even in an out-of-hospital environment. The project aims to design and produce a wearable device for sensing planar pressure and reaction forces by means of piezoresistive force sensors and inertial sensors. The device concept consists of a sensory shoe insert with implemented sensors and a control-communication unit.
Realization:	09/2022 – 08/2023
Coordinator:	Maroš Šmondrk (DEBE)

17719: Non-contact evaluation of local muscle load based on perfusion changes in the muscle and surrounding tissues	
Summary:	The project focuses on studying the influence of static and dynamic contractions on muscle and tissue perfusion in its vicinity. Evaluating muscle condition in terms of perfusion using the non-contact photoplethysmographic imaging (PPGI) method is equally important as monitoring local muscle load. The legislation of the Slovak Republic, decree No. 542/2007 Coll., addresses the monitoring of local muscle load, primarily considering the electrical activity generated by skeletal muscles (EMG). However, for a thorough and precise evaluation of muscle condition, it is essential to take into account the state of the cardiovascular system and its ability to supply the muscle with the necessary nutrients and oxygen required for its activity. This project offers a unique perspective on the evaluation of local muscle load, which may contribute to greater objectivity in its assessment.
Realization:	10/2023 – 10/2024
Coordinator:	Michal Labuda (DEBE)
Co-operators:	Ladislav Janoušek

18771 Innovation of the arm intended for measuring the physical condition of a person	
Summary:	The project is focused on the innovation of an arm designed to measure a person's physical condition. The arm with the converter and the motor were created as part of the grant project in 2022. The new PLC will ensure the control, setting of the system and display of the necessary results on the local display. A friendly, local and remote user interface will be designed and created. The innovation will also include the application of new security functions ensuring the safety of the tested persons. The created system will be portable and will be used for presentation activities and also as a teaching aid.
Realization:	10/2023 – 9/2024
Coordinator:	Marián Hruboš (DCIS)
Cooperators:	Jozef Hrbček, Aleš Janota

UNIZA Grant system (14882): Implementation of the intelligent classroom subsystem into the connected university system	
Summary:	The Internet of Things (IoT) technology has experienced a global boom in recent years and finds application not only in various sectors of the economy but also in the everyday lives of ordinary people. The goal of the proposed project is the implementation of the intelligent classroom subsystem into the connected university system (available on the public domain https://connectedduniza.sk), which was also created with the support of an internal grant from 2021/2022. The smart classroom subsystem will include a smart chair prototype. The smart chair senses the weight distribution of the sitting person using pressure sensors and sends this information to the server for further processing. After the evaluation, the information about the correctness of the session is then displayed to the user using a mobile application on the phone. solution of the connected university system from the previous year.
Realization:	09/2022 - 08/2023
Coordinator:	Slavomír Matúška (DMICT)

UNIZA Grant system (17713): Binaural separation in a reverberant environment	
Summary:	In the real acoustic conditions that surround us every day, stationary conditions are not met. On the contrary, sound sources change their number and are found in different reverberation conditions. In contrast to today's deep learning approaches, our hearing works not only on the basis of previous experience ("training") but also on the basis of blind separation (BSS), because it can to some extent deal with the dynamics of acoustic conditions such as convolutional combination caused by a reverberant field or dynamic change of musical structures. For further progress in the field of MSS and its use for real acoustic conditions, it is necessary to create a more generalized and robust separation. This project aims to create hybrid structures, working with combinations of different approaches to separation, which can be used in different areas of audio processing, mainly hearing aids and cochlear implants.
Realization:	10/2023 – 09/2024
Coordinator:	Peter Kasák (DMICT)
Co-operators:	Róbert Hudec

UNIZA Grant system (17686): Innovative teaching of computer 3D graphics and 3D animation	
Summary:	This project focuses on innovative teaching of computer 3D graphics and 3D animation. The goal of the project is to provide students with modern tools and techniques that will enable the creation of visually impressive and creative 3D graphic and animation works. The project will include extensive teaching resources that will be adapted to the needs of students with different levels of experience. The result of the project will be a group of students with excellent skills in the field of 3D graphics and animation, who will be able to successfully apply their skills in various fields of industry, medicine, transport, etc.
Realization:	09/2023 - 08/2024
Coordinator:	Róberta Hlavatá (DMICT)

UNIZA Grant system (18780): Adaptive streaming based on maximum QoE satisfaction	
Summary:	The goal of the project is to expand the database of 4K video sequences created by us, which will be shot by other devices, transcoded to various quality settings, and evaluated by subjective and objective metrics. The dynamism of the given scenes will be determined by calculating the spatial and temporal information of each

	scene. Sequences will be shot to cover all quadrants. They will be used in the analysis of quality requirements and subsequent recommendations of appropriate settings to achieve maximum QoE (Quality of Experience) satisfaction. Within the project, we would use variable bit streaming (VBR) based on our recommended value, which will guarantee the required level of QoE. We would thus determine a suitable bit stream for individual video scenes characterized by their dynamism. Likewise, we would also test adaptive streaming based on the quality of network parameters, where we will exploit the network using a simulation tool. We will compare the results with a constant bit rate (CBR).
Realization:	10/2023 - 09/2024
Coordinator:	Lukáš Ševčík (DMICT)

18764: Creating a model of an apartment unit with a smart installation	
Summary:	The practical application of a smart installation embodies home automation. The centralized control system integrates all commonly used household devices, including lights, blinds, heating, irrigation and alarm systems, along with their associated control and regulation elements. This system enables comprehensive control of home elements from a single point, accessible through a smartphone, tablet, or other devices. Additionally, the installation incorporates conventional wall switches enhanced with supplementary functions. The primary objective of this installation is to establish seamless automation by utilizing sensors of non-electric quantities such as light intensity, temperature, humidity, movement, smoke and more. This approach ensures that desired household processes occur with minimal manual intervention, thereby enhancing overall comfort and convenience in daily living.
Realization:	10/2023 – 09/2024
Coordinator:	Marián Tomašov (DPSED)

Other National Research Projects

Name	**Coordinator**
Phenomenology and Outreach (FEPO), Agreement between Ministry of Education SR and University of Žilina	Ivan Melo (DPh)
Analysis of 3-phase inverter options	Michal Frivaldský (DME)
Feasibility Study for the National Broadband Plan	Milan Dado (DMICT)

Other National Non-research Projects

Name	**Coordinator**
Transformer coil tests	Vladimir Vavrúš (DPSED)
Professional training Fit for Mechatronics	Michal Frivaldský (DME)
V3 Žilina Childrens University 2023	Peter Hockicko (DPh)

Submitted Proposals of International Research Projects in 2023

Type / call	Name of the project	Outcome of evaluation
NATO SPS	Advanced technologies for Physical ResIlience Of cRitical Infrastructures (APRIORI)	supported
COST	GREen-ENergy-trAnsition - JunCTION-NETWORK	not supported
HORIZON-CL5-2023-D6-01	Enabling Seamless Continuity for CAV's ODDs through Infrastructure-enabled Solutions	not supported

Research for Practice; the Most Important Realized Outputs

DPh:

Project number: Advanced 3D optical splitters for photonics
Číslo projektu: SK-AT-20-0012
Coordinator: Dušan Pudiš
Summary / Achievement: The project was focused on the development of a complete process of new polymer optical splitters with a unique 3D geometry for photonic applications using a 3D lithography system. The whole process was from design to preparation, simulation of properties to optimization of the divider, including its inlet and outlet parts and the dividing part itself. The project was successfully solved up to the result of several 3D multimode optical splitters with division ratios of 1x4, 1x9 and even an asymmetric arrangement of 1x6. Dividers produced in this way have an extremely small volume with regard to the number of dividing branches, where the length of the prepared dividers ranges from 200 to 300 micrometers. All these results were published in important journals and presented at important conferences. The entire developed process method shows a new way of prototyping complex 3D optical splitters for on-chip and nanotechnology applications.

Name of the project: 3D photonic polymeric microsensors integrated with optical fibers
Číslo projektu: APVV-19-0602
Coordinator: Ivan Martinček, PhD.
Summary / Achievement: The research team developed prototypes of polymer photonic sensors and verified their sensing properties on structures made of polydimethylsiloxane (PDMS) integrated with optical fibers. The developed sensors created an interference optical signal in the Fabry-Pérot (FP) cavity created between the end of the optical fiber and the beginning of the PDMS layer, while the interior of the FP cavity was filled with air or solvent vapors in the air. By investigating the swelling properties of PDMS measured through an interference signal, which was measured in both the frequency and time domains, it was possible to determine the swelling kinetics of PDMS in isopropanol, acetone and toluene. From a broader point of view, it was possible to develop an innovative method of measuring the swelling properties of polymers in vapors of substances, which allows determining the swelling kinetics of polymers on microscopic polymer samples within a few tens of seconds to minutes.

Name of the project: Developing intellectual competences and manual skills in STEM education
Číslo projektu: KEGA 023ŽU-4/2021
Coordinator: Peter Hockicko
Summary / Achievement: As part of the project, the Children's University of Žilina was organized every year for primary school students (2021 - distance learning due to covid, 2022, 2023 - face-to-face) in which lectures, exercises, visits to laboratories were organized for primary school children. Lectures were organized for secondary school students either at UNIZA or in their local schools. For students coming to study at the university, summer courses (Physics Course) were prepared every year, the increase in knowledge was

monitored by testing their knowledge, three scripts were prepared: Interactive tasks from physics and Instructions for laboratory exercises 1 with new laboratory tasks, Physics and acoustics in presentations . Several meetings were organized for secondary school teachers, gymnasiums and pedagogues working at universities within the educational section of the Elektro 2022 conference (Krakow), the Actual problems of physics education and their solutions conference (Zuberec, UNIZA center) 2023. Results of student testing at the beginning and end of the course, mutual comparison, comparison of experimental and control group results were presented at domestic and foreign conferences. It was confirmed that by using interactive methods it is possible to achieve better results in the teaching process.

DEBE:

Name of the project: Biocompatibility and objectification of the grid frequency electromagnetic field in densely populated areas (LIFE)
Project number: APVV-19-0214
Coordinator: Milan Smetana
Summary / Achievement:

1. Critical survey of electromagnetic field levels with a frequency of 50 Hz in densely populated areas of the Slovak Republic.
2. Proven methodology for calculating electromagnetic field values in the vicinity of HV/LV transformer electrical stations in stable operating modes.
3. Research of potential biological effects and definition of measures aimed at reducing health risks in connection with long-term exposure of residents to low-frequency electromagnetic fields.
4. A website that summarizes all the above-mentioned outputs in a suitable form and offers the general professional and lay public an overview of the current levels of the electromagnetic field of the network frequency in selected densely populated areas of the Slovak Republic, as well as adequate information regarding possible health risks and measures to prevent them, or how to reduce the effects of electromagnetic field exposure.

Name of the project: Research and development of lower limb prosthetic sockets manufactured by additive technologies (PSAMBS)
Project number: APVV-19-0290
Coordinator: Jozef Živčák, Technical University in Košice
Coordinator za FEEIT UNIZA: Ladislav Janoušek
Dosiahnuté výsledky:

1. Design methodology of transfemoral bed using CAD software.
2. Design methodology of transtibial bed using CAD software.
3. Methodology of additive manufacturing of prosthetic beds.
4. Methodology of 3D scanning of the transtibial shin.
5. Sensory system for measuring pressure ratios at selected places in the prosthetic bed.

DME:

Name of the project: Research of methodologies to increase the quality and lifetime of hybrid power semiconductor modules
Project number: VEGA 1/0063/21
Coordinator: Michal Frivaldský
Summary / Achievement: The scientific goals of the project include the creation of a methodology for identifying the elements of the electrical equivalent diagram of an electrochemical cell depending on its charge level. Through this methodology, it is subsequently possible to create a simulation model of an electrochemical cell, for the needs of simulating electrotechnical systems in the time domain.
Other scientific goals can also be categorized as a proposal for a solution for the creation of an automated laboratory measuring station for the needs of identification, or regeneration of electrochemical cells. A very

important scientific goal was also the investigation of the rate of regeneration of electrochemical cells that reached the end of their 1st cycle life. From the point of view of evaluating the tangible and intangible outputs of the project application, it can be concluded that all these outputs were fully achieved.

Name of the project: Modern education methods in analysis, modeling and control of Power Semiconductor Systems
Project number: KEGA 018ŽU-4/2021
Coordinator: Michal Praženica
Summary / Achievement: As part of the project, the laboratory was modernized with new computer technology, a publicly available educational website https://vps.kme.uniza.sk/ was also created, which also includes an online simulator. During the implementation of the project, university scripts "PERFORMANCE SEMICONDUCTOR SYSTEMS ANALYSIS, MODELING AND SIMULATION" and a chapter in a professional monograph under the title "LAPLACE-CARSON TRANSFORM UNDER NON-HARMONIC EXCITING FUNCTIONS AND ITS TRANSIENT APPLICATIONS" were created in electronic form and freely available, and 12 other contributions to 5 scientific conferences (at home and abroad) and 2 contributions in CCC journals with assigned Q2. During the implementation of the project, 1 bachelor's, 2 diploma theses and 1 doctoral dissertation were solved (still in progress). During the implementation of the project, excursions to the companies SEMIKRON and BEL POWER SOLUTION were carried out for the students, and training was also carried out for the employees of the company SEMIKRON.

DPSED:

Name of the project: Innovation of MSc. study programme Electric Power Engineering at FEEIT UNIZA in the context of new requirements for power network automation and management
Project number: KEGA 053ŽU-4/2021
Coordinator: Peter Braciník
Summary / Achievement: During the implementation of the project, a new structure and content of four profile subjects was proposed in the master degree of the study program Power Electronic Systems - Specialization in Electrical Power: Automation of Power System Control, Protection of Power Networks, Projecting in Electric Power Engineering and Control of Power Systems. By completing these subjects, students will acquire key competencies related to the automation of management and operation of electric power networks, which future graduates should master.
At the same time, a unique laboratory was built, which will enable the realization of identified goals and proposed methods of education within the framework of exercises of innovative subjects and project-based teaching of students. It is about the creation of a functional model of an electrical station in the form of a control panel within the local dispatching, which combines real and simulated hardware. The model enables connecting knowledge and strengthening skills from various areas of power station operation. Students thus have the opportunity to acquire habits that will make them better prepared to enter practice.

Name of the project: Research of side effect of modern control techniques on efficiency of electrical drive
Project number: VEGA 1/0795/21
Coordinator: Pavol Makyš
Summary / Achievement: The most important result of the project is a new PMSM engine control algorithm based on the principle of scalar control supplemented by the MTPA algorithm. The results prove that in certain applications, this algorithm is fully comparable to the much more complex vector control with sensorless mode from the point of view of the quality of regulation and achievable efficiency. Usability is mainly proven by the submitted utility model applications and the patent application entitled "Field oriented control of permanent magnet synchronous motor with constant power factor control independent of the machine parameters", Patent ID: 8235042950429, 16 March 2023, authors Michal Vidlak, Lukas Gorel, Tomas Kulig.

Conferences and seminars

The Faculty of Electrical Engineering organized, or participated in preparation of the following scientific events in 2023:

- Progress in Applied Surface, Interface and Thin Film ScienceNázov podujatia, 20. 11. – 22. 11. 2023, Bratislava, SUZA SAV, responsible organizer: Stanislav Jurečka
- Advances in electronic and photonic technologies, 12. 6. - 15. 6. 2023, Podbanské, organizer: Dušan Pudiš.
- International Masterclasses 2023 for high schools 14. 2. - 16. 2. 2023, University of Žilina, organizer: Ivan Melo
- Problems of Physics education, 13. 9. - 14. 9. 2023, Zuberec, UNIZA, organizer: Peter Hockicko
- 17th international conference on railway communication and safety technology, 24. 4. - 26. 4. 2023, Košice, main organizer: Betamont s.r.o., Zvolen, co-organizer for DCIS: Aleš Janota.

Publication activities

The permanent task of the Faculty is to increase the publication activity in quality journals which are indexed in international professional databases.

The outputs of the faculty's publishing activities in the period 2017-2023 in the perspective of categorization according to Decree No. 456/2012 until 2021 and according to Decree No. 397/2020 from 2022 is summarized in the following table.

Tab. 13: The outputs of the faculty's publishing activities in the period 2017-2023

Code	Category name	Code	Category name	2017	2018	2019	2020	2021	2022	2023
V3	Scientific output of publication activity from the journal	ADC	Scientific papers in foreign peer-reviewed journals	52	34	26	44	58	106	84
		ADE	Scientific papers in foreign non peer-reviewed journals	14	17	9	6	1		
		ADF	Scientific papers in other domestic non peer-reviewed journals	8	8	26	10	3		
		ADM	Scientific papers in foreign journals registered in the WoS or SCOPUS databases	17	9	22	30	15		
		ADN	Scientific papers in domestic journals registered in the WoS or SCOPUS databases	7	13	9	10	7		
V2	Scientific output of publication activity as part of an edited	AFC	Published papers at foreign scientific conferences	72	145	84	175	58	188	119
		AFD	Published papers at domestic scientific conferences	79	53	123	27	66		

	book or collection									
V1	Scientific output of publication activity as a whole	AAA	Scientific monographs published by foreign publishers	1	0	0	0	0	1	4
		AAB	Scientific monographs published by domestic publishers	1	2	1	3	3		
P1	Pedagogical output of publication activity as a whole	ACA	University textbooks published by foreign publishers	0	0	0	1	1	5	6
		ACB	University textbooks published by domestic publishers	4	1	0	3	1		
		BCI	Scripts and textbooks	4	1	3	2	6		
O3	Odborný výstup publikačnej činnosti z časopisu	BDF	Professional papers in domestic non peer-reviewed journals	5	2	1	1	0	0	1
TOTAL (selected categories)				264	285	304	312	219	300	214
TOTAL (all categories)				**339**	**338**	**368**	**343**	**243**	**322**	**239**

Awards

- Peter Hockicko: Slovak Physical Society Prize for Pedagogy 2023
- Michal Labuda: 1st place - competition of the best PhD. thesis defended in 2021-2022 in the category „Health and Applications in Healthcare“, March 2023, VŠB Technical University Ostrava and consortium PROGRES 3, Czech Republic
- Štefan Borik: 2nd place - the best evaluated projects in the category of young scientific and pedagogical employees, UNIZA grant competition - call no. 1/2022
- Maroš Šmondrk: 3rd place - the best evaluated projects in the category of young scientific and pedagogical employees, UNIZA grant competition - call no. 1/2022
- Patrik Prôčka: 2nd place - the best evaluated projects in the category of PhD. students, UNIZA grant competition - call no. 1/2022

Habilitations and Inaugurations

Tab. 13: Number of habitations and inaugurations within last twelve years

Year	Habilitation		Inauguration	
	Internal	External	Internal	External
2008	2	5		3
2009			1	1
2010			2	
2011	3		2	

2012	5			
2013	2			1
2014	6	1	3	
2015			2	
2016	2		1	
2017	1		1	
2018	2		2	
2019	1		1	
2020	8			
2021	5		2	
2022	1		1	
2023	1		1	

FOREIGN ACTIVITIES

Foreign activities of the Faculty of Electrical Engineering and Information Technology (FEEIT) in 2023 were developed in connection with the solution of international projects, active participation in foreign scientific and professional events and also mutual mobility of teachers, researchers and students at foreign institutions.

From the point of the implementation of foreign projects, the implementation of the project within the call DIGITAL-2022-CLOUD-AI-02 called TEF-HEALTH - Testing and Experimentation Facility for Health, has started. TEF-Health will provide standards for certification and quality control to facilitate the access of trusted AI to the market and ensure its simple and effective evaluation.

The scientific project APRIORI (Advanced technologies for Physical ResIlience of Critical Infrastructures) started to be solved, financed from the resources of the NATO organization. The project aims to provide innovative technologies for the entire management cycle of critical infrastructures.

The implementation of the project focused on the European space program continued, within the ESA (European Space Agency) scheme, in cooperation with industrial partners SPINEA Technologies (SK) and THALES Alenia Space (FR), which deals with the development of advanced electronic systems for powering building blocks of space robotic arms.

The Erasmus+ project A lexicon of educational films on the subject of STEM for primary and secondary school students - Films4edu: no. 2020-1-PL01-KA226-SCH-096354, was successfully completed in cooperation with 5 other foreign institutions.

The Faculty successfully continues in the participation in the "Double degree program" in the study field "Electrical Engineering" with the partner University of Catania in Sicily, Italy. Five students from the partner university studied at FEEIT also in the academic year 2022/2023.

Dean’s office gets information from various agencies and institutions about offered study stays, government scholarships, summer schools, excursions, work offers, foundations and so on. The information is effectively disseminated using modern communication means to the faculty staff as well as to the students.

Programmes supporting educational activities

Program ERASMUS+

Within the frame of Erasmus+ programme, bilateral agreements with 29 foreign universities were approved for students / teachers / other staff exchanges for the academic year 2022/2023, as follows:

1. University of West Bohemia (CZ)
2. Czech Technical University in Prague (CZ)
3. VŠB-Technical University in Ostrava (CZ)
4. Technical University of Liberec (CZ)
5. RWTH Aachen (DE)
6. Hochschule für Technik und Wirtschaft Dresden (DE)
7. Technische Universität Ilmenau (DE)
8. Universitat Autonoma de Barcelona (ES)
9. University of Jyväskylä (FIN)
10. Aalto University (FIN)
11. University of Vaasa (FIN)
12. Université de Technologie de Compiègne (FR)
13. University of Patras (GR)
14. Budapest University of Technology and Economics (HU)

15. University of Catania (IT)
16. Universita degli Studi di Palermo (IT)
17. Riga Technical University (LV)
18. Kaunas University of Technology (LT)
19. Universidade da Beira Interior (PT)
20. Universidade do Porto (PT)
21. Instituto Politecnico de Braganca (PT)
22. Kazimierz Pulaski University of Technology and Humanities in Radom (PL)
23. Lublin University of Technology (PL)
24. West Pomeranian University of Technology (PL)
25. Gdansk University of Technology (PL)
26. Cracow University of Technology (PL)
27. Universitatea "POLITEHNICA" din Bucuresti (RO)
28. Gheorghe Asachi Technical University of Iasi (RO)
29. University of Maribor (SI)

Erasmus+ stays

In the academic year 2022/2023 45 students (thence 18 students for Erasmus+ practical placements) participated in the Erasmus+ programme and 28 teachers/ employees from FEEIT participated in the Erasmus+ programme.

The Faculty accepted altogether 14 foreign students and 15 teachers/ employees from partner universities.

Other scholarship programmes

In the academic year 2022/2023, the following mobilities were relized from FEEIT:

- 4 students studied at the foreign universities within the National Scholarship Programme of the Slovak Republic,
- 1 teacher was accepted within the National Scholarship Programme of the Slovak Republic.

The Faculty accepted in the academic year 2022/2023:

- 4 students within the National Scholarship Programme of the Slovak Republic,
- 4 foreign student within the CEEPUS program,
- 5 foreign students within the "Double degree program".

Other activities

The Faculty of Electrical Engineering and Information Technology cooperates in the frame of bilateral agreements with the following institutions:

- Technische Universität Ilmenau (DE)
- Universita degli Studi di Catania (IT)
- Tohoku University (JP)
- University of Novi Sad (RS)
- Cracow University of Technology (PL)
- The Indian Institute of technology Indore (IN)

Purpose of these agreements is to enhance academic exchange and co-operation in the field of education and research. The co-operation programme involves especially the following activities:

- exchange of students,

- exchange of faculty members and staff,
- exchange of scientific materials, publications and information,
- joint research and research meetings,
- cooperation within the Doctoral study (mainly with University of Catania (IT)).

In addition, FEEIT cooperates with many other international institutions, in particular:

- University of Strathclyde, Glasgow (UK)
- Tokyo University, Tokio (JP)
- DFCM ISIR Osaka University (JP)
- National Research Council, Ottawa (CA)
- CERN, Ženeva (CH)
- Málaga University (ES)

A detailed list of institutions is presented in the annual reports of the departments.

Foreign stays, visits and conferences

Employees of the Faculty performed in 2023 several short or long stays in foreign countries at partner universities or institutions, and on the contrary, FEEIT and its departments accepted teachers from abroad.

An overview of the number of people who arrived at FEEIT or left FEEIT as part of foreign stays (in addition to Erasmus+ and NŠP SR) and visits is shown in the following table.

Tab. 14: Foreign stays, conferences and visits in 2023

Foreign stays and visits in 2023							
Country	**Department (IN/OUT)**						
	DPh	**DEBE**	**DME**	**DPSED**	**DCIS**	**DMICT**	**IAS**
Czech Republic		3 / 1		1 / 0	0 / 1		
Finland				0 / 1			
Greece							
Hungary	0 / 1						
Germany		0 / 1			2 / 0		
Poland	0 / 2	1 / 0					
Austria					0 / 2		
Italy	0 / 2						
USA		0 / 1					
Total	**0 / 5**	**4 / 3**	**0 / 0**	**1 / 1**	**2 / 3**	**0 / 0**	**0 / 0**
Total all	**7 / 12**						

Employees of the FEEIT published and/or took part in some international conferences, workshops and symposiums. Detailed information about particular names of employees, titles of papers and conferences,

activities performed during the study stays and purposes of foreign visits are presented in annual reports of the departments of FEEIT for 2023.

Membership in International Institutions/Committees

Employees of the Faculty of Electrical Engineering and Information Technology, respectively the departments as a whole, are members of many national and international institutions/organizations/committees of international journals, conferences, in scientific boards and trade committees, and so on.

Detailed information about memberships are presented in annual reports of the departments of FEEIT for 2023.

MAIN TASKS OF THE FACULTY FOR THE YEAR 2024

The development of FEEIT will continue in accordance with the Long-term plan of the Faculty for the period 2021-2027, which was approved by the Scientific Board of FEEIT on 15th Faberuary 2021, while in the process will be incorporated knowledge obtained from the practical implementation of the activities proposed in the framework program. The basic strategic goal is permanent developing of the Faculty as a prestigious educational and research institution with a prominent place among Slovak faculties, which has a significant international recognition in the most offered study programmes and fields of research and development.

The development of the Faculty will also include the improvement of the infrastructure by building a modern meeting room in the premises of the dean's office and the faculty ICT laboratory designed to support the teaching of IT subjects.

Field of education

- To ensure the quality of education in terms of the new standards of the quality of education and the established internal quality system at UNIZA.
- To get better feedback from students about their satisfaction with the education provided at FEEIT for the optimization of educational activities.
- Organize a meeting of the faculty management with the academic community of the faculty once a year.
- Within the marketing activities, continue the implementation of at least one event directed towards primary schools and twenty actions directed towards secondary schools in order to inform students of schools about study possibilities at FEEIT.
- As part of marketing activities, implement at least one event towards primary and twenty events towards secondary schools to increase the awareness of secondary school students about the possibilities of studying at the FEEIT.
- Organize at least 2 faculty open days for high school students.
- As part of improving cooperation with secondary schools, continue offering and implementing individual visits of secondary school students to the faculty in the form of specialized laboratory exercises.

Field of science and research

- Active participation in the organization of conferences/seminars/events;
- In accordance with plans to realize the qualification growth of faculty members;
- Organization and promotion of Student Scientific Competitions for all three study degrees and to focus attention on the possibility of participation of the faculty students at the organized national and international students' competitions;
- Monitoring and at least twice a year evaluation of accreditation criteria;
- Evaluation of the submitted project proposals to national and international funding agencies twice a year;
- Improve the cooperation with industrial partners and other institutions;
- Define areas of relevant scientific and research activities at the Faculty, including the staff;
- Monitoring and control of scientific research activities and related outputs;
- Preparaton of grant calls for young researchers and other FEEIT researchers.

Field of international cooperation

- Development of tools for more efficient engagement of research groups in the EU Framework Programme for Research and Innovation HORIZON 2020 and other European programs as COST, cross-border cooperation and cooperation with foreign industrial partners;
- Improve the propagation and support of students' and teachers' mobility within the framework of the internationalization of education in order to increase the quality and number of mobilities;
- Create conditions for more effective international cooperation in terms of accreditation standards;
- Attractiveness of the faculty's educational system for international students;
- More prominent presentation of study opportunities in Eastern European countries.

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