UNIVERSITY OF ŽILINA

FACULTY OF ELECTRICAL ENGINEERING AND INFORMATION TECHNOLOGY

ANNUAL REPORT 2022

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 eight departments (seven departments located directly in Žilina and one institute established at the satellite work place in Liptovský Mikuláš; the Department of Measurement and Applied Electrical Engineering was abolished on May 12, 2022), 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 Measurement and Applied Electrical Engineering (DMAEE) – abolished on May 12, 2022
- 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. 2022.

Tab. 1: Number of pedagogical and research employees at the departments of FEEIT as of 31. 12. 2022

Department	Pedagogical staff		Research staff	
	Full-time	Part-time	Full-time	Part-time
DPh	14	3	2	1
DEBE	9	2	1	1
DME	14	3	4	15
DPSED	10	3	3	2
DCIS	13	1	-	-
DMICT	22	4	3	-
IAS	5	-	-	-
Total	**87**	**16**	**13**	**19**

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 2016 - 2022

Year	2016		2017		2018		2019		2020		2021		2022	
Full-time / Part-time	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT
Prof.	19	-	18	-	15	-	16	-	15	-	16	-	16	-
Assoc. Prof. in the position of Prof.	-	-	-	-	-	-	-	-	1	-	1	-	-	-
Guest Prof.	-	4	-	4	-	1	-	1	-	3	-	4	-	4
Assoc. Prof.	29	4	28	3	32	1	29	1	29	1	32	2	30	3
Senior Lecturer in the position of Assoc. Prof.	-	-	-	-	-	-	-	-	-	-	-	-	3	-
Senior Lecturer	53	5	57	6	53	9	53	8	48	10	42	9	39	9
Lector	4	-	2	3	2	2	1	2	-	2	-	3	-	3
Tech. Admin. Staff	26	3	27	2	22	2	25	2	23	2	23	1	20	2
Research Staff	14	4	16	6	18	8	13	14	13	15	12	17	13	19
Total	**145**	**20**	**147**	**24**	**142**	**23**	**137**	**28**	**129**	**33**	**126**	**36**	**121**	**40**

Highlights

The most important events in 2022 can be summarized as follows:

- harmonization of selected study programs with SAAVŠ Quality Standards as of September 1, 2022 – 6 study programs in the bachelor degree, 6 study programs in the master degree and 5 study programs in the doctoral degree in three fields of study - electrical engineering, cybernetics and informatics,
- sending a request for the granting of accreditation of four selected fields of study of the habilitation procedure and the inaugural procedure,
- implementation of the project SENSIBLE "SENSors and Intelligence in BuiLt Environment" Marie Skłodowska-Curie Actions (MSCA) Research and Innovation Staff Exchange (RISE) H2020-MSCA-RISE-2016,
- implementation of an international project within the ESA (European Space Agency) scheme in cooperation with industrial partners SPINEA Technologies (SK) and THALES Alenia Space (FR) for the development of advanced electronic systems for powering building blocks of space robotic arms,
- realization of projects under the operational program *Integrated Infrastructure* and *Innovation Research*,
- setting a strategy with building two top teams at FEEIT 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 resources, promising technologies, materials, thermal management, sustainability, space applications, energy storage and lighting technology. In the field of information technology - smart systems, localization in 5G and B5G networks, optical and radio communication networks, machine learning and computer vision,
- organization of the 14th international conference Elektro 2022 indexed in IEEE and Scopus, 23 - 26 May 2022, Kraków, PL,
- the Faculty has so far recorded the highest number of published journals with a quartile: 77 with a reporting year 2022,
- the Faculty has been successful in solving UNIZA grant projects: UNIZA grant competition - call no. 1/2021 – in the categories projects of young scientific and teaching staff under 35 years of age: FEEIT 1st, 2nd, 3rd place, doctoral projects: FEEIT 1st, 2nd, 3rd place, students of the 2nd degree of university studies: FEEIT 1st the place,
- successful implementation and realization of national research projects (SRDA, VEGA, KEGA),
- implementation of the marketing strategy through a number of supporting actions, such as Technical idea of the year, active participation in the MyMachine event, organizing an online Open Day at FEEIT UNIZA and more,
- successful development of cooperation with industrial entities in the field of contract research and marketing activities,
- progress of the FEEIT teacher (Prof. Ladislav Janoušek, PhD.) to the final category "Exceptional personality of higher education 2022" of the ESET Science Award competition,
- construction of a photovoltaic power plant representing an additional source of electricity of BA - BD buildings.

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.
- 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.).
- 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.
- In 2022, a successful generational exchange contunued in the position of guarantors and staffing in several study programs at all three levels of higher education.
- 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).
- Introduction of mandatory completion of practice in the chosen institution according to the focus of the study program, or specializations of the study program in the scope of min. 60 hours.
- 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 participates in a student mobility system. Mobility of students to foreign universities, as well as to industrial environment are supported and fully integrated into the learning process of students. Students can thus part of their study take at leading foreign educational institutions or in major industrial enterprises or corporations.
- FEEIT supports the development of interdisciplinary, multidisciplinary, distance and lifelong learning; and education of foreign languages mainly for young employees and doctoral students.
- FEEIT has had the credit system for all study degrees. The system enables uniform evaluation 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.	Juraj Ždánsky (till 31. 8. 2022), Aleš Janota (from 1. 9. 2022)
Electrical Engineering	Biomedical Engineering	FT	3 years	Bc.	Ladislav Janoušek
Electrical Engineering	Autotronics	FT	3 years	Bc.	Pavol Špánik (till 31. 8. 2022)
Electrical Engineering	Electrical Engineering	FT	3 years	Bc.	Alena Otčenášová (till 31. 8. 2022)
Electrical Engineering	Electrical Engineering	FT, PT	3, 4 years	Bc.	Michal Frivaldský (from 1. 9. 2022)
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	Electric Power Systems	FT	2 years	Ing.	Juraj Altus (till 31. 8. 2022)
Electrical Engineering	Electric Drives	FT	2 years	Ing.	Pavol Rafajdus (till 31. 8. 2022)
Electrical Engineering	Power Electronic Systems	FT	2 years	Ing.	Pavol Špánik (till 31. 8. 2022), Michal Frivaldský (from 1. 9. 2022)
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	3 years	PhD.	Karol Rástočný, Aleš Janota, Rastislav Pirník (till 31. 8. 2022)
Cybernetics	Process Control	FT, PT	3, 4 years	PhD.	Aleš Janota (from 1. 9. 2022)
Electrical Engineering	Electric Power Systems	FT, PT	3, 4 years	PhD.	Juraj Altus, Alena Otčenášová, Peter

					Braciník (till 31. 8. 2022)
Electrical Engineering	Electrotechnologies and Materials	FT, PT	3, 4 years	PhD.	Dušan Pudiš, Ivan Martinček, Jozef Kúdelčík (till 31. 8. 2022)
Electrical Engineering	Electrotechnologies and Materials	FT, PT	3, 4 years	PhD.	Dušan Pudiš (from 1. 9. 2022)
Electrical Engineering	Power Electrical Engineering	FT, PT	3, 4 years	PhD.	Pavol Špánik, Pavol Rafajdus, Michal Frivaldský (till 31. 8. 2022)
Electrical Engineering	Power Electrical Engineering	FT, PT	3, 4 years	PhD.	Pavol Špánik (from 1. 9. 2022)
Informatics	Telecommunications	FT, PT	3, 4 years	PhD.	Peter Brída, Milan Dado, Róbert Hudec (till 31. 8. 2022)
Informatics	Telecommunications	FT, PT	3, 4 years	PhD.	Peter Brída (from 1. 9. 2022)
Electrical Engineering	Theory of Electrical Engineering	FT, PT	3, 4 years	PhD.	Ladislav Janoušek, Mariana Beňová, Milan Smetana (till 31. 8. 2022)
Electrical Engineering	Theory of Electrical Engineering	FT, PT	3, 4 years	PhD.	Ladislav Janoušek (from 1. 9. 2022)

Tab. 4: Number of the faculty students (as of 31. 10. 2022)

Field of study/Study program	**Number of students**			
	Full-time study		**Part-time study**	
	Nationals	**Foreigners**	**Nationals**	**Foreigners**
1st study degree				
Control Engineering	102	4		
Biomedical Engineering	74	18		
Electrooptics	5			
Electrical Engineering	216	4	30	
Multimedia Technologies	148	37		
Communication and Information Techn.	90	8		
Total	**635**	**53**	**30**	
2nd study degree				
Biomedical Engineering	35	1		
Photonics	2			
Multimedia Engineering	73	3		
Process Control	43	2		
Telecomm. and Radio-comm. Eng.	17	7		
Power Electronic Systems	81	8		
Total	**251**	**21**		

3rd study degree				
Electrotechnologies and Materials	1			1
Process Control	5			
Power Electrical Engineering	13	1	3	
Telecommunications	11		3	
Theory of Electrical Engineering	6			
Total	**36**	**1**	**6**	**1**

Tab. 5 and 6: Overview of the faculty students' number since 2018 (as of 31. 10. 2022)

Full-time study				
2018	**2019**	**2020**		**2022**
1st study degree				
578	639	741	785	688
2nd study degree				
317	295	288	263	272
3rd study degree				
48	53	54	52	37

Part-time study				
2018	**2019**	**2020**	**2021**	**2022**
1st study degree				
10	18	8		30
2nd study degree				
3rd study degree				
5	4	3	9	7

Admission for study

a) Form of the admission procedure in 2022 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 2022

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	94	60	36			
Biomedical Engineering	64	48	34			
Electrooptics	9	3	1			
Electrical Engineering	153	113	69	35	35	30
Multimedia Technologies	164	122	83			
Communication and Information Techn.	115	67	38			
Total	**599**	**413**	**261**	**35**	**35**	**30**
2nd study degree						
Biomedical Engineering	20	16	16			
Photonics	2	1	1			
Multimedia Engineering	56	52	45			
Process Control	40	39	34			
Telecomm. and Radio-comm. Engeneering	19	18	16			
Power Electronic Systems	54	52	48			
Total	**191**	**178**	**130**			

3rd study degree						
Electrotechnologies and Materials	3	2	2	1	1	1
Process Control						
Power Electrical Engineering	4	4	4			
Telecommunications	4	3	3			
Theory of Electrical Engineering	1	1	1			
Total	**12**	**10**	**10**	**1**	**1**	**1**

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

Tab.8: Number of graduates of the Faculty in the academic year 2021/2022

Field of study/Study program	**Number of graduates in 2021/2022**			
	Full-time study		**Part-time study**	
	Nationals	**Foreigners**	**Nationals**	**Foreigners**
1st study degree				
Control Engineering	35			
Autotronics	9			
Biomedical Engineering	15			
Electrical Engineering	48	2		
Multimedia Technologies	29	1		
Communication and Information techn.	17			
Total	**153**	**3**		
2nd study degree				
Biomedical Engineering	15			
Electric Power Systems	17			
Electric Drives	9			
Photonics	2			
Multimedia Engineering	27			
Process Control	26	1		
Telecomm. and Radio-comm. Eng.	15			
Power Electronic Systems	17	2		
Total	**128**	**3**		
3rd study degree				
Electric Power Systems				
Electrotechnologies and Materials	1			
Process Control	2			
Power Electrical Engineering	7			
Telecommunications	5			
Theory of Electrical Engineering	2			
Total	**17**			

Tab. 9: Overview of graduates of the Faculty since 2016/2017 (as of 31. 12. 2022)

Full-time study					
2016/2017	**2017/2018**	**2018/2019**	**2019/2020**	**2020/2021**	**2021/2022**
1st study degree					
167	165	140	134	102	156

2nd study degree					
161	163	153	124	112	131
3rd study degree					
18	17	13	14	10	17
Part-time study					
2016/2017	**2017/2018**	**2018/2019**	**2019/2020**	**2020/2021**	**2021/2022**
1st study degree					
	4		9	1	
2nd study degree					
31					
3rd study degree					
1	2	1	1		

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.

Autotronics
(Field of study Electrical Engineering)

The graduate will acquire basic and general knowledge required in wide spectrum of electrical proficiency especially in areas of automobile electronics, hybrid vehicles and electromobility. The gained knowledge is needed for the second degree study programs in this study program or affinitive ones. Even if a graduate would not continue in the next level of the university studies, he/she will gain required wide professional profile and he/she is able to adapt in different technical or other businesses. The graduates of Autotronics study program should be professionals who are able to identify various electronic faults in cars. They can successfully apply mainly in car services and repair workshops, car selling shops and in education institutions. *Software skills: C language, C++, MATLAB, Simulink, CodeWarrior, CodeComposer, Asembler, AVR Studio, Vissim, PLECS.*

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: C language, MATLAB, EAGLE.

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.

Electrooptics
(Field of study Electrical Engineering)

Electrooptics is a field at the interface of physical and several technical sciences, which is mainly connected to optics and electronics. It is a young field that has already found a firm place in the study programmes at many universities around the world. Graduates of the bachelor's degree study programme Electro-optics are able to continue their study in the engineering study programme Photonics that has a close connection and thus the application especially in telecommunications, information technology, medicine, industrial technologies, aviation, military technology, construction industry, but it is also used in consumer devices and entertainment industry. Graduates of Electro-optics should be able to orientate themselves in the following areas: geometric optics; optical radiation properties; principles of fibre optics; electronics and microprocessors; principles of nanotechnologies; principles of photonics; analysis and testing of fibre optic lines; testing of laser devices and components for telecommunications, medicine and other purposes; testing of optical, photonic or imaging prototypes and devices; determination of commercial, industrial or scientific use of electro-optical applications or elements.

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.

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.

MASTER STUDY PROGRAMMES

Biomedical Engineering
(Field of study Electrical Engineering)

The graduate has an overview of modern technical tools of biomedicine, diagnostic, therapeutic and rehabilitation devices, their safe use and the world trend in their development. He/she gains knowledge in theoretical and selected clinical medical disciplines in order to understand the purpose of technical tool application, ability to assess functionality and ability to create conditions for qualified communication with medical doctors. He/she has wide knowledge of existing information systems and technologies. He/she gains knowledge in the field of management in health care, bioethics, medical ethics and psychology of management. 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 of mainly health care operations. He/she will also operate as managerial employee in the management of health care facilities, as well as a pedagogue and researcher at universities.
Software skills: C language, HTML, PHP, MATLAB, Simulink, CST-studio suite.

Electric Power Systems
(Field of study Electrical Engineering)

The graduate has knowledge in the subjects of theoretical base developed in the field of power and applied electronics, programming and utilisation of computer technology, electric drives, electrical traction, electric power systems, management of electricity transmission systems and information systems in electric power systems, has basic knowledge of economic methods for operation of systems, has knowledge of law, psychology and quality management. The graduate is capable of independent projection, constructional and design works, is able to decide on concept issues and management of large organisational units. The graduate may successfully operate in projecting, management, construction and operation of industrial companies, railways, city public transport, in all areas of electric power systems, in projection and research institutes and other organisations of administrative, production, operation or repair character.
Software skills: MATLAB, EMTP-ATP, MODES, GE-PSLF, MS OFFICE, PTOLEMY, SICHR, LABVIEW, EAGLE, ASSEMBLER, VISUAL STUDIO, C++, C, RUPLAN.

Electric Drives
(Field of study Electrical Engineering)

The graduate has knowledge in the subjects of theoretical base developed in the field of power and applied electronics, programming and utilisation of computer technology, electric drives, electrical traction, electric power systems, management of electricity transmission systems and information systems in electric power systems, he/she has basic knowledge of economic methods for operation of systems, has knowledge of law, psychology and quality management. The graduate is capable of independent projection, constructional and design works, is able to decide on concept issues and management of large organisational units. The graduate may successfully operate in projecting, management, construction and operation of industrial companies, railways, city public transport, in all areas of electric power systems, in projection and research institutes and other organisations of administrative, production, operation or repair character.

Software skills: FEMM, MATLAB, OPERA-3D, COMSOL Multiphysics, MS Office, Code Warrior, EAGLE, Altium Desinger, Visual Studio, Python, Step 7, Micro win, WinCC.

Photonics
(Field of study Electrical Engineering)

The application of graduates has close connection especially with telecommunications, information technologies, medicine, industrial technologies, aeronautics, military technologies, and civil engineering as well as in consumer goods and entertainment industry. The graduate should know to creatively, analytically and in details orient in the following technical areas: design, modification and testing of laser equipment and components for telecommunications, medicine and for other purposes; utilization and enhancing quality and design of optical fibres technologies; development and testing of optical, photonic or imaging prototypes and equipment; design of electro-optical sensor systems; application of new photonic technologies and equipment into different industrial areas; optical design of standard lighting; definition of commercial, industrial or scientific utilization of electro-optical applications; creation, analysis and testing of optical fibres lines.
Software skills: Code Block (C, C++), LabVieW.

Power Electronic Systems
(Field of study Electrical Engineering)

Universality of this study programme guarantees very wide application of graduates on the labour market. The acquired knowledge may be applied in the most lucrative areas of electrical engineering, machinery and energetic industry, as well as in transportation. In the future their application in the services field is also expected. These are mainly areas of development, design, projection and application of power and control electronic systems, mechatronic and automotive systems, their control nodes, superior control systems, industrial automatic machines and robots and equipment of industrial automation. With regard to significant representation of subjects oriented to programming and development of control software, the graduate may operate successfully in very interesting jobs. The graduates from this study programme may apply for jobs at companies dealing with projects, production and application of power electronic and/or mechatronic systems and industrial automation. They may successfully apply also in specialised machinery companies working in the fields of automobile industry, chemical and petrochemical industry, gas industry, paper mill and transportation.
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.

Process Control
(Field of study Cybernetics)

The graduate gains education in the field of analysis and synthesis of automated control and information systems mainly for the area of information processing and transmission in the control of safety critical processes. Graduates from the study programme Process Control specialize in safe control of transportation process with emphasis on intelligent transport systems and signalling systems. They handle support telematic systems and safe control of industrial processes with emphasis on complex technologies, safe critical production applications, intelligent buildings, security systems for personal and property protection, security of information systems and modern computer networks.
Software skills: Ethernet, PLC, Jazyk PHP, MySQL, Jazyk HTML, UML, Jazyk OCL, MATLAB, Jazyk PYTHON, SCADA/HMI systems.

Telecommunication and Radiocommunication Engineering
(Field of study Informatics)

The education is focused on the topic of telecommunication and information networks with direction on digital communication networks, i.e. optic and metallic systems and networks, intelligent networks, terrestrial mobile networks, microwave radio and satellite communication, network management, architecture of signalling systems and communication protocols, applications of multimedia and multimedia services, reliability and diagnostics of systems and networks. The graduate will successfully apply as a creative employee in research, technical development, telecommunication design and management, as well as in all fields of applications of telecommunication, radiocommunication and information and communication technologies and services.
Software skills: ADOBE, HTML, PHP, MySQL, Blender, 3dMax, Cinema 4D, Android, JAVA, Microsoft Direct3D, OpenGL, MATLAB, After Effect, ZScan, Geomagic, MS Office, MATLAB, SIMULINK, from SPICE family – simulation programs oriented in analyses and syntheses of electronic circuits, VPIphotonics, ASEMBLER.

Multimedia Engineering
(Field of study Informatics)

The student of the Multimedia Engineering study programme in the informatics field of study will enhance his/her knowledge to the necessary extent in the subjects of theoretical base of the field of study and gain detailed knowledge of media communication, networks and services, their convergences and also their securities. By selection of optional subjects he/she may more closely specialize in the field of processing image, graphic or audio information. A significant element of knowledge is understanding of web technologies, mainly as far as the design of web services is concerned, knowledge of 2D and 3D graphic and animation systems and applications and digital processing of the multimedia contents. The student of this study will also acquire knowledge of aesthetics and creative attitude in the design of multimedia products, legal regulations in the field of electronic communication, their management, economics and marketing. The graduate from master study will be able to specialise and to adapt to different levels depending on the needs of practice, research and development, as well as the ability of permanent knowledge enhancement in the field. The students will obtain knowledge and skills that enable them to work independently as well as in teams in solving projects integrating the technical and creative level into one, or even to lead such teams.
Software skills: ADOBE, HTML, PHP, MySQL, Blender, 3dMax, Cinema 4D, Android, JAVA, Microsoft Direct3D, OpenGL, After Effect, ZScan, Geomagic, MS Office, MATLAB, SIMULINK, from SPICE family – simulation programs oriented in analyses and syntheses of electronic circuits.

DOCTORAL STUDY PROGRAMMES

Electric Power Systems
(Field of study Electrical Engineering)

The doctoral study in the field of Electric power systems is designed for graduates of the second degree of university study (Master/Master of Science) who tend to the original solutions of engineering and scientific problems in the electrical engineering/electric power systems. For solving of these challenges the doctoral student utilises the latest findings of modern analytical and numerical methods, methods of mathematical and physical modelling, informatics, measurements of electric and non-electric variables, microelectronics, electric power systems, automatic and discrete control up to the level of artificial intelligence, including the implementation of control by corresponding processors, as well as knowledge of other disciplines. Prerequisites for successful completion of the doctoral degree studies are the PhD student´s ability of abstract thinking and his/her ability to apply and implement acquired knowledge when solving technical problems. The PhD student learns how to properly characterize and understand physical phenomena and experimental observations on them; he/she searches for their adequate models and is able to implement new applications in the above specified disciplines in science, research and practice. During his/her doctoral studies the PhD student acquires comprehensive theoretical knowledge, experimental skills and practical experience. He/she masters methodology of scientific work and is prepared for independent scientific work.

Electro-technologies and Materials
(Field of study Electrical engineering)

The graduates in the doctoral degree study in the field of Electro-technologies and materials master scientific methods of evaluation of material structures and systems in terms of process technology, structure, durability, reliability, intermediate and final diagnostics and control, both in terms of determination their basic physical properties of the substrate material and their final structure. The graduate is able to use the obtained in-depth knowledge in a wide range of production technologies in electronics, in the design, as well as in the organization and optimisation of various technological processes.
The graduate acquires abilities to predict changes of material properties in various conditions of their use as well as in terms of utilising various technological procedures in production of electrical components, structures, systems and equipment.
The graduates of the third degree of university studies in the field of study Electrotechnologies and materials acquire deep theoretical and methodological knowledge of technologies and materials applied in electrical and electronics industry, of properties of materials and processes running in them that create the object of the scientific research and development at the state-of-the-art level of scientific research in the world.

Power Electrical Engineering
(Field of study Electrical Engineering)

The doctoral study in the field of Power electrical engineering is designed for graduates of the second degree of university study (Master/Master of Science) who tend to the original solutions of engineering and scientific problems in the field of power electrical engineering, i.e. electric drives, power electronics, electric traction, electrical machinery and equipment and traction electric power systems. For solving of these challenges the doctoral student utilises the latest findings of modern analytical and numerical methods, methods of mathematical and physical modelling, informatics, measurements of electric and non-electric variables, microelectronics, electric power systems, automatic and discrete control up to the level of artificial intelligence, including the implementation of control by corresponding processors, as well as knowledge of other disciplines. Prerequisites for successful completion of the doctoral degree studies are the PhD student´s ability of abstract thinking and his/her ability to apply and implement acquired knowledge when

solving technical problems. The PhD student learns how to properly characterize and understand physical phenomena and experimental observations on them; he/she searches for their adequate models and is able to implement new applications in the above specified disciplines in science, research and practice. During his/her doctoral studies PhD student acquires comprehensive theoretical knowledge, experimental skills as well as practical experience. He/she masters methodology of scientific work and is prepared for independent scientific work. The graduates in the doctoral study in Power electrical engineering acquire knowledge based on the state-of-the-art scientific knowledge in the field and by their own creative work they will contribute to their development as well as to new findings in the respective field.

Theory of Electrical Engineering
(Field of study Electrical engineering)

The doctoral study in the field of Theory of electrical engineering is designed for graduates of the second degree of university study (Master/Master of Science) who tend to the original solutions of engineering and scientific problems in the field of electrical engineering and its applications. For solving of these challenges the doctoral student utilises the latest findings of modern analytical and numerical methods, methods ofmathematical and physical modelling, informatics, measurements of electric and non-electric variables, interdisciplinary methodologies, biomedical applications, as well as knowledge of other disciplines.
Prerequisites for successful completion of the doctoral degree studies are the PhD student´s ability of abstract thinking and his/her ability to apply and implement acquired knowledge when solving technical problems. The PhD student learns how to properly characterize and understand physical phenomena and experimental observations on them; he/she searches for their adequate models and is able to implement new applications in the above specified disciplines in science, research and practice. During his/her doctoral studies the PhD student acquires comprehensive theoretical knowledge, experimental skills as well as practical experience. He/she masters methodology of scientific work and is prepared for independent scientific work.

Process Control
(Field of study Cybernetics)

The doctoral study in the field of Cybernetics is designed for graduates of the second degree of university study (Master/Master of Science) who tend to the original solutions of engineering and scientific problems in management and control of transport and technological processes. For solving of these challenges the doctoral student utilises the latest findings of modern analytical and numerical methods, methods of mathematical and physical modelling, informatics, measurements of electric and non-electric variables, microelectronics, electric power systems, automatic and discrete control up to the level of artificial intelligence, including the implementation of control by corresponding processors, as well as knowledge of other disciplines. Prerequisites for successful completion of the doctoral degree studies are the PhD student´s ability of abstract thinking and his/her ability to apply and implement acquired knowledge when solving technical problems. The graduates in the field of study Automation gain knowledge based on the state-of-the-art scientific knowledge in the field and by their own creative work they will contribute to their development as well as to new findings in the respective field. The aim of the doctoral study is to educate such a specialist who will not only possess complex knowledge but will be able to enrich the science and knowledge in the field of process control.
The graduates acquire in-depth theoretical and methodological knowledge and practical experience in the main areas of process control (including processes related to security) such as the theory of automatic control, system theory, process control, control systems, logic and event systems and also in the field of secure communication and information processing.

Telecommunications
(Field of study Informatics)

The aim of the doctoral degree studies is to prepare skilled professionals focused on the development, implementation, management and operation of complex telecommunication systems of the new generations that virtually permeated all spheres of human activity. The study programme is built on the previously accredited field of study Telecommunications / doctoral degree study programme. Research activities of the Department of Telecommunications and Multimedia of the Faculty of Electrical Engineering UNIZA aim in the field of telecommunications at optical communication systems, broadband networks, mobile radio networks and digital signal processing. The PhD graduates in the field of Telecommunications gain deep theoretical and methodological knowledge and practical experience in key areas of telecommunications at the current state of research in the world, acquire principles of individual and team research work, research exploration, scientific formulation of problems, solutions of complex scientific problems and presentation of scientific results. They are able to analyse and solve complex and non-standard tasks in the field of telecommunications and to provide original, new solutions, to apply acquired knowledge in practice in a new, creative way. They are able to apply the acquired knowledge in various fields of science, research, industry and services in the public as well as in private sectors. The graduates are capable of following the latest scientific and research trends in telecommunications and of adding and updating their knowledge through lifelong learning process.

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				
165	158	110	21	5
Master thesis				
134	131	81	10	12
Doctoral thesis				
17	17	14	0	0

Students' awards

Awards of students within the university:

- Dean's price was in 2022 awarded to the following students of the 1st degree study:
  - study program Electrical engineering: Michal Klimo
  - study program Multimedia technologies: Lenka Smatanová
  - study program Communication and information technologies: Dávid Dziaček
  - study program Control engineering: Ivan Chlebničan
  - study program Autotronics: Samuel Ulehla
- Dean's price was in 2022 awarded to the following students of the 2nd degree study:
  - study program Biomedical Engineering: Martina Gáliková
  - study program Electric drive: Miroslav Kamhal
  - study program Electrical Power Systems: Matej Tkáč
  - study program Photonics: Michal Durdiak
  - study program Multimedia engineering: Lukáš Krajči

- study program Process control: Miroslav Gallo
- study program Power Electronic Systems: Milan Krenžlák

- Rector's price was awarded in 2022 to:
  - Matej Vrábel (1st degree study – Control engineering)
  - Milan Šnapko (2nd degree study – Power Electronic Systems)
  - Martin Ďurčo – for diploma thesis (2nd degree study – Biomedical Engineering)
  - Tadeáš Bednár – Rector's prize in cathegory Doctoral study for the year 2022
- Student awards for works presented at ŠVOS:
  - 1st place: Tomáš Mizera (3rd degree study)
  - 2nd place: Ján Andel (3rd degree study)
  - 3rd place: Radovan Korček (3rd degree study)
- Letter of appreciation from the head of DCIS for the bachelor's thesis:
  - Martin Bartka
  - Peter Brezina
  - Martin Jaržabek
  - Marek Motýľ
- Letter of appreciation from the head of DCIS for the diploma thesis:
  - Gabriel Benčat
  - Miroslav Gallo
  - Timea Krúpová
  - Katarína Mäsiarová
  - Peter Rangelov
  - Marek Michálek
  - Andrej Straka

Support for students in 2022

a) Scholarships (motivation, faculty)

For excellent study results the Faculty provides the scholarships to students. These scholarships were allocated in 2022:

- merit scholarships - the number of students: 91, the amount paid: 51 212 EUR,
- special scholarships - the number of students: 17, the amount paid: 1 750 EUR,
- social scholarships - the average number of recipients/students: 58, the amount paid: 11 775 EUR,
- trade scholarships - number 372, the amount paid: 156 918 EUR,
- from own resources - the number of students: 9, the amount paid: 3 340 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 High-energy physics works in the area of strong electroweak symmetry breaking and deuteron spin structure.

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.

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.
The department has modern research infrastructure and means for realizing numerical simulation, measurements, and experimental analyses.

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 electric 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 and biomedical applications, and on optoelectronic applications. Problems of photoelectrocatalytic 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 new 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, new analytical methods focused on the simulation of optical elements in the time and spectral domain and dynamic bandwidth allocation 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

Together with education, the scientific and research activities are the primary mission of the Faculty and its further growth is a necessary assumption of the future development since it is closely related to the quality of education. Scientific and research activities are at FEEIT realized especially in the form of projects and are mainly based on individual activities at departments and their co-operation. One of the major outputs of scientific and research activities are scientific publications indexed in major international databases such as Web of Science and SCOPUS and international conferences supported by major professional organizations, in particular the IEEE, SPIE, IFAC, IFIP, ACM, SEFI, etc.

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 13 projects of international cooperation, 32 projects financed from national sources, 8 projects of Structural Funds and 50 other projects have been realized at FEEIT in 2022. The most important information about the projects is summarized in the following subsections. The contract-based expertise activities are also listed.

Projects of International Programmes

Horizon 2022

MSCA-RISE-2016: SENSors and Intelligence in BuiLt Environment SENSIBLE	
	The goal of this project is to develop novel information sensing research and innovation approaches for acquiring, communicating and processing a large volume of heterogeneous datasets in the context of smart buildings, by building an international, inter-disciplinary and inter-sectoral collaboration network through research and innovation staff exchanges and seamless exchange of ideas, expertise, data, testbeds, and know-how. The need to sense and process ever increasing amount of data requires novel engineering that goes far beyond conventional centralised methods, where signal acquisition, communications and data processing are performed centrally and independently. Building on integrating signal acquisition, communications and information extraction into an overarching smart sensing approach, the project will provide a holistic decision support framework for non-residential buildings of the future. The key challenges of providing intelligence to the building lie in ubiquitous sensing, inside and outside the building, and connecting the sensing technology to people and outside world via meaningful decision support. Though significant research has been dedicated to developing novel sensing and instrumentation technologies, further research and innovation advances are needed to integrate physical sensing to data processing via distributed estimation and fusion approaches, giving actionable meaning to the suite of collected data. In that context, it is necessary not only to continuously monitor the environment,

	equipment, systems and processes, but also to sense occupants' behaviour inside and outside the building and provide timely response and feedback.
Realization:	01/2017 – 12/2022
Coordinator:	Vladimir Stankovic, University of Strathclyde, Glasgow, UK
Sub-Coordinator from FEEIT:	Juraj Machaj (DMICT)
Co-operators:	Milan Dado, Stanislav Jurečka, Gabriel Cibira, Peter Holečko, Michal Gregor, Vojtech Šimák, Peter Braciník

COST projects

Action CA17136: INDAIRPOLLNET	
Summary:	INDAIRPOLLNET (INDoor AIR POLLution NETwork) will improve our understanding of the cause of high concentrations of indoor air pollutants. It will assemble experts in laboratory and chamber experiments, modelling studies and measurements of relevance to indoor air quality (IAQ), including outdoor air chemists. Our network includes experts in chemistry, biology, standardisation, particulate matter characterisation, toxicology, exposure assessment, building materials (including those manufactured specifically to improve IAQ such as green materials), building physics and engineering (including ventilation and energy) and building design. This Action aims to significantly advance the field of indoor air pollution science, to highlight future research areas and to bridge the gap between research and business to identify appropriate mitigation strategies that optimise IAQ. The findings will be disseminated to relevant stakeholders such as architects, building engineers and instrument manufacturers.
Realization:	09/2018 – 09/2022
Coordinator:	Peter Brída (DMICT)

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 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)

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 – 09/2022
Coordinator:	Jesus Medina (Facultad de Ciencias, Campus Río San Pedro, Spain)
Co-operators:	Peter Holečko (DCIS)

ERASMUS Projects

2020-1-PL01-KA226-SCH-096354 (2021 – 2023): 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:	Gabriela Tarjányiová, Martin Vaculík, Miroslav Uhrina, Juraj Bienik, Jozef Kúdelčík, Štefan Hardoň, Martin Šinko, Anna Holešová

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

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

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)

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 2022	
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:	01/2022 – 12/2022
Coordinator:	Ivan Melo (DPh)
Co-operators:	Gabriela Tarjányiová, Mikuláš Gintner, Jozef Kúdelčík

PLSK.03.01.00-24-0181/18: GAME JAM as new didactic method. Improvement of quality of teaching in area of new technologies in region of polish-Slovak border	
Summary:	The goal of the project is to improve cross border teaching in the area of multimedia technologies by the creation of a forum for the presentation of the gaming industry and companies in the given area from the region around Polish-Slovak border. The main contribution of the project is the organisation of joint GAME JAMs, i.e. events where students from both universities can form teams and compete in game design, exchange experience and meet experts from the gaming industry.
Realization:	10/2019 – 09/2022
Coordinator:	Agnieszka Maj, Silesian university, Katowice
Sub-Coordinator from FEEIT:	Miroslav Benčo (DMICT)
Co-operators:	Peter Sýkora, Patrik Kamencay, Olga Kovalčiková

Projects of National Programmes

Slovak Research and Development Agency (SRDA)

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-17-0345: Research of the optimization procedures for improvement of transfer, safety and reliability characteristics of WET system	
Summary:	The project focuses on the research of the optimization methodology of the WET (Wireless energy transfer) operating parameters, representing a progressive solution for the transfer of energy to mobile and industrial equipment. The main aim of the project is the research of properties that influence it: • technical and hygienic properties (investigation of negative impact on living and non-living objects) and • relevant parameters of WET systems, such as efficiency, action radius, reliability, and environmental safety. The main reason for this research is the fact that the use of WET systems in terms of a variety of application uses can be expected within the power infrastructure of electric vehicles, cars (contactless charging, dashboard power supply, infotainment power supply, non-contact entertainment charging - smartphones, tablets etc. ...) in smart-grid systems in homes, industrial chargers for mobile and service robots, medical applications ... In the first step the solution will identify the interaction phenomena that affect

	the negative interference of WET systems with the environment. This is mainly about: • radiating EMI into the environment - modification of coil geometry and layout, • optimization of topology of the main circuit and compensating elements, • an appropriate way to manage energy transfer. Based on the results obtained, optimization of properties through multi-physical analyses and multi-level simulations will be carried out in order to significantly improve the efficiency of the process of receiving and controlling the flow of energy on the load side. Another task will be to investigate interactions of WET systems with biological systems. A very important step will be to suppress undesirable impacts by topological optimization of the WET system, while the primary method will be computer simulation realized through circuit and block simulators, respectively. 3D Field Analysis Systems (COMSOL) using models with a wide range of validity
Realization:	08/2018 – 06/2022
Coordinator:	Pavol Špánik (DME)
Co-operators:	Michal Frivaldský, Viliam Jaroš, Miroslav Pavelek, Marek Paškala, Ján Morgoš, Michal Pipíška, Branislav Hanko

APVV-17-0218: Investigation of biological tissues with electromagnetic field interaction and its application in the development of new procedures in the design of electrosurgical instruments	
Summary:	The aim of this research is to investigate the interaction of the radio frequency electromagnetic field with biological tissues, with an emphasis on the investigation of the effects of vaporization, fulgurisation and desiccation of tissues. These tissue effects will be investigated in connection with the design of the optimal electrosurgical unit, which is one of the most commonly used devices in medical practice.. The aim of the project will be to investigate the phenomena of a major impact on the effectiveness of electrosurgical instruments. An important aspect will be the implementation and correct interaction of progressive solutions to assess the frequency and temperature dependence of tissue impedance with different dielectric properties.
Realization:	07/2017 – 06/2022
Coordinator:	Dagmar Faktorová
Co-operators:	Pavol Špánik, Miroslav Pavelek, Marek Paškala, Michal Frivaldský, Rastislav Štefún (DME)

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

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-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, Patrik Kamencay, Ivan Dolnák, Ján Litvik, Miroslav Markovič, Radovan Korček, Anna Holešová

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 Vršková, Peter Kasák, Adam Škrváň, Adam Štech

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

VEGA 1/0069/19: 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:	01/2019 – 12/2022
Coordinator:	Ivan Martinček (DPh)
Co-operators:	Dušan Pudiš, Daniel Káčik, Norbert Tarjányi, Ivana Lettrichová, Jana Ďurišová, Peter Gašo, Daniel Jandura, Ľuboš Šušlik, Matej Goraus

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 1/0471/20: Degradation analysis of insulating elements of high-voltage transformers	
Summary:	The aim of the project will be to analyze the insulation state of various high-voltage transformers with respect to the degradation effects of operation and environment. The main attention will be devoted to diagnostics of insulating state of transformer, where for the dry devices they are mainly epoxy resins and in the oil devices it is oil-paper insulation. The effects of short-circuit and inrush currents, overload, overvoltage, environmental effects and other operating factors on the degradation effects of insulating elements will be analyzed. Subsequently, the effect of partial discharges in the transformer insulation, which has a direct impact on the degradation of the insulating state, will be analyzed. The process of their formation, extension and influence on the insulation of the transformer will be described. New measurement procedures, diagnostic methods and systems will be proposed, the results of which will be used to determine the degree of degradation of insulating elements of the transformers.
Realization:	01/2020 – 12/2022
Coordinator:	Miroslav Gutten (DME)
Co-operators:	Daniel Korenčiak, Matej Kučera

VEGA 1/0593/20: Research of energy flow control in the network using a smart transformer	
Summary:	The project is focused on the design of the topology and control system of an electronic "smart transformer" in a smart grid network. The primary area of application is within small and medium-sized networks, consisting of households, renewable energy sources and storage. The aim of the project is to select the topological configuration and design the energy flow control of the electronic intelligent transformer. The smart transformer will be designed to control the flow of energy between renewable energy sources, load (batteries), micro grid systems and the distribution network. The methodology will be divided into several parts, the first part will be the selection of a suitable topology for the electronic transformer, the second step is the design of active control of the smart transformer with emphasis on minimizing power supply back to the distribution system and maximizing energy use within the node with smart transformer. In order to obtain information about the state of the network and individual elements, a detailed design of methods and systems for measuring energy flow will be needed.
Realization:	01/2020 – 12/2022
Coordinator:	Peter Drgoňa (DME)
Co-operators:	Michal Frivaldský, Ondrej Hock, Pavol Špánik, Peter Šindler, Ján Morgoš, Peter Sojka

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:	Dobrucký Branislav,Praženica Michal, Jozef Šedo, Koňarik Roman, Kellner Jakub, Resutík Patrik, Zelník Richard

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, Vladimir Vavrus, Lukas Gorel, Marek Stulrajter, Pavel Lehocky, Matej Pacha, Stefan Kocan, Michal Kovacik, Martin Sumega, Patrik Varecha, Simon Zossak

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

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, Peter Počta, Bohumil Adamec, Juraj Bienik, Lukáš Ševčík, Roman Jarina, Peter Kasák, Erik Sádovský, Darina Jarinová, Miroslav Uhrina, Veronika Hromadová, Ivana Brídová, Anna Holešová, Branislav Krnáč, 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 005ZU-4/2020: Creation of modern supporting mechanisms aimed at the development of pedagogicalpsychological competences of university teachers (beginners) at the technical and economical faculties at the University of Žilina.	
Summary:	Project is based on the need to set up a systematic process at the University of Žilina for the education of university teachers at technical and economical faculties. This education will be focused on the area of development of their pedagogical-psychological competences. In the research phase, the project focuses on the study of contemporary professional information and comparison

	of the actual contents of education focused on the development of university teachers in the field of their pedagogical activities. In the implementation of qualitative and quantitative research, we will focus on identifying individual stages in the professional life cycle of university teachers and identifying the current educational needs of university teachers in the field of engineering pedagogy. It implements the acquired knowledge in a monograph containing the results of the research and the creation of the proposal for new university teachers adaptation education. We will verify the updated content, forms and teaching instructions. We will continue by developing a modern electronic textbook and the necessary modern textbooks that are not currently available to UNIZA teachers. It will include a database of best practice - examples of the use innovative teaching strategies that activate students in teaching technical and economic subjects. These will be methodically prepared and will contain methodological sheets for teachers and students. We will share the project outputs on the website. Our goal is to stimulate formation of a learning professional community of professionals (university teachers) in the field of education and to find room for the exchange of experience and know-how, as co-researchers will actively participate in the implementation of each phase.
Realization:	01/2020– 05/2022
Coordinator:	Jana Trabalikova (ÚCV)
Co-operators:	Marek Roch (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, Mihálik Michal, (until 08/2022). Pavol Kuchár Ing. (since 09/2022)

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 008KU-4/2020: Comprehensive Innovation and Educational Support of Study Program "Teaching Informatics" with the "Internet of Things"	
Summary:	The basic aim of the project is to fundamentally innovate and modernize the current study program "Teaching Informatics" for the 1st and 2nd degree of higher education based on the content integration of the "Internet of Things" issue across the program and with close links to creative use in practical life. By introducing the issue of "Internet of Things" into the teaching process, the support of creativity and analytical thinking of students is monitored, which is reflected in the meaningful integration of new information into already acquired skills and habits in accordance with current development trends. At the same time, the curriculum will become more attractive, the profile will be improved and the graduates' ability to work in practice in a difficult to predict future.
Realization:	01/2020 – 12/2022
Coordinator:	Daša Tichá (DMICT)
Co-operators:	Darina Jarinová, Alžbeta Kanáliková

KEGA 011ZU-4/2020: Implementation of on-line education in the field of bearing production technologies with emphasis on the educational process to increase the skills and flexibility of mechanical engineering students	
Summary:	The amount of information that needs to be mastered by students is constantly growing. The processing of teaching material into multimedia courses and their interactive study increases the quality and speed of acquiring knowledge and

	skills, allows the student to move from the passive role of the listener to the role of an active participant in the educational process. Learning through e-learning is an increasingly preferred method, which is also the focus of the present project. It focuses on the modernization of education and the online approach to the teaching of bearing production technologies, which are an integral part of mechanical engineering. The outputs of the project in the form of multimedia and internet applications in the form of websites can be used not only for the active education of students at the university but also on a national scale and for the general public. In addition, the outputs of the project should serve as important materials in solving research projects and final theses of students in bachelor's and master's study programs.
Realization:	2020 – 2022
Coordinator:	Dana Stancekova, (FME UNIZA)
Co-operators:	Ivan Litvaj (DPSED)

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 Bracinik (DPSED)
Co-operators:	Marek Hoger, Martina Kajanova, Michal Regula, Marek Siranec, Alena Otcenasova, Marián Tomasov, Marek Roch

Structural Funds

ITMS 313012N944: Research and development of the new PLASMABIT BHA plasma milling system for efficient and ecological closure of wells and introduction of a new product into the production process	
Summary:	The main objective of the project is to carry out research and development of the PLASMABIT BHA plasma milling system (Bottom Hole Assembly), to perform functional tests of the prototype and subsequently to introduce a new product into the production process. BHA refers to a device that is located in a borehole and is intended for a specific activity or operation (milling, drilling, cleaning, etc.). Our new product is designed for plasma milling of production pipes (steel pipes) with the aim of a more efficient, economical and especially environmentally friendly way of tight closing of exhausted oil and gas wells. PLASMABIT BHA will be able to remove contactless parts of the production line intended to close the well and thus prevent leakage of residual oil fractions or gas. In order to eliminate environmental impacts, there is a growing demand for new efficient technologies used in oil and gas extraction. Tight closure of wells encounters problems such as clean removal of the production line, tightness and seal life, which will make our product significantly eliminate. A comprehensive system that will solve these problems and meet market requirements has a highly export character with a global reach and would significantly increase the competitiveness of Slovakia. The project is divided into several activities that logically follow up. Their mission is to research the plasma milling system together with the research of a new power supply system and a new generation of high-resistance electrodes for the plasma milling system. The research will be followed by a development phase where the prototype will be intensively tested until the final parameters are debugged. The applicant shall also carry out the activity of protection of the rights of created intellectual property. In the innovative part of the project, we plan to purchase the infrastructure needed to introduce the new PLASMABIT BHA product into the production process.
Realization:	6/2019 – 2/2022
Coordinator:	Pavol Špánik (DME)
Co-operators:	Pavol Rafajdus, Vladimír Vavruš, Marek Höger, Branislav Dobrucký, Michal Frivaldský, Michal Praženica, Slavomír Kaščák

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 (DME), Pavol Rafajdus (DPES)
Co-operators:	Daniel Káčik, Ivan Martinček, Pavol Špánik, Pavol Makyš, Vladimír Vavruš, Pavel Lehocký, Michal Reguľa, Martina Kajanová, Pavol Rafajdus, Michal Frivaldský, Vojtech Šimák

313010BWX9: Hybrid Energy Storage to increase the efficiency of energy systems	
Summary:	Research and development within the project is focused on hybrid low and medium capacity storage. In its research part, the project focuses on the comparison and assessment of various battery technologies in terms of their optimal use, respectively. Possibilities of combination of battery technologies for various applications in energy and electromobility.
Realization:	08/2022 – 11/2023
Coordinator:	Michal Frivaldský (DME)
Co-operators:	ENERGO-Aqua

ITMS 312011BFJ9: Support of the internal quality system for higher education at the University of Zilina in Zilina	
Summary:	The long-term plan of the University of Zilina also sets out the goals and objectives for the quality of education to be achieved through a functioning and effective internal quality system. The project supports the fulfillment of these key objectives in the review of the internal quality system. The priority areas of this system that the project objectives are focused on are the area of setting up processes and their debureaucratization, the area of creating and establishing structures taking over responsibility for the functionality and efficiency of the internal quality system, and the area of preparation of specific target groups to master tasks of quality assurance.
Realization:	01/2021 – 12/2022
Coordinator:	Renata Švarcová (UNIZA)
Co-operators:	Ivan Litvaj, Marek Roch (DPES)

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:	As part of the project, a ring will be designed to detect and signal the degree of surface contamination of the integrated sensor, which signals the achievement of the selected limit level of surface contamination of the sensor. This sensor is part of a detection unit that is integrated into the component. The ring for detecting and signalling the degree of surface contamination of the integrated sensor consists of a component, a signalling unit, a detection unit, a power supply and a module for communication with the external environment. The technical solution is watertight sealed to ensure protection against moisture. The signalling unit, a detection unit, power supply and communication module with the external environment are interconnected by electrical supply and communication circuits. Upon reaching the selected contamination limit of the sensor integrated with the pollutant detection unit, the signalling unit informs about this state, the information being transmitted via electrical communication circuits installed in or on the component. The communication module with the external environment communicates wirelessly outside the technical solution with the environment, which is a computer, mobile phone or tablet.
Realization:	04/2021 – 06/2023
Coordinator:	Peter Brída (DMICT)
Co-operators:	Juraj Machaj, Roman Jarina, Slavomír Matúška, Lukáš Ševčík, Aleš Janota, Karol Rástočný, Rastislav Pirník, Peter Holečko, Emília Bubeníková, Alžbeta Kanáliková

NFP304010Y497, Interreg V-A Slovenská republika - Česká republika 2014-2020: Optical fiber sensors with photonic elements for innovative applications	
Summary:	Goal of the project is research and development of the photonic sensor elements for industrial applications with unique properties.
Realization:	03/2020-03/2022
Coordinator:	Ľuboš Šušlik (DPh)
Co-operators:	Ľuboš Šušlik, Dušan Pudiš, Jana Ďurišová, Peter Gašo, Ivana Lettrichová

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
Co-operators:	Miroslav Benčo, Róbert Hudec, Peter Sýkora, Martin Paralič, Patrik Kamencay

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)

Other National Research Projects

Name	Coordinator
New semiconductors for the production of hydrogen from solar energy with higher efficiency and lifetime	Peter Čendula, IAS
Research on hybrid inverter solutions with adaptive series-parallel modularity capability with applications for EV charging and advanced distribution network management	Michal Frivaldský, DME
DualShunter - research and development of concept and traction drive of dual-powered shunting locomotive.	Matěj Pácha, DPSED
Electric scooter upgrade to 2x2 mode for improvement of riding characteristics	Andrej Blaško, DPSED
Design and implementation of a control algorithm for extending operating areas and increasing the efficiency of the synchronous motor	Michal Vidlák, DPSED
Design of a power element for high-speed motors supply.	Daniel Konvičný, DPSED
Purchase and manufacturing of educational and representative tools.	Michal Staňo, DPSED
Research of control techniques for multi-phase electric drives in the automotive industry.	Marek Furmanik, DPSED
Innovative solutions of nanocomposite dielectric materials for use in the field of electrical engineering and electromobility	Jozef Kúdelčík, DPh
Polymeric laboratory on fiber for the measurement of the intereference of light in the spectral region	Matej Goraus, DPh
3D photonic microcircuits for lab on fiber applications	Matej Goraus, DPh
Phenomenology and Outreach (FEPO), Agreement between Ministry of Education SR and University of Žilina	Ivan Melo, DPh

Analysis, modelling, control and simulation of electrical and electronic circuits and systems.	Roman Koňarik, DME
Research of methods for investigation of operating and fault conditions of drives with multiphase asynchronous motor	Michal Praženica, DME
Research of hybrid converters solutions with adaptive option for serial-parallel modularity using EV Charging and advanced distribution network management	Michal Frivaldský, DME
Design of power source and BMS for small electric vehicle	Maksim Kuzmin, Michal Frivaldský, DME
Analysis and application of MMWave Radar development plates for the purpose of meeting trends in the sensor area	Michal Frivaldský, DME
Analysis of 3-phase inverter options	Michal Frivaldský, DME
Coordination of the public lighting process of the city of Žilina	Peter Drgoňa, DME
Feasibility Study for the National Broadband Plan	Milan Dado, DMICT
Agreement on cooperation in the implementation of an innovation project (TNtech, s.r.o.) Preparation of an analytical study for the needs of the development of localization products in medical facilities	Peter Brída, DMICT
VP - Smart systems, networks and services	Róbert Hudec, DMICT
Increasing the information value of tissue perfusion change recordings obtained using photoplethysmography imaging techniques	Štefan Borik, DEBE
Device for measuring the fingers' flexion of the of the upper limb	Maroš Šmondrk, DEBE
Innovative sensors and methods of biological signal sensing	Maroš Šmondrk, DEBE
Functional mapping of dermal tissue perfusion in allergology	Štefan Borik, DEBE
Increasing credibility and equity of redemption of experimental results from electromagnetic radiation of biological cultures	Michal Labuda, DEBE
Device for monitoring gait dynamics	Maroš Šmondrk, DEBE
The design and realization of the human-computer interface	Ivana Králiková, DEBE
Fusion of photoplethysmography imaging and electromyography to analyse the changes in subcutaneous and muscle tissues blood supply during muscle exercise	Michal Labuda, DEBE
Targeted to the cell by an electromagnetic signal III	Lucia Čarnecká, DEBE
Geomagnetic shielding by Mu-Metal	Marek Bajtoš, DEBE
Hybrid investigation of autonomic neural and thermoregulatory mechanisms	Patrik Prôčka, DEBE
Dry electrodes for bioelectrical signal measurement	Ivana Králiková, DEBE
Sensing metabolic processes of cells in real time	Lucia Čarnecká, DEBE
Robotic systems for the support of rescue services	Dušan Nemec, DCIS
Safety features in the force testing process	Marián Hruboš, DCIS
Spherical robot to support the resolution of emergencies in tunnel construction	Marek Bujňák, DCIS

Other National Non-research Projects

Name	**Coordinator**
Transformer coil tests	Vladimir Vavrúš, DPSED
Stratospheric balloon	Peter Sýkora, DMICT
Compressor for 3D printed cryocooler	Róberta Vršková, DMICT
Towards a connected university with Internet of Things technology	Slavomír Matúška, DMICT

Classification of unwanted artifacts degrading perceived image quality	Anna Holešová, DMICT
Database of 4K video sequences with content for smart cities and smart transport	Lukáš Ševčík, DMICT
AUDIO module research	Veronika Hromadová, DMICT
Research on the separability of hearing aids and cochlear implants for the field of musical signals	Peter Kasák, DMICT
A ground station for communication with artificial space satellites as a terrestrial segment of a virtual satellite operator	Boris Cucor, DMICT
Implementation of the intelligent classroom subsystem into the connected university system	Slavomír Matúška, DMICT
Hybrid education in area of artificial intelligence, machine learning and cybernetics at UNIZA	Róbert Hudec, DMICT
V3 Žilina Childrens University 2022	Peter Hockicko, DPh

Submitted Proposals of International Research Projects in 2022

Type / call	**Name of the project**	**Outcome of evaluation**
101081896-1 Horizon Europe	The influence of high – frequency electromagnetic field on a honey bee colony as an innovative method of fighting the Varroa destructor parasite to limit the losses of bee colonies	not supported
101104014 Horizon Europe	Advanced understanding of batteries' interfacial process and critical interfaces by aggregating multi-scale experimental and computational characterisation techniques	not supported

Research for Practice; the Most Important Realized Outputs

DMICT

Project number: PP-COVID-20-0100
Name of the project: DOLORES.AI: Pandemic Protection System
Coordinator: Patrik Kamencay
Summary / Achievement: In the project DOLORES.AI: Pandemic protection system, we developed a new direction of research to a small and non-negligible extent, which we want and will devote ourselves to in the coming years. Integrated in this direction is silicon photonics - a scientific research direction that fundamentally shapes many scientific research and practical applications, such as optical communication systems, optical links, sensing/detection or also biomedicine and many other areas of health sciences. All of these proliferating applications, coupled with integrated silicon photonics, create a blueprint for the creation of diverse systems feasible on semiconductor chips. In this way of creating new and progressive systems, we can eliminate a large number of shortcomings and pitfalls in the future that present systems provide in practice. These shortcomings are mainly the large dimensions of the systems, their imperfect and often complicated control, but also their price and demanding maintenance.

Project number: APVV-17-0631
Name of the project: Coexistence of photonic sensor systems and networks within the Internet of Things - CONSENS
Coordinator: Milan Dado
Summary / Achievement: The solution of the APVV 17-0631 KONSENS project brought results in the design of selected elements of integrated optics based on subwavelength structures, silicon-based thin layers and multilayers prepared in different deposition conditions on the insulator, KCN optical chemical sensor and sensors on basis of fiber Bragg gratings. The use of fiber Bragg gratings was also designed and implemented for the generation of slow light. The possibilities of incorporating optical sensors for efficient use of the spectrum in all-optical networks and a specific study of their incorporation into WDM multiplexes of future passive optical networks with multiplex rasters according to currently known international standards were investigated and proposed. For the application of optical sensors, specific solutions of sensor networks and the possibility of incorporating sensor systems and networks based on elements of fiber optics as part of fully photonic communication networks with application in transport were proposed. For signals from the sensor network based on FBG and interrogators, an artificial intelligence system based on AlexNet, GoogLeNet, and ResNet-50 neural networks was deployed. On the basis of international cooperation, the design of integrated structures of sublevel photonics for sensors was carried out, as well as the design, production, measurement and optimization of fiber Bragg gratings for the generation of slow light and sensors, silicon-based thin layers and multilayers and new types of silicon-germanium-silicon p-i-n photodetectors, which enable high-speed detection on a monolithic platform. We presented amorphous SiN:H/Si:H multilayers as a successful optical platform for sensors. This concept enables the engineering and optimization of the optical properties of the structure, especially its spectral absorption response, optical bandwidth and refractive index. For future dense channel multiplexes, the possibilities of using channel coding on batches of LDPC codes were investigated.

Project number: APVV SK-IL 2018-0005
Name of the project: ICT and intelligent cars for effective emergency response and traffic management SENECA
Coordinator: Milan Dado
Summary / Achievement: As part of the SENECA project solution (SK-IL-18-005), a set of data based on GPS measurements was obtained that describe the movement of emergency medical service vehicles, another one presents video recordings of departures and traffic accidents involving emergency medical service vehicles. The first set was used to create statistically reliable models of the time-space characteristics of vehicle exits usable in the optimization of the rescue system. The second data set was used to create a reconstruction methodology and in-depth quantitative analysis of traffic accidents and dangerous non-contact traffic

situations of road vehicles from the video footage of the vehicle's digital video camera. This methodology is particularly applicable in forensic engineering practice. The other goals that formed the core of the project and the stages related to them, focused on the design, modelling and simulation of transport and communication systems, brought four results. The first output is a concept and a study of the technical feasibility of a system for warning drivers about an approaching emergency vehicle, which brings possibilities of its application in the technical implementation or in the standardization process of similar systems. The second result is a case study of the impact of communication errors on the efficiency of intersection management. From a practical point of view, the study points to the need to consider communication errors in the design of future traffic light control algorithms that will work based on DRSC technology and also shows the possibilities of minimizing the effects of communication errors using data-analytical approaches. The third result is a comparison of DSRC, LTE-D2D in mode 3 and LTE in vehicle-network mode on a realistic urban scenario. The result is intended to serve as a guide for the selection of appropriate communication technology in the planning and technical implementation of the communication infrastructure. The fourth result is the concept of MLR estimates and their use in intersection management. The application of the concept consists in providing an estimate of the communication quality in real time in future intersection control systems based on DRSC technology.

DME

Name of the project: The center of the technical support ON Semiconductor
Coordinator: Michal Frivaldský
Summary / Achievement: 2022 CEE Business services awards – Winner for Best University-Business Cooperation of the Year – ON Semiconductor Slovakia.

Conferences and seminars

The Faculty of Electrical Engineering organized, or participated in preparation of the following scientific events in 2022:

- 14th International Conference ELEKTRO2022, 23. 5. – 26. 5. 2022, Krakow, Poland, organizer: Peter Hockicko.
- 23rd International conference Computational Problems of Electrical Engineering, CPEE 2022, 11. - 14. 9. 2022, Zuberec, Slovak Republic, Chairman: Ladislav Janoušek, DEBE.
- International conference Solid State Surfaces and Interfaces 2022, 21. 11. – 23. 11. 2022, CC SAS Smolenice, Emil Pinčík, IP SAS Bratislava, Stanislav Jurečka, IAS.
- 16th international conference on railway communication and safety technology, 23. 5. – 24. 5. 2022, Košice, main organizer: Betamont s.r.o., Zvolen, co-organizer: Aleš Janota, DCIS.
- Advances in electronic and photonic technologies, 20. 6. 2022. – 24. 6. 2022, Tatranská Lomnica, organizer: Jaroslav Kováč, FEI STU Bratislava, Dušan Pudiš, DPh.
- International Masterclasses 2022 for high schools 30. 3. 2022, University of Žilina, organizer: Ivan Melo, DPh.

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 until 2021 are summarized in the following table.

Tab. 11: Publication activities at FEEIT (based on registration at the University Library up to February/March of the relevant year)

Year	Monographs and university textbooks	Scientific works in journals	Scientific publications in Conference pub.	Patents, Utility Models	Others (Scripts, etc.)
2010	4	76(12*)	246	3	49
2011	4	86 (13*)	219	2	70
2012	4	76 (12*)	223	8	65
2013	12	107 (18*, 36**)	198	1	94
2014	5	89 (24*, 23**)	257	7	28
2015	10	84 (16*, 45**)	209	3	25
2016	4	61 (24*, 27**)	243	12	36
2017	6	98 (52*, 24**)	175	8	52
2018	5	78 (34*, 22**)	218	5	32
2019	4	94 (28*, 31**)	227	14	21
2020	7	91 (43*, 32**)	159	26	24
2021	3	75 (64*, 18**)	99	14	19

* out of which indexed in Current Contents Connect database

** out of which indexed in SCOPUS or Thomson Scientific Master Journal

In the following Tab. 12 we present in detail the publishing activities of the Faculty in 2022 (based on registration at the University Library up to February, 2023)

Category name (according to University Library)	Number
V1 - Scientific output of publication activity as a whole	1
V2 - Scientific output of publication activity as part of an edited book or collection	188
V3 - Scientific output of publication activity from the journal	106
O2 - Professional output of publication activity as part of a book publication or collection	2
P1 - Pedagogical output of publication activity as a whole	5
D1 - Document of intellectual property rights	21
I1 - Other output of publishing activity as a whole	1
Number of all records	**324**

Books, Textbooks and Lecture Notes

[1]	KONIAR, Dušan – HARGAŠ, Libor – DANKO, Matúš – ŠINDLER, Peter : Virtuálna inštrumentácia v meracích aplikáciách s podporou LabVIEW, Žilina: Žilinská univerzita v Žiline, 2022, ISBN 978-80-554-1830-8, 136 s.
[2]	HRABOVCOVÁ, Valéria – RAFAJDUS, Pavol – VAVRÚŠ, Vladimír: Elektrické stroje 1: Transformátory, Žilina: EDIS, 2022, ISBN 978-80-554-1891-9, 125 pp.

[3]	HRABOVCOVÁ, Valéria – RAFAJDUS, Pavol: Elektrické stroje 2: Jednosmerné stroje, Žilina: EDIS, 2022 ISBN 978-80-554-1892-6, 131 pp.
[4]	HRABOVCOVÁ, Valéria – RAFAJDUS, Pavol: Elektrické stroje 3: Striedavé točivé elektrické stroje, Žilina: EDIS, 2022 ISBN 978-80-554-1893-3, 240 pp.
[5]	KAJANOVÁ, Martina – HÖGER, Marek: Matematické modelovanie a simulácie v elektroenergetike, Žilina: EDIS, 2022, ISBN 978-80-554-1929-9, 187 pp.

Journals in WoS - Current Contents Connect

[1]	LITVAJ, Ivan – PONIŠČIAKOVÁ, Oľga – STANČEKOVÁ, Dana – SVOBODOVÁ, Jaroslava – MRÁZIK, Jozef: Decision-making procedures and their relation to knowledge management and quality management, In: Sustainability, Vol. 138, No. 1 2022, ISSN 2071-1050, p. 1-17.
[2]	KAJANOVÁ, Martina – BRACINÍK, Peter: The vehicle-to-grid concept with respect to the preferences of electric vehicle drivers and charging station operators. In: Applied Sciences, Vol. 12, No. 11, ISSN 2076-3417, p. 1-19.
[3]	REGUĽA, Michal – ŠIRANEC, Marek – OTČENÁŠOVÁ, Alena – HÖGER, Marek: Possibilities of Stray Current Measurement and Corrosive Risk Evaluation. In: Electrical Engineering: Archiv für Elektrotechnik, Vol. 104, No. 4, 2022, ISSN 0948-7921, p. 2497-2513.
[4]	KAJANOVÁ, Martina – BRACINÍK, Peter: Social welfare-based charging of electric vehicles in the microgrids fed by renewables. In: International Journal of Electrical Power & Energy Systems, Vol. 138, ISSN 0142-0615, p. 1-10.
[5]	VIDLÁK, Michal – MAKYŠ, Pavol – GOREL, Lukáš: A novel constant power factor loop for stable V/f control of PMSM in comparison against sensorless FOC with Luenberger type back-EMF observer verified by experiments. In: Applied Sciences, Vol. 12, No. 18, ISSN 2076-3417, p. 1-29.
[6]	VAVERKA, Filip – SMETANA, Milan – GOMBÁRSKA, Daniela – JANOUŠEK, Ladislav: Diagnosis of artificial flaws from eddy current testing signals based on sweep frequency non-destructive evaluation, In: *Applied Sciences*, Vol. 12, No. 8, 2022, ISSN 2076-3417, p. 1-15.
[7]	BORIK, Štefan – LYRA, Simon – PERLITZ – KELLER, Micha – LEONHARDT, Steffen – BLAZEK, Vladimir: On the spatial phase distribution of cutaneous low-frequency perfusion oscillations, In: *Scientific Reports*, Vol. 12, No. 1, 2022, ISSN 2045-2322, p. 1-18.
[8]	BORIK, Štefan – PRÔČKA, Patrik – KUBÍČEK, Jakub – HOOG, Antink Christoph: Skin tissue perfusion mapping triggered by an audio-(de)modulated reference signal, In: *Biomedical Optics Express*, Vol. 13, No. 7, 2022, ISSN 2156-7085, p. 4058-4070.
[9]	PRÔČKA, Patrik – ČELOVSKÁ, Denisa – ŠMONDRK, Maroš – BORIK, Štefan: Correlation mapping of perfusion patterns in cutaneous tissue, In: Applied sciences, Vol. 12, No. 15, 2022, ISSN 2076-3417, p. 1-12.
[10]	PŠENÁKOVÁ, Zuzana – ŠMONDRK, Maroš – BARABÁŠ, Ján – BEŇOVÁ, Mariana – BROCIEK, Rafal – WAJDA, Agata – KOWOL, Pawel – COCO, Salvatore – LO SCIUTO, Grazia: Computational analysis of a multi-layered skin and cardiac pacemaker model based on neural network approach, In: *Sensors*, Vol. 22, No. 17, 2022, ISSN 1424-8220, p. 1-13.
[11]	JUDÁKOVÁ, Zuzana – JANOUŠEK, Ladislav – RADIL, Roman – ČARNECKÁ, Lucia: Low-frequency magnetic field exposure system for cells electromagnetic biocompatibility studies, In: *Applied Sciences*, Vol. 12, No. 14, 2022, ISSN 2076-3417, p. 1-18.
[12]	LABUDA, Michal – ŠMONDRK, Maroš – BABUŠIAK, Branko – BORIK, Štefan: System for non-contact and multispectral examination of blood supply to cutaneous tissue, In: *Electronics*, Vol. 11, No. 18, 2022, ISSN 2079-9292, p. 1-19.
[13]	KRÁLIKOVÁ, Ivana – BABUŠIAK, Branko – ŠMONDRK, Maroš: EEG-based person identification during escalating cognitive load, In: *Sensors*, Vol. 22, No. 19, 2022, ISSN 1424-8220, p. 1-21.

[14]	SMETANA, Milan – GOMBÁRSKA, Daniela – JANOUŠEK, Ladislav – VAVERKA, Filip: Multi-point interaction of partially conductive cracks with sweep frequency eddy currents in electromagnetic non-destructive evaluation, In: *Applied Sciences*, Vol. 12, No. 22, 2022, ISSN 2076-3417, p. 1-14.
[15]	RADILOVÁ, Martina – KAMENCAY, Patrik – HUDEC, Róbert – BENČO, Miroslav – RADIL, Roman: Tool for parsing important data from web pages, In: *Applied Sciences*, Vol. 12, No. 23, 2022, ISSN 2076-3417, p. 1-18.
[16]	ŻUKOWSKI Paweł – ROGALSKI, Przemyslaw – BONDARIEV, Vitalii – ŠEBÖK, Milan: Diagnostics of high water content paper-oil transformer insulation based on the temperature and frequency dependencies of the loss tangent, In: *Energies*, Vol. 8, No. 15, 2022, ISSN 1996-1073, p. 1-16.
[17]	SMETANA, Milan – GOMBÁRSKA, Daniela – PŠENÁKOVÁ, Zuzana – CHUDÁČIK, Vladimír: Non-destructive investigation of intrinsic magnetic field of austenitic biomaterials by magnetic field sensors, In: *Sensors*, Vol. 22, No. 23, 2022, ISSN 1424-8220, p. 1-18.
[18]	VAVERKA, Filip – SMETANA, Milan – GOMBÁRSKA, Daniela – JANOUŠEK, Ladislav: Diagnosis of artificial flaws from eddy current testing signals based on sweep frequency non-destructive evaluation, In: *Applied Sciences*, Vol. 12, No. 8, 2022, ISSN 2076-3417, p. 1-15.
[19]	CIBIRA, Gabriel – GLESK, Ivan – DUBOVAN, Jozef: Dynamic bandwidth allocation for C-Band shared FBG sensing and telecommunications. In: IEEE Internet of Things Journal, Vol. 9, No. 22, 2022, p. 23272-23284.
[20]	CENDULA, Peter – BEDOYA, Lora – FRANKY, Esteban – PRABHAKAR, Rajiv Ramanujam: Semiconductor catalyst for oxygen and hydrogen evolution reactions. In: ACS Applied Energy Materials, Vol. 5, No. 12 (2022), ISSN 2574-0962, p. 14593-14604.
[21]	VAŇKO, Matúš – MÜLLEROVÁ, Jarmila – DADO, Milan: Numerical analysis of parameter optimization in slow light phase-shifted fiber bragg gratings. In: Materials Transactions, Vol. 63, No. 4, 2022, ISSN 1345-9678, p. 436-441.
[22]	HABIBI, Maryam – MIRZAEI, Saeed – ARMAN, Ali – JUREČKA, Stanislav – SADEGHI, Mohammad – ZELATI, Amir – SHAKOURY, Reza – TANHAEE, Ehsan – GHOBADI, Nader – ETHERAM, Hamid – ŢĂLU, Ştefan: Microstructure, fractal geometry and corrosion properties of CrN thin films. In: Materials Today Communications Vol. 32, ISSN 2352-4928, p. 1-8.
[23]	JANOTA, Aleš – PIRNÍK, Rastislav – ŽDÁNSKY, Juraj – NAGY, Peter: Human factor analysis of the railway traffic operators. In: Machines, Vol. 10, Issue 9, 2022, ISSN 2075-1702, p. 1-25.
[24]	RÁSTOČNÝ, Karol – ŽDÁNSKY, Juraj – HRBČEK, Jozef – MEDVEDÍK, Milan: Calculation of the Dangerous Failure Rate of the Safety Function. In: Applied Sciences, Vol. 12, Issue 5, 2022, ISSN 2076-3417, p. 1-15.
[25]	PENIAK, Peter – RÁSTOČNÝ, Karol – KANÁLIKOVÁ, Alžbeta – BUBENÍKOVÁ, Emília: Simulation of Virtual Redundant Sensor Models for Safety-Related Applications. In: Sensors, Vol. 22, Issue 3, 2022, ISSN 1424-8220, p. 1-19.
[26]	MEDVEDÍK, Milan – ŽDÁNSKY, Juraj – RÁSTOČNÝ, Karol – HRBČEK, Jozef – GREGOR, Michal: Safety of Control Systems with Dual Architecture Based on PLCs. In: Applied Sciences, Vol. 12, Issue 19, 2022, ISSN 2076-3417, p. 1-18.
[27]	ANDEL, Ján – ŠIMÁK, Vojtech – KANÁLIKOVÁ, Alžbeta – PIRNÍK, Rastislav: GNSS Based Low-Cost Magnetometer Calibration. In: Sensors, Vol. 22, Issue 11, 2022, ISSN 1424-8220 p. 1-10.
[28]	BUJŇÁK, Marek – PIRNÍK, Rastislav – RÁSTOČNÝ, Karol – JANOTA, Aleš – NEMEC, Dušan – TICHÝ, Tomáš – KUCHÁR, Pavol – LUKASIK, Zbigniew: Spherical Robots for Special Purposes. A review on current possibilities. In: Sensors, Vol. 22, Issue 4, 1413, 2022, ISSN 1424-8220, p. 1-36.
[29]	MIHÁLIK, Michal – HRUBOŠ, Marián – VESTENICKÝ, Peter – HOLEČKO, Peter – NEMEC, Dušan – MALOBICKÝ, Branislav – MIHÁLIK, Ján: A Method for Detecting Dynamic Objects Using 2D LiDAR Based on Scan Matching. In: Applied Sciences, Vol. 12, Issue 11, 5641, 2022, ISSN 2076-3417, p. 1-19.
[30]	MIHÁLIK, Michal – MALOBICKÝ, Branislav – PENIAK, Peter – VESTENICKÝ, Peter: The New Method of Active SLAM for Mapping Using LiDAR. In: Electronics, Vol. 11, Issue 7, 1082, 2022, ISSN 2079-9292, p. 1-15.

[31]	KIERCZYŃSKI, Konrad – ROGALSKI, Przemysław - BONDARIEV ,Vitalii – OKAL, Pawel – KORENČIAK, Daniel: Research on the influence of moisture exchange between oil and cellulose on the electrical parameters of the insulating oil in power transformers, In: Energies, Vol. 15, No. 20, 2022, ISSN 1996-1073, p. 1-15.
[32]	DOBRUCKÝ, Branislav – KAŠČÁK, Slavomír – ŠEDO, Jozef – PRAŽENICA, Michal - RESUTÍK, Patrik: Single-step response and determination of power components mean values of PES using p-q method during transients, In: Applied sciences, Vol. 12, No. 22, 2022, ISSN 2076-3417, p. 1-35.
[33]	USKOVAS, Gediminas – VALINEVIČIUS, Algimantas – ZILYS, Mindaugas – NAVIKAS, Dangirutis – FRIVALDSKÝ, Michal – PRAUZEK, Michal – KONEČNÝ, Jaromír – ANDRIUKAITIS, Darius: A novel seismocardiogram mathematical model for simplified adjustment of adaptive filter, In: Electronics, Vol. 11, No. 15, 2022, ISSN 2079-9292, p. 1-17.
[34]	KINDL, Vladimír – KAVALIR, Tomas – SIKA, Jiří – HNÁTÍK, Jan – KRIZEK, Michal – FRIVALDSKÝ, Michal: Wireless power transmission system for powering rotating parts of automatic machineries, In: Energies, Vol. 15, No. 18, 2022, ISSN 1996-1073, p. 1-15.
[35]	KINDL, Vladimír – SOBOTKA, Lukáš – FRIVALDSKÝ, Michal – SKALICKÝ, Martin: Analytical method for designing three-phase air-gapped compensation choke, In: Energies, Vol. 15, No. 19, 2022, ISSN 1996-1073, p. 1-17.
[36]	KINDL, Vladimír – SKALA, Bohumil – FRIVALDSKÝ, Michal: Analytical method for compensation choke geometry optimization to minimize losses, In: IEEE Access: practical innovations, open solutions, No. 10, 2022, ISSN 2169-3536, p. 89211-89220.
[37]	FRIVALDSKÝ, Michal – ŠIMČÁK, Marek: Evaluation of the accuracy of the identified equivalent electrical circuit of LiPePO(4) battery through verified measurements, In: Batteries, Vol. 8, No. 5, 2022, ISSN 2313-0105, p. 1-20.
[38]	DAI, Wenbin – TSANG, Kim Fung – BELLO, Lucia Lo – IBRAHIM, Yousef – FRIVALDSKÝ, Michal – TURZYŃSKI, Marek - SAHESCH-PUR, Ludwig S. – ROOS, Regina - AL-DILAIMY, Auday – BEHNAM, Moris – JASINSKI, Marek: Students and young professionals of the IEEE IES in the time of information, automation, and energy transformation, In: IEEE Industrial Electronics Magazine, Vol. 16, No. 1, 2022, ISSN 1932-4529, p. 95-103.
[39]	FRIVALDSKÝ, Michal – PAVELEK, Miroslav: Indirect electro-thermal modelling of semiconductor diode using non-linear behavior of volt-ampere characteristic, In: Energies, Vol. 15, No. 1, 2022, ISSN 1996-1073, p. 1-16.
[40]	HANKO, Branislav – FRIVALDSKÝ, Michal – MORGOŠ, Ján: Evaluation of the efficiency performance of 3-phase, 6-switch PFC circuit based on the used 1.2 kV SiC transistor, In: Electronics, Vol. 11, No. 3, 2022, ISSN 2079-9292, p. 1-16.
[41]	FRIVALDSKÝ, Michal – USKOVAS, Gediminas – VALINEVIČIUS, Algimantas – ZILYS, Mindaugas – NAVIKAS, Dangirutis – PRAUZEK, Michal – KONEČNÝ, Jaromír – ANDRIUKAITIS, Darius: Driver cardiovascular disease detection using seismocardiogram, In: Electronics, Vol. 11, No. 3, 2022, ISSN 2079-9292, p. 1-16.
[42]	KOLTUNOWICZ, Tomasz N. – KIERCZYŃSKI, Konrad – OKAL, Pawel – PATRYN, Aleksy – GUTTEN, Miroslav: Diagnostics on the basis of the frequency-temperature dependences of the loss angle tangent of heavily moistured oil-impregnated pressboard, In: Energies, Vol. 15, No. 8, 2022, ISSN 1996-1073, p. 1-14.
[43]	ŻUKOWSKI, Paweł – ROGALSKI, Przemysław - KOLTUNOWICZ Tomasz N. – KIERCZYŃSKI, Konrad – ZENKER, Marek – POGREBNJAK, Alexander D. – KUČERA, Matej: DC and AC tests of moisture electrical pressboard impregnated with mineral oil or synthetic ester-determination of water status in power transformer insulation, In: Energies, Vol. 15, No. 8, 2022, ISSN 1996-1073, p. 1-16.
[44]	KELLNER, Jakub – KAŠČÁK, Slavomír – FERKOVÁ, Želmíra: Investigation of the properties of a five-phase induction motor in the introduction of new fault-tolerant control, In: Applied sciences, Vol. 12, No. 4, 2022, ISSN 2076-3417, p. 1-25.

[45]	FRIVALDSKÝ, Michal – PIPÍŠKA, Michal - ZUREK-MORTKA, Marta – ANDRIUKAITIS, Darius: PFC inductor design considering suppression of the negative effects of fringing flux, In: Applied sciences, Vol. 12, No. 13, 2022, ISSN 2076-3417, p. 1-16.
[46]	DRGOŇA, Peter – ŠTEFÚN, Rastislav – KAŠČÁK, Slavomír – MORGOŠ, Ján: Recursive-iterative identification method for power converters, In: Electrical Engineering, Archiv für Elektrotechnik, Vol. 104, No. 1, 2022, ISSN 0948-7921, p. 145-153.
[47]	DANKO, Matúš – HANKO, Branislav – DRGOŇA, Peter – HOCK, Ondrej: Energy flow control of electric vehicle based on GNSS, In: Electrical Engineering, Archiv für Elektrotechnik, Vol. 104, No. 1, 2022, ISSN 0948-7921, p. 155-163.
[48]	KAŠČÁK, Slavomír – RESUTÍK, Patrik: Method for estimation of power losses and thermal distribution in power converters, In: Electrical Engineering, Archiv für Elektrotechnik, Vol. 104, No. 1, 2022, ISSN 0948-7921, p. 179-190.
[49]	SKALA, Bohumil – KINDL, Vladimír – FRIVALDSKÝ, Michal: Design, construction and calibration of the current sensor for medium frequency high-power electronic applications, In: Electrical Engineering, Archiv für Elektrotechnik, Vol. 104, No. 1, 2022, ISSN 0948-7921, p. 217-230.
[50]	ČULÍK, Kristián – ŠTEFANCOVÁ, Vladimíra – HRUDKAY, Karol – MORGOŠ, Ján: Interior heating and its influence on electric bus consumption, In: Energies, Vol. 14, No. 24, 2021, ISSN 1996-1073, p. 1-19.
[51]	KACIK, D. - MARTINCEK, I. - MACIAK, J. - GORAUS, M., Fabry-Pérot Interferometer Monitoring System for Counting Train Axle, IEEE Transactions on Instrumentation and Measurement, Vol. 712022 Art. num 7005409, 2022.
[52]	BURY, Peter – VEVERIČÍK, Marek – ČERNOBILA, František – TOMAŠOVIČOVÁ, Natália – ZAKUŤANSKÁ, Katarína – KOPČANSKÝ, Peter – TIMKO, Mila – JAROŠOVÁ, Markéta: Role of magnetic nanoparticles size and concentration on structural changes and corresponding magneto-optical behavior of nematic liquid crystals: In: Nanomaterials [electronic]. - ISSN 2079-4991 (online). - Roč. 12, č. 14 (2022), s. [1-11].
[53]	CHYLEK, Jakub – MANIAKOVÁ, Petra – HLUBINA, Petr – SOSBOTA, Jaroslav – PUDIŠ, Dušan: Highly sensitive plasmonic structures utilizing a silicon dioxide overlayer [electronic] In: Nanomaterials [electronic]. - ISSN 2079-4991 (online). - Roč. 12, č. 18 (2022), [1-13].
[54]	JANEK, Marián – et. all: Angular dependences of the deuteron analyzing powers in elastic dp scattering at large transverse momenta [print, electronic] In: Physics of Particles and Nuclei [print, electronic]. - ISSN 1063-7796. - Roč. 53, č. 2 (2022), s. 251-255.
[55]	ZIMAN, Martin – FEILER, Martin – MIZERA, Tomáš – KUZMA, Anton – PUDIŠ, Dušan – UHEREK, František: Design of a power splitter based on a 3D MMI coupler at the fibre-tip [electronic In: Electronics. - ISSN 2079-9292 (online). - Roč. 11, č. 18 (2022), s. 1-11.
[56]	ŠTRBÁK, Milan – KAJÁNEK, Daniel – KNAP, Vidžaja – FLORKOVÁ, Zuzana – PASTORKOVÁ, Jana – HADZIMA, Branislav – GORAUS, Matej: Effect of plasma electrolytic oxidation on the short-term corrosion behaviour of AZ91 magnesium alloy in aggressive chloride environment [electronic] In: Coatings [electronic]. - ISSN 2079-6412 (online). - Roč. 12, č. 5 (2022), s. 1-20.
[57]	MIZERA, Tomáľ – GAŠO, Peter – PUDIŠ, Dušan – ZIMAN, Martin – KUZMA, Anton – GORAUS, Matej: 3D polymer-based 1 × 4 MMI splitter [electronic] In: Nanomaterials [electronic]. - ISSN 2079-4991 (online). - Roč. 12, č. 10 (2022), s. 1-10.
[58]	HARDOŇ, Štefan – KÚDELČÍK, Jozef – BARAN, Anton – MICHAL, Ondrej – TRNKA, Pavel – HORNAK, Jaroslav: Influence of nanoparticles on the dielectric response of a single component resin based on polyesterimide [electronic] In: Polymers [electronic]. - ISSN 2073-4360 (online). - Roč. 14, č. 11 (2022), s. 1-13.
[59]	JANEK, Marián – et. all: Study of the dp elastic and dp breakup complementary processes using polarized and unpolarized beam of Nuclotron [electronic In: Few-Body Systems [print]. - ISSN 0177-7963. - Roč. 63, č. 1 (2022), s. 1-6.
[60]	TIOTSOP, L.F. – MIZDOS, T. – BARKOWSKY, M. – POČTA, P. – SERVETTI, A. – MASALA, E.: Mimicking Individual Media Quality Perception with Neural Network based Artificial Observers, In ACM

	Transactions on Multimedia Computing, Communications and Applications, vol. 18, No.1, ISSN 1551-6857.
[61]	FINKELBERG, I. – PETROV, T. – GAL-TZUR, A. – ZARKHIN, N. – POČTA, P. – KOVÁČIKOVÁ, T. – BUZNA, Ľ. – DADO, M. – TOLEDO, T.: The effects of vehicle-to-infrastructure communication reliability on performance of signalized intersection traffic control, In IEEE Transactions on Intelligent Transportation Systems, vol.23, No.9, pp. 15450-15461, ISSN 1524-9050.
[62]	DESPOTOVIC, V. – POČTA, P. – ZGANK, A.: Audio-based Active and Assisted Living: A review of selected applications and future trends, In Computers in Biology and Medicine, vol.149, ISSN 0010-4825.
[63]	PETROV, T. – POČTA, P. – KOVÁČIKOVÁ, T.: Benchmarking 4G and 5G-based cellular-V2X for vehicle-to-infrastructure communication and urban scenarios in cooperative Intelligent Transportation Systems, In Applied Sciences, vol. 12, No.19, ISSN 2076-3417.
[64]	VRSKOVA, R. – HUDEC, R. – KAMENCAY, P. – SYKORA, P.: Human Activity Classification Using the 3DCNN Architecture. Appl. Sci. 2022, 12, 931.
[65]	VRSKOVA, R. – HUDEC, R. – KAMENCAY, P. – SYKORA, P. (2022). A New Approach for Abnormal Human Activities Recognition based on ConvLSTM Architecture. Sensors, 2022, 22(8).
[66]	MATÚŠKA S. – MACHAJ J. – HUDEC R. – KAMENCAY P.: An improved IoT-based system for detecting the number of people and their distribution in a classroom, In: Sensors, Multidisciplinary Digital Publishing Institute, ISSN 1424-3210, Roč. 22, č. 20 (2022), s. 1-17.
[67]	PETKOVIC M. – BAJOVIC D. – VUKOBRATOVIC D. – MACHAJ J. – BRÍDA P. – MCCUTCHEON G. – STANKOVIC L. – STANKOVIC V.: Smart dimmable LED lighting systems, In: Sensors, Multidisciplinary Digital Publishing Institute, ISSN 1424-3210. - Roč. 22, č. 21 (2022), s. 1-21.
[68]	ORJESEK, R. – JARINA, R. – CHMULIK, M., 2022. End-to-end music emotion variation detection using iteratively reconstructed deep features. Multimedia Tools and Applications, 81(4), pp. 5017-5031.
[69]	BRIDA, P. – KREJCAR, O. – KOTSOPOULOS, S.: Enabling Technologies for Smart Mobile Services 2020, Vol: 2022, Article Number: 9870706, MOBILE INFORMATION SYSTEMS.
[70]	BRIDOVA, I. – BRIDA, P. – PAPAN, J. – KREJCAR, O.: New advanced approach for data flows prioritization at an output of a user terminal, Vol: 10, Page: 60887-60903, 2022, IEEE ACCESS.
[71]	SAHU, G. – SEAL, A. – BHATTACHARJEE, D. – NASIPURI, M. – BRIDA, P. – KREJCAR, O.: Trends and Prospects of Techniques for Haze Removal From Degraded Images: A Survey, Vol: 6, Iss: 4, Page762-782, 08/2022, IEEE TRANSACTIONS ON EMERGING TOPICS IN COMPUTATIONAL INTELLIGENCE.
[72]	KIRIMTAT, A. – TASGETIREN, MF. – BRIDA, P. – KREJCAR, O.: Control of PV integrated shading devices in buildings: A review, Vol: 214, Article Number: 108961, 108961, 04/2022, BUILDING AND ENVIRONMENT.
[73]	ŻUKOWSKI, Paweł - ROGALSKI, Przemysław - KOLTUNOWICZ, Tomasz: Influence of temperature on phase shift angle and admittance of moistened composite of cellulose and insulating oil. In: Measurement : journal of the International Measurement Confederation. – London (Veľká Británia) : Institute of Measurement and Control, Oxford (Veľká Británia) : Elsevier. – ISSN 0263-2241. – ISSN (online) 1873-412X. – č. 185 (2021), s. [1-13]
[74]	BENEDIKOVIČ, Daniel a kol.: Silicon-germanium avalanche receivers with fJ/bit energy consumption. In: IEEE Journal of Selected Topics in Quantum Electronics – USA : Institute of Electrical and Electronics Engineers. – ISSN 1077-260X. – ISSN (online) 1558-4542. – Roč. 28, č. 2 (2022), s. [1-8]
[75]	ALAHMADI, Mohannad - POČTA, Peter - MELVIN, Hugh: An adaptive bitrate switching algorithm for speech applications in context of WebRTC. In: ACM Transactions on multimedia computing, communications, and applications – New York (USA) : Association for Computing Machinery. – ISSN 1551-6857. – ISSN (online) 1551-6865. – Roč. 17, č. 4 (2021), s. [1-21]
[76]	Liu, QIANKUN - BENEDIKOVIČ, Daniel - SMY, Tom - ATIEH, Ahmad - CHEBEN, Pavel - YE, Winnie N.: Circular optical phased arrays with radial nano-antennas. In: Nanomaterials – Bazilej (Švajčiarsko) : Multidisciplinary Digital Publishing Institute. – ISSN (online) 2079-4991. – Roč. 12, č. 11 (2022), s. [1-11] [online]

[77]	ŠEVČÍK, Lukáš - VOZNAK, Miroslav: Adaptive reservation of network resources according to video classification scenes. In: Sensors [textový dokument – Bazilej (Švajčiarsko) : Multidisciplinary Digital Publishing Institute. – ISSN 1424-3210. – ISSN (online) 1424-8220. – Roč. 21, č. 6 (2021), s. [1-31]
[78]	SEYEDZADEH, Saleh - AGAPIOU, Andrew - MOGHADDASI, Majid - DADO, Milan - GLESK, Ivan: WON-OCDMA system based on MW-ZCC codes for applications in optical wireless sensor networks. In: Sensors – Bazilej (Švajčiarsko) : Multidisciplinary Digital Publishing Institute. – ISSN 1424-3210. – ISSN (online) 1424-8220. – Roč. 21, č. 2 (2021), s. [1-14]
[79]	CUCOR, Boris - PETROV, Tibor - KAMENCAY, Patrik - POURHASHEM, Ghadir - DADO, Milan: Physical and digital infrastructure readiness index for connected and automated vehicles. In: Sensors – Bazilej (Švajčiarsko) : Multidisciplinary Digital Publishing Institute. – ISSN 1424-3210. – ISSN (online) 1424-8220. – Roč. 22, č. 19 (2022), s. [1-28]
[80]	GLESKOVA, Helena - ISHAKU, Amayikai A. - BEDNÁR, Tadeáš - HUDEC, Róbert: Optimization of all-textile capacitive sensor array for smart chair. In: IEEE Access : practical innovations, open solutions. – Piscataway (USA) : Institute of Electrical and Electronics Engineers. – ISSN (online) 2169-3536. – Roč. 10 (2022), s. 48615-48621
[81]	BENEDIKOVIČ, Daniel a kol.: Circular optical phased array with large steering range and high resolution. In: Sensors – Bazilej (Švajčiarsko) : Multidisciplinary Digital Publishing Institute. – ISSN 1424-3210. – ISSN (online) 1424-8220. – Roč. 22, č. 16 (2022), s. [1-15] [online]
[82]	MÜLLEROVÁ, Jarmila - ŠUTTA, Pavol - HOLÁ, Michaela: Optical absorption in Si:H thin films: revisiting the role of the refractive index and the absorption coefficient. In: Coatings [elektronický dokument] . – Bazilej (Švajčiarsko) : Multidisciplinary Digital Publishing Institute. – ISSN (online) 2079-6412. – Roč. 11, č. 9 (2021), s. [1-10]
[83]	ŠEVČÍK, Lukáš - VAN, Hoang-Phuong - NGUYEN, Hoang-Sy: Performance analysis on low-power energy harvesting wireless sensors eco-friendly networks with a novel relay selection scheme. In: Electronics [elektronický dokument] . – Bazilej (Švajčiarsko) : Multidisciplinary Digital Publishing Institute. – ISSN (online) 2079-9292. – Roč. 11, č. 13 (2022), s. [1-14]
[84]	NASIR, Ali - Gao, Qiang - Sovička, Pavel - Makyš, Pavol - Štulrajter, Marek - Ma, Ke: Power converter fault detection and isolation using high-frequency voltage injection in switched reluctance motor drives for automotive applications. In: IEEE Journal of Emerging and Selected Topics in Power Electronics [textový dokument – New York (USA) : Institute of Electrical and Electronics Engineers. – ISSN 2168-6777. – ISSN (online) 2168-6785. – Roč. 10, č. 3 (2022), s. 3395-3408

Patents, Utility Models, Designs, Trade Marks

Submitted patents and industrial designes in 2022:

[1]	Category: patent Application number: 27-2022 Authors: Ivan Martinček, Matej Goraus, Daniel Káčik Title: Sensor for measuring the swelling kinetics of polymeric materials
[2]	Category: patent Application number: PP 35-2022 Authors: Marián Hruboš, Marek Bujňák, Dušan Nemec, Rastislav Pirník, Pavol Kuchár, Michal Gregor Title: Hazardous environment survey equipment
[3]	Category: patent Application number: 114-2022 Authors: Daniel Káčik, Ivan Martinček Title: The optical sensor of changes in the geometric dimensions of the accumulator cell
[4]	Category: Utility Model Application number: PUV 56-2022 Authors: Michal Vidlák, Pavol Makyš, Lukáš Gorel, Vladimír Vavruš

	Title: Method of positioning the car sunroof in sensorless mode
[5]	Category: Utility Model Application number: PUV 119-2022 Authors: Michal Praženica, Branislav Dobrucký, Slavomír Kaščák, Marek Höger Title: Connection for measuring overvoltages and overcurrents with a high-voltage cable model
[6]	Category: Utility Model Application number: 21-2022 Authors: Michal Praženica, Branislav Dobrucký Title: Wiring to increase the reliability of the power system
[7]	Category: Utility model Application number: 147-2022 Authors: Gabriel Gašpar, Peter Brída, et.al. Title: Device for wireless communication, management and disinfection of wearable electronics
[8]	Category: Utility Model Application number: 158-2022 Date of publication of the application: 07.12.2022 Authors: Štefan Borik, Juraj Strych Title: Circuitry for cardiorespiratory monitoring using a digital inductance converter
[9]	Category: Utility Model Application number: PUV 36-2022 Authors: Marián Hruboš, Marek Bujňák, Dušan Nemec, Rastislav Pirník, Pavol Kuchár, Michal Gregor Title: Hazardous environment survey equipment

Granted patents and industrial designes in 2022:

[1]	Category: patent Application number: 110-2016 Authors: Ivan Martinček, Daniel Káčik Title: Optical fiber Mach-Zehnder interferometer with tunable air arm and its tuning method Granted by the office:
[2]	Category: Patent Application number: 72-2020 Authors: Michal Praženica, Miroslav Pavelek, Michal Frivaldský Title: The chamber to irradiate biological samples by electromagnetic radiation
[3]	Category: Patent Application number: 123-2020 Authors: Dušan Koniar, Jozef Volák, Jakub Bajzík, Silvia Janišová, Libor Hargaš Title: Parallel Multi -Sensor Spatial Scan System with Current cameras:
[4]	Category: Utility Model Application number: 21-2022 Authors: Michal Praženica, Branislav Dobrucký Title: Wiring to increase the reliability of the power system
[5]	Category: Utility model Application number: 177-2021 Authors: Róbert Hudec, Slavomír Matúška, Martina Radilová Title: Electroconductive connection with magnetic bond
[6]	Category: Utility Model Date of registration and making available to the public: 25.03.2022 Inventor(s): Branko Babušiak, Maroš Šmondrk Title: Miniature electrocardiograph
[7]	Category: Utility Model

	Date of registration and making available to the public: 13.06.2022 Inventor(s): Maroš Šmondrk, Branko Babušiak, Štefan Borik, Ladislav Janoušek Title: A device for sensing finger motor skills
[8]	Category: Utility Model Application number: 108-2021 Inventor(s): Štefan Borik Title: A biosignal transmission in the audio band
[9]	Category: Utility Model Application number: 12-2022 Inventor(s): Štefan Borik, Michal Labuda Title: Device for non-contact examination of blood circulation in the skin, subcutaneous tissue and muscle
[10]	Category: Utility Model Application number: PUV 36-2022 Authors: Marián Hruboš, Marek Bujňák, Dušan Nemec, Rastislav Pirník, Pavol Kuchár, Michal Gregor Title: Hazardous environment survey equipment

Awards

- Ladislav Janoušek: J. A. Comenius plaque for the thankworthy pedagogical activity awarded by the rector of the the railway infrastructure. The medal was awarded by the Ministry of Transport and Construction University of Žilina on the International Teachers Day, Žilina, Slovak Republic
- Ladislav Janoušek: ESET Science Award 2022, finalist at the category Outstanding Academic in Slovakia, 14.10.2022, Bratislava, Slovak Republic
- Ladislav Janoušek: Award of the University of Žilina Rector for the 2022 in category: Outstanding scientific asset for the representation of UNIZA at the ESET Science Award, Žilina, Slovak Republic
- Štefan Borik: Award of the University of Žilina rector for the 2022 in category: 1st place at the UNIZA Grant competition in the category of young scientists, 16.12.2022, Žilina, Slovak Republic
- Valéria Hrabovcová: Recognition for contribution to the development and representation of the town of Žilina
- Marek Höger, et al.: Best Paper Award at the 14th International Conference "ELEKTRO2022", Krakow, Poland
- Marek Bajtoš: Best Paper Award at the 14th International Conference "ELEKTRO2022", Krakow, Poland
- Peter Brída: Certificate of successful completion of the project solution VEGA 1/0626/19 *Research on the localization of mobile objects in the IoT environment* and achieving excellent results
- Aleš Janota: Commemorative medal for lifelong contribution in signalling and security technology - an important part of the railway infrastructure. The medal was awarded by the Ministry of Transport and Construction of the Slovak Republic and the Railways of the Slovak Republic
- Karol Rástočný: Commemorative medal for lifelong contribution in signalling and security technology - an important part of the railway infrastructure. The medal was awarded by the Ministry of Transport and Construction of the Slovak Republic and the Railways of the Slovak Republic
- Peter Nagy: Commemorative medal for lifelong contribution in signalling and security technology - an important part of of the Slovak Republic and the Railways of the Slovak Republic
- DCIS: STU FCHPT Institute of Informatization, Automation and Mathematics - Director's Award for extraordinary development of mutual cooperation
- Štefan Hardoň: 3rd place: Defence of UNIZA grant for researchers under 35

- Štefan Hardoň: Conference Diagnostics: award from IEEE for invited lecture
- Marek Bujňák: Award for 1st place in the category: doctoral grant projects, call no. 1/2021. The award was given by the rector of the University of Žilina
- Michal Labuda: Award of the University of Žilina rector for the 2022 in category: 2nd place at the UNIZA Grant competition in the category of PhD. students, Žilina, Slovak Republic

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	

FOREIGN ACTIVITIES

Foreign activities of the Faculty of Electrical Engineering and Information Technology in 2022 were partially still affected by the pandemic situation caused by the COVID-19 coronavirus. Activities related to the solution of international projects were developed, mutual mobility of teachers, researchers and students at foreign institutions gradually increased, as well as active participation in foreign scientific events.

The Faculty successfully continues in the participation in the "Double degree program" in the study field "Electrical Engineering" for the study programs "Power Electronic Systems" and "Electric Drives" with the partner University of Catania in Sicily, Italy. Students from the partner university studied at FEEIT also in the academic year 2021/2022.

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 68 foreign universities were approved for students / teachers / other staff exchanges for the academic year 2021/2022, as follows:

1. TU Wien (AT)
2. Todor Kableshkov Higher School of Transport (BG)
3. University of Telecommunications and Post (BG)
4. "NikolaVaptsarov" Naval Academy (BG)
5. University of Hradec Králové (CZ)
6. University of West Bohemia (CZ)
7. Czech Technical University in Prague (CZ)
8. VŠB-Technical University in Ostrava (CZ)
9. Technical University of Liberec (CZ)
10. Brno University of Technology (CZ)
11. Silesian University in Opava (CZ)
12. Tomas Bata University in Zlín (CZ)
13. Czech University of Life Sciences Prague (CZ)
14. University of Central Lancashire (CY)
15. RWTH Aachen (DE)
16. TU Dresden (DE)
17. Hochschule für Technik und Wirtschaft Dresden (DE)
18. Hochschule fuer Telekommunikation Leipzig (DE)
19. RUHR Bochum (DE)
20. University of Applied Sciences Aschaffenburg (DE)
21. Technische Universität Ilmenau (DE)
22. Deggendorf Institute of Technology - Technische Hochschule Deggendorf (DE)
23. Universitat Autonoma de Barcelona (ES)
24. Tampere University of Technology (FIN)
25. Tampere University of Applied Sciences (FIN)
26. University of Jyväskylä (FIN)
27. Aalto University (FIN)

28. University of Vaasa (FIN)
29. Lappeenranta University of Technology (FIN)
30. Télécom SudParis (FR)
31. Télécom Ecole de Management (FR)
32. Université de Picardie “JulesVerne“ (FR)
33. Université de Technologie de Compiègne (FR)
34. Polytech Orléans (FR)
35. Lille 1 University Science and Technology, Polytech Lille (FR)
36. Ecole d'ingénieurs ECE Paris (FR)
37. Pole Universitaire Leonard De Vinci (FR)
38. University of Patras (GR)
39. University of Zagreb (HR)
40. Budapest University of Technology and Economics (HU)
41. University of Catania (IT)
42. Universita degli Studi di Palermo (IT)
43. Dublin Institute of Technology (IRL)
44. Transport and Telecommunication Institute (LV)
45. Riga Technical University (LV)
46. Kaunas University of Technology (LT)
47. Universidade da Beira Interior (PT)
48. Universidade de Lisboa (PT)
49. Universidade do Porto (PT)
50. Polytechnic Institute od Beja (PT)
51. Kazimierz Pulaski University of Technology and Humanities in Radom (PL)
52. Lublin University of Technology (PL)
53. Silesian University of Technology (PL)
54. West Pomeranian University of Technology (PL)
55. Gdansk University of Technology (PL)
56. Uniwersitet Technologiczno Przyrodniczy w Bydgoszczy (PL)
57. Warsaw University of Technology (PL)
58. Gdynia Maritime University (PL)
59. Wroclaw University of Science and Technology (PL)
60. Transilvania University of Brasov (RO)
61. Universitatea Technica din Cluj-Napoca (RO)
62. Universitatea “POLITEHNICA” din Bucuresti (RO)
63. University of Maribor (SI)
64. Uludağ University (TR)
65. Istanbul Arel University (TR)
66. Biruni University (TR)
67. Karabuk University (TR)

Erasmus+ stays

In the academic year 2021/2022 22 students (thence 7 students for Erasmus+ practical placements) participated in the Erasmus+ programme and 18 teachers from FEEIT participated in the Erasmus+ programme.

The Faculty accepted altogether 27 foreign students and 14 teachers from partner universities.

Other activities

The Faculty of Electrical Engineering 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)
- Ryazan State Radio Engineering University (RU)
- Ramboll UK Ltd. (UK)
- PanonIT (RS)
- University of Sydney (AU)
- Tongji University (CN)
- MC Gill University (CA)

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)
- National Research Council, Ottawa (CA)
- Moscow Technical University of Communications and Informatics (RU)
- Moscow Power Engineering Institute (RU)
- Cracow University of Technology (PL)
- 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 2022 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 2022

Foreign stays and visits in 2022							
Country	**Department (IN/OUT)**						
	DPh	**DEBE**	**DME**	**DPSED**	**DCIS**	**DMICT**	**IAS**
Czech Republic	2 / 0	3 / 4			0 / 5		
Finland	0 / 1						
France	1 / 0						
India		0 / 1					
South Korea					0 / 1		
Germany		0 / 4			3 / 0		
Poland	0 / 2	2 / 0	0 / 4				
Serbia		0 / 1				0 / 3	
Spain	0 / 1						
Switzerland	0 / 1						
Italy			0 / 1				
USA					0 / 1		
Total	**3 / 5**	5 / 10	0 / 5	0 / 0	3 / 7	0 / 3	0 / 0
Total all	**11 / 30**						

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 2022.

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 2022.

MAIN TASKS OF THE FACULTY FOR THE YEAR 2023

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 quality of education, cooperation in the processes of assessment of applications for granting accreditation in the provided study fields of FEEIT;
- get better feedback from students about their satisfaction with the education provided at the Faculty;
- organize a meeting of the faculty management with the academic community of the faculty once a year;
- to continue with marketing activities towards primary and secondary schools to increase students' awareness of the possibilities of studying at FEEIT;
- within the marketing activities, continue the implementation of at least one action directed towards primary schools and twenty actions directed towards secondary schools in order to inform students of schools about study possibilities at FEEIT;
- organization of two open-door actions towards secondary school students;
- in the context of improving the cooperation with secondary schools, to offer 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.

Contacts and Address

Academic Officials

Dean of the Faculty
Prof. Pavol Špánik, PhD.
Phone: +421 41 513 2050
E-mail: dean@feit.uniza.sk

Vice-dean for Education
Assoc. Prof. Mariana Beňová, PhD.
Phone: 041-513 2057
E-mail: education.vicedean@feit.uniza.sk

Vice-dean for Development and International Co-operation
Prof. Peter Brída, PhD.
Phone: 041-513 2066
E-mail: international.vicedean@feit.uniza.sk

Vice-dean for Research
Assoc. Prof. Peter Hockicko, PhD.
Phone: 041-513 2058
E-mail: research.vicedean@feit.uniza.sk

Vice-dean for information systems
Assoc. Prof. Marek Roch, PhD.
Phone: 041-513 2065
E-mail: marek.roch@feit.uniza.sk

Head of Administration and Finance
MSc. Katarína Jurošková
Phone: 041-513 20 52
E-mail: finance.head@feit.uniza.sk

Address
Faculty of Electrical Engineering and Information Technology
University of Žilina
Univerzitná 1
010 26 Žilina
Slovak Republic

Contact
Phone: +421 41 513 2051
E-mail: dean.office@feit.uniza.sk

For more information, please visit our Internet site on https://feit.uniza.sk.