Slovak Research and Development Agency (SRDA)

APVV-15-0152: Research of physical properties and growth kinetics of black silicon layers	
Summary:	Dominant aims of the project are focused on basic experimental, applied and theoretical research of black Si (c- Si and poly-Si) consisting of nanocrystalline objects. The research is oriented on i) forming of black Si in chemical wet solutions as well as in plasma using catalytic overlayer, ii) black Si layer growth kinetics, iii) research and modelling of basic physical parameters of black Si structures – such as optical, electrical and morphological ones, and iv) surface passivation of formed Si nanocrystalline objects using suitable technology (-ies) leading to the long termed durability of their properties. The project solves i) choice of suitable surface catalytic overlayer and chemical composition of used solutions, ii) formation of modified surface layers using catalytic overlayer and their physical properties also on GaAs, iii) formation and testing of pn black c-Si solar cells, and iv) antibacterial effect of black c-Si structures. Results of the above mentioned research will be compared with results obtained on the porous Si structures prepared electrochemically without catalytic overlayer.
Realization:	07/2016 – 06/2019
Coordinator:	Emil Pinčík, Institute of Physics, Slovak Academy of Sciences
Sub-Coordinator from FEE:	Jarmila Müllerová (IAS)
Co-operators:	Stanislav Jurečka, Zdeněk Dostál, Gabriel Cibira, Libor Ladányi, Ľubomír Scholtz (IAS)

APVV SK-CN-2015-0007: Progressive electric drives for automobile applications tolerant to system failures	
Summary:	The project deals with the operational safety of electric drives in critical applications in automotive and electric cars. The operational safety of the drive is assessed in the project based on its fault tolerance, in order to achieve an operation that does not allow the total system crash and fail, but the system will be able to operate in a reduced power and limited performance. The solved project captures the findings of current trends in automotive development, it contains a detailed analysis of the individual parts of the system, especially with regard to the use of modern electrical machines of the reluctance type (SRM and SRMPM), the sensors used and the methods of drive control. The project reflects the problems created by the global effort of the automotive industry to reduce production costs and thus reduce the cost of cars, but at the same time to improve the properties of electric drives by using modern electric machines with new, progressive methods of their control.
Realization:	1/2016 – 12/2017
Coordinator:	Pavol Makyš (DPES)
Co-operators:	Marek Štulrajter, Juraj Makarovič, Pavel Sovička (DPES)

APVV-15-0571: Research of the Optimum Energy Flow Control in the Electric Vehicle System	
Summary:	The project encompasses research into the multi energy storage system for a new generation of electric mobility applications focused on optimal use of energy stored in the primary electrochemical battery. The main criterion is thereby ensuring maximum range of the electric vehicle, at a given stored energy, which will be ensured by utilization of the recovery energy processes in changing the driving dynamics of the vehicles and optimum management of the bidirectional energy flow between the storages (batteries, supercapacitors) and traction drives. The main output of the project will be the simulator traction drive based on two-energy storage system designed to practical testing and optimization algorithms of the flow control and distribution of the power within the on-board network. Another output

	will be the software packets to manage and monitor on-board power system, including fault conditions and measurements of the relevant traction and energy quantities. The obtained results will be practically utilized in the design of the on-board power systems with optimal use of energy in the newly built university laboratory to teaching specialists in the field of electromobility.
Realization:	10/2016 – 09/2020
Coordinator:	Peter Drgoňa (DME)
Co-operators:	Branislav Dobrucký, Slavomír Kaščák, Michal Praženica, Michal Frivaldský, Roman Koňarik, Marek Paškala (DME)

APVV-15-0462: Research on Sophisticated Methods for Analysing the Dynamic Properties of Respiratory Epithelium's Microscopic Elements	
Summary:	The project is focused on research of sophisticated methods based on image analysis, intended to improve the objectivity, efficiency and automation of diagnostic processes in medicine. Its main objective is to identify the dynamic properties of biological objects of interest, which are the cilia of respiratory epithelium. Movement of such objects will be captured using high-speed video microscopy, while recording and data analysis will be carried out by high-power computer system. The recorded data will be then processed by our software system designed for segmentation of the objects of interest. The main criterion for segmentation will be the identification of pathological structures that are, due to disease or structural changes, static and do not contribute to cilia's primary function in vivo. Identification and subsequent analysis of segmented regions will notably contribute to an accurate specification of patient's diagnosis, and thus to determination of early and effective therapy. Although the results of the project are intended to be applied in the medical field, the project is mainly about the research of optimal technical solutions for modern diagnostic methods in medicine also in terms of international research in this area. The dominant project outcome will be the device enabling the analysis of high-speed videos.
Realization:	10/2016 – 09/2020
Coordinator:	Libor Hargaš (DME)
Co-operators:	Dušan Koniar, Miroslav Hrianka, Anna Simonová, Pavel Pavlásek, Peter Čuboň, Zuzana Loncová, Tomáš Uriča, Michal Taraba (DME)

APVV-15-0396: Research of Perspective High Frequency Converter Systems with GaN Technology	
Summary:	The project is focused on the issue of increasing the efficiency and power density of power semiconductor systems, while reducing the electromagnetic interference, which ultimately reduces negative environmental aspects of their application. Its main task is to research the phenomena related to applications of advanced semiconductor structures based on GaN transistors in power electronic systems, including research of commutation techniques applied in the switching frequency range of MHz units. Investigators will be outgoing from the results of the projects addressed at the national (ELTECO Ltd.), respectively international level (Panasonic Gmhb Lueneburg SNR). Another task of the project is to research phenomena affecting the efficiency of the practical application of those facilities. Specifically, the economic burden of production, reduction of CO2 and return on investment. The project also highlighted the issue of the reliability analysis and research methodology for the estimation of mean lifetime of power electronic systems based on GaN technology. At the same time, the project deals with draft measures on the possibility of extending the operation of such systems through multi-level multi-physics simulations. The main outcome of the project will be functional sample of the system meeting the declared goals, intended for direct use in industrial

	applications of electromobility application or respectively of wireless transmission of electricity. Another output will be a set of knowledge and measures for the optimal design of these systems, reducing the failure rate and lifetime extensions. Based on preliminary discussions with companies ELTECO Ltd. and Delta Electronics, it can be assumed rapid utilization of the results obtained in industrial practice.
Realization:	10/2016 – 09/2020
Coordinator:	Michal Frivaldský (DME)
Co-operators:	Pavol Špánik, Anna Kondelová, Anna Simonová, Ondrej Hock, Jozef Šedo, Peter Čuboň, Boris Kozáček, Michal Prídala (DME)

APVV-0314-12: Research and Development of New Generation of Power Supplies Based on Converters with High Power Density, High Efficiency, Low EMI and Circular Energy	
Summary:	Project is focused on research and development of new generation of switched mode power supplies, which are based on LLC, LLCLC and LCTLC topology with high power density and multifunction output and with double half-bridge DC/DC converter characterized by low circulating energy and low EMI. Co-operation with Elteco.
Realization:	10/2013 – 09/2017
Coordinator:	Branislav Dobrucký (DME)
Co-operators:	Pavol Špánik, Peter Šindler, Peter Drgoňa, Michal Frivaldský, Michal Praženica, Tomáš Laškody, Pavol Štefanec, Boris Kozáček, Ondrej Hock, Anna Simonová, Slavomír Kaščák, Anna Kondelová (DME)

APVV-0433-12: Research and Development of Intelligent System for Wireless Energy Transfer in Electromobility Application	
Summary:	The project is focused on problem of systems for wireless energy transfer, representing progressive solution for supplying of mobile and industrial devices. Task of this project is research of major effects on efficiency of systems for wireless energy transfer, usable for realization of charging points in the area of electromobility.
Realization:	10/2013 – 09/2017
Coordinator:	Pavol Špánik (DME)
Co-operators:	Libor Hargaš, Peter Drgoňa, Michal Frivaldský, Dušan Koniar, Michal Praženica, Ondrej Hock, Roman Mažgút, Martin Galád, Viliam Jaroš, Marek Píri (DME)

APVV-15-0441: Measurement system with optical sensor for systems Weight In Motion	
Summary:	Proposed project of applied research will be focused on design, optimalization and creation of a device for weight measurement of a vehicle (or its axle) in movement according to the currently valid traffic regulations on the road or highway. Project will discuss the selection of proper sensor hardware for the system, its mounting into existing solutions Measure-in-Motion® previously designed by project partner and compatibility of the used optical sensor output with the interface of the existing processing unit.
Realization:	07/2016 – 06/2020
Coordinator:	Daniel Káčik (DPh)
Co-operators:	Norbert Tarjányi (DPh), Milan Dado (DMICT), Aleš Janota, Juraj Spalek, Marián Hruboš, Rastislav Pirník, Peter Vestenický, Vojtech Šimák, Dušan Nemec, Jozef Hrbček (DCIS), Juraj Maciak, Jakub Horka, Milan Rysula

APVV-16-0006: Automated robotic assembly cell as an instrument of concept Industry 4.0	
Summary:	Global aim of the project is design of new modern concept of automated robotic assembly cell consisted of mobile manipulator, whereby manipulation task is performed by compliant manipulator. This aim is divided into partial tasks - design of mobile platform with capability of autonomous movement in unknown environment, concept of compliant manipulator with enhanced sensorial systems, which allows the manipulator better modelling of environment and interactions with human, and finally mutual cooperation of both modules to ensure the safe and stabile manipulation with objects also during the movement of robot. A suitable design of hardware and development of software will lead to construction of such unique concept, which combines actual trends in R&D in robotics.
Realization:	07/2017 – 06/2020
Coordinator:	František Duchoň (FEI STU)
Co-operators:	Aleš Janota, Juraj Spalek, Vojtech Šimák, Emília Bubeníková, Michal Gregor, Dušan Nemec, Jozef Hrbček (DCIS)

APVV-14-0519: Smart Textiles and Clothing for Mobile Monitoring of Human Vital Functions - INTELIGENTEX	
Summary:	Basic idea of the project is to contribute to implementation of platforms of the future based on wireless monitoring and transfer of human vital functions with a possibility of subsequent healthcare in real time. The project will focuse on preparation of functional components of smart clothing, development and testing innovative algorithms for analysis, evaluation, display and storage of the monitored biomedical signals and preparation of a prototype of smart clothing. Anticipated result of the project will be a prototype of smart clothing with incorporated textile sensors, textile electrodes with microelectronics, communication interface and terminal with user interface.
Realization:	07/2015-06/2017
Coordinator:	Ladislav Janoušek (DEBE)
Co-operators:	Branko Babušiak, Ján Barabáš, Štefan Borik, Michal Gála, Roman Radil (DEBE), Róbert Hudec, Slavomír Matuška, Martin Paralič, Martin Vestenický (DMICT)

APVV-16-0190: Research of Integration of functional system of TEXtiles for monitoring of BIO data for achievement of synergy of health, comfort and human safety	
Summary:	The main goal of the interdisciplinary projects is significant innovation and development of novel intelligent textile structures in European market, with use of progressive technologies in form of low temperature plasma and further application of nanotechnologies and integrated intelligent system for monitoring of biomedical data. The results of the research task will be prototype of intelligent mattress topper EKG-SmartSheet with increased hygienic parameters, which will be able to monitor human biomedical data in real time. By implementation of the project new possibilities to improve adequate healthcare and social conditions for post productive generation in Slovakia and EU will be created. Proposed project is reaction on the prognosis of negative social development in Slovakia and EU in next 20-30 years, with aim to improve possibilities for sustainability of quality of life and health for significant part of population.
Realization:	07/2017-06/2020
Coordinator:	Dana Rástočná Illová (VÚTCH - CHEMITEX,spol. s r.o.)
Co-operators:	Ladislav Janoušek (coordinator of FEE), Branko Babušiak, Ján Barabáš, Štefan Borik, Michal Gála, Roman Radil (DEBE), Róbert Hudec, Slavomír Matúška, Martin Paralič (DMICT)

APVV-16-0505: The short-term PREDICtion of photovoltaic energy production for needs of pOwer supply of Intelligent BuildiNgs – PREDICON	
Summary:	The proposed project is aimed at the developing of method for a very short-term prediction of photovoltaic (PV) power plant output with timescale ranging from 5 to 30 minutes. To forecast the intensity of solar irradiance, as the main factor affecting the performance of PV power plant, the algorithm using analysis of recorded image data representing cloudiness motion above the installation site of PV power plant will be proposed. To achieve the best accuracy of output prediction of PV power plant, local factors affecting solar irradiance and PV power plant operation will be identified. The analysis will be done in order to define correction factors for the adaptation of predicted values of solar irradiance determined by the proposed algorithm to current local conditions at the installation site of PV power plant. The functionality and accuracy of proposed method will be verified by the help of created PV power plant mathematical model as well as by measurements performed on real PV power plant.
Realization:	07/2017-06/2020
Coordinator:	Róbert Hudec (DMICT)
Co-operators:	Miroslav Benčo, Patrik Kamencay, Peter Sýkora, Slavomír Matúška, Martin Paralič, Martin Vestenický, Daša Tichá, Ján Hlubík, Miroslav Uhrina, Martin Šinko (DMICT), Peter Braciník, Marek Novák (DPES)

APVV-14-0560: PatRec- Resistive Switching Structures for Pattern Recognition	
Summary:	Verification of the possibility of application of memristors for realisation of logic circuits. Prepared memristors will be connected to simple logic circuits for implementation of fuzzy logic and switching functions. Final goal of the project is to demonstrate ability of memristor circuits to recognize patterns based on experiments and computer models.
Realization:	07/2015-06/2018
Coordinator:	Karol Frohlich (Slovak Academy of Sciences), Martin Klimo (Faculty of Management Science and Informatics)
Co-operators:	Roman Jarina, Michal Kuba, Michal Chmulík (DMICT)

APVV-15-0464: Efficiency Improvement of Electrical Power Transmission in Slovakia	
Summary:	The project deals with research and development of power losses caused by asymmetrical impedance of selected electric components (transformers, catenary, compensation chokes) of electrical power grid in Slovakia. The aim is to develop a series of steps and technology needed to determine impedance and admittance matrixes and to minimize the power losses due to the asymmetry of the components. Power losses optimization is still the most effective way of improving the energy resources utilization. Importance of such subject is supported by European Commission statement from 10/23-24/2014 aiming to the climate and energy policies frame, which expresses minimum 27% improvement of energy efficiency by 2030.
Realization:	1/2016 – 12/2020
Coordinator:	Juraj Altus (DPES)
Co-operators:	Marek Roch, Marek Höger, Alena Otčenášová (DPES), Jozef Lago, Ľuboš Pavlov

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

VEGA 1/0676/17: Research of electrical and optical properties of nanostructured semiconductor interfaces	
Summary:	In the project questions of experimental research and theoretical modelling of electrical and optical properties of nanostructured semiconductor-dielectric systems and porous layers on Si prepared by etching with assistance of electric field were solved. New theoretical methods of analysis of nanostructural and optical properties of investigated systems were developed, which were based on the implementation of Drude-Lorentz formalism, methods of approximation of effective medium and modelling of Raman scattering. For the completion of the experimental base, a project for the construction of an experimental device for measuring optical properties and for measuring the electrical properties of semiconductor samples was developed and implemented.
Realization:	01/2017 – 12/2019
Coordinator:	Stanislav Jurečka (IAS)
Co-operators:	Robert Menkyna, Ľubomír Scholtz (IAS), Michaela Solanská (DMICT)

VEGA 1/0491/14: Optoelectronical and optical devices with photonic structures	
Summary:	Project is focused on fabrication of photonic and optic structures for optoelectronical devices using maskless lithographic techniques. These lithographic methods and their combination with imprinting technique allow fabrication of photonic structures with period of order of few hundreds of nanometers and various optical structures. These will be patterned in the surface of optoelectronical and optical devices and in polydimethylsiloxane followed by direct application on light emitting diodes and waveguides. In combination with optimization of optical properties in simulation program, there is a great opportunity to develop unique optoelectronical and optical devices.
Realization:	01/2014 – 12/2017
Coordinator:	Dušan Pudiš (DPh)
Co-operators:	Daniel Káčik, Norbert Tarjányi, Ľuboš Šušlik, Ivana Lettrichová, Peter Gašo, Mária Pardelová, Jana Ďurišová (DPh)

VEGA 1/0510/17: Research and characterization of nanostructures by acoustic spectroscopy	
Summary:	The project is focused to the utilization of acoustic spectroscopy methods to study the structural, transport and relaxational properties of selected materials, forward for the application in the electrical engineering.
Realization:	01/2017 – 12/2019
Coordinator:	Jozef Kúdelčík (DPh)
Co-operators:	Peter Bury, Peter Hockicko, Ivan Bellan, Štefan Hardoň, Marek Veveričík, Emil Jahoda, Jana Bírešová (DPh)

V-1/0602/17: Ultra-high-cycle fatigue of welds with nanostructured layers	
Summary:	The aim of the project is the analysis of constructional and insulation condition of transformers using the selected frequency and time measurement methods. The focus will be to determine the parameters of the winding and insulating elements of transformer through simulations, physical models and direct experimental measurements at different degradation effects. Based on a synthesis will create a new methodology for analyzing the condition of specific types of transformers using

	the specified measuring methods with increased originality and innovation and on this basis will be create a new integrated system of diagnostics with the possibility of analysis and classification of possible faults on power transformers.
Realization:	01/2017 – 12/2019
Coordinator:	Miroslav Gutten (DMAEE)
Co-operators:	Martin Brandt, Milan Chupáč, Daniel Korenčiak, Matej Kučera, Milan Šebök, Milan Šimko (DMAEE)

VEGA 1/0957/16: Research and Development of Novel Construction of Switched Reluctance Machines for Automotive Traction Applications	
Summary:	This project deals with scientific research of modern electrical drive with switched reluctance motor (SRM) and with investigation of its performances and parameters for traction application in electrical vehicles. In the frame of this project, the detail analysis of a new SRM construction design and optimized construction of SRM will be carried out to obtain the best performances from point of view efficiency, distance range and reliability of electrical car. The modern methods of design as finite element method will be used for these SRM. The research of new control algorithms for this drive will be analysed with cooperation with power converter to obtain best efficiency for all working range. On the base of scientific research of these motors, some recommendations will be given for their manufacturing.
Realization:	01/2016 – 12/2018
Coordinator:	Pavol Rafajdus (DPES)
Co-operators:	Valéria Hrabovcová, Pavol Makyš, Vladimír Vavrúš, Pavel Lehocký, Juraj Makarovič, Adrián Peniak, Milan Diko (DPES)

VEGA 1/0610/15: Scientific research of fractional winding of synchronous machines with permanent magnets	
Summary:	This project will address - Research of synchronous machines with simple design, which will be optimized with respect to cost reduction of construction materials, where the geometry should, according to the latest research, tend to concentrated windings, - Increasing the efficiency of the machine by reducing the coil dimensions, by the possible use of superconducting coils as well by reduction of losses in the magnetic circuit. To achieve these two main objectives it is necessary in this project - Extend the theory of the windings to the windings with concentrated coils
Realization:	2015 – 2017
Coordinator:	Valéria Hrabovcová (DPES)
Co-operators:	Pavol Rafajdus, Pavol Makyš, Juraj Makarovič, Adrián Peniak, Milan Diko, Lukáš Gorel (DPES)

VEGA 2/0076/15: Research of black silicon structures	
Summary:	Project is oriented towards basic experimental and theoretical investigation of black silicon starting with its preparation chemically in liquid media and/or using high frequency plasma, electrochemistry of formation of such structure, investigation of basic properties of the structure, passivation of formed nano-crystalline objects using proper technology leading to tunnelling dielectric layers, research of electrical transport mechanisms in passivated structures, its structural and optical properties. The structures are prepared on the following substrates: i) c-Si, ii) poly-Si, and ii) proper type of amorphous Si and/or mc-Si thin film. The project will resolve selection of a proper type of doping of surface area of black silicon in order to form

	pn junction, to study its electrical properties and to fabricate corresponding black silicon based solar cell.
Realization:	01/2015 – 12/2017
Coordinator:	Emil Pinčík, Institute of Physics, Slovak Academy of Sciences, Bratislava
Sub-Coordinator:	Jarmila Müllerová (IAS)
Co-operators:	Stanislav Jurečka, Zdeněk Dostál, Gabriel Cibira, Libor Ladányi, Ľubomír Scholtz (IAS)

VEGA 1/0278/15: Research and development of optical waveguides and waveguide structures from polydimetylsiloxane	
Summary:	Design and development of waveguides, fibers and waveguide structures from polydimetylsiloxane with the aim to use them for photonic and sensor applications. Optical properties of waveguides and structures will be investigated in the visible and the near infrared region of the electromagnetic spectrum. Photonic elements on the basis of polydimetylsiloxane will be designed such as tunable waveguide optical attenuators, optical waveguide power limiters, optical fiber switches and optical planar and fiber sensors.
Realization:	01/2015 – 12/ 2018
Coordinator:	Ivan Martinček (DPh)
Co-operators:	Dušan Pudiš, Daniel Káčik, Norbert Tarjányi, Ľuboš Šušlik, Ivana Lettrichová, Peter Gašo, Daniel Jandura (DPh)

VEGA 1/0123/15: Ultra-high-cycle fatigue of welds with nanostructured layers	
Summary:	The aim of the project is to examine the procedure for evaluation of weld quality with nanostructured layers when applied ultra-high-cycle fatigue process.
Realization:	01/2015 – 12/2017
Coordinator:	Otakar Bokůvka (Faculty of Mechanical Engineering)
Co-operators:	Dagmar Faktorová (DMAEE)

VEGA 1/0928/15: Research of electronic control of power transmission and motion of road ICE- hybrid HEV and EV vehicles	
Summary:	The project deals with research in the area automotive electronics - Autotronics - identifying structures and advanced management methods of power transmission and motion ICE internal combustion vehicles, hybrid HEV and EV using their controllers and fieldbus (CAN) communication with them. Then there is the research of embedded processor systems for the electronic transmission control of performance of HEV and EV vehicles with central and distributed electric propulsion systems, as well as research into the power structure for optimal energy management and vehicle research and development environment for programming autotronics systems. The research results will be used for the education of specialists for the automotive industry, where it appears at present scarcity.
Realization:	01/2015 – 12/2017
Coordinator:	Branislav Dobrucký (DME)
Co-operators:	Pavel Pavlásek, Ondrej Hock, Martin Galád, Pavol Štefanec, Viliam Jaroš, Boris Kozáček, Roman Koňarik (DME)

VEGA 1/0479/17: Research on optimal approaches to managing energy transfer in systems with accumulation elements	
Summary:	The core of this project is research of relevant phenomena which influence the effectivity of energy management process in systems with accumulation elements. Such systems are represented mainly by dashboard network of electric cars and accumulation nodes of energetic systems. Starting point for the project will be the analysis of characteristic properties of each individual way how to accumulate energy with subsequent selection of optimal accumulation system for transfer process, with acceptance of allowed environmental impact. Another important aspect will be the research of possibilities how to improve the effectiveness of mentioned process using optimal energy flow into accumulation node, and implementation of obtained results through sophisticated converter technologies with ultrahigh switching frequencies. During the project solution, proven scientific methods based on computer simulations will be used, both for analysis in temporal domain as well as in 3D analysis of processes in electrochemical system.
Realization:	01/2017 – 12/2019
Coordinator:	Pavol Špánik (DME)
Co-operators:	Michal Frivaldský, Pavel Pavlásek, Peter Drgoňa, Anna Kondelová, Peter Šindler, Michal Prídala, Michal Taraba, Juraj Adamec, Ján Morgoš, Rastislav Štefúň (DME)

VEGA 1/0160/17: Pharmacological Influence of defense mechanisms of the airways, inflammation and remodeling by flavonol derivatives in conditions of experimental allergic asthma	
Summary:	The project is linked to projects VEGA 1/0073/08 a VEGA 1/0020/11. Their solution has shown the benefit of administering flavonoid mixtures on sensitivity of cough, bronchoconstriction and inflammation in conditions of experimentally induced allergic asthma. Solution of the current project will bring new knowledge about the effect of other derivatives of polyphenols from the flavonol group, in which an antiasthmatic action is expected. Searching for new sources of substances with complex anti-asthmatic action, substances that act as bronchodilatories, anti-inflammatories and anti-remodeling is trend of current experimental research on allergic asthma. The project solution will provide a comprehensive view of the activity of the monitored substances: examination of all basic defense mechanisms of the airways (cough, bronchoconstriction, mucociliary clearance), allergic inflammation (using the determination of inflammatory, immune cells, inflammatory cytokines and chemokines, etc.), and the degree of airway remodeling.
Realization:	01/2017 – 12/2020
Coordinator:	Soňa Fraňová, Institute of Pharmacology JLF UK Martin
Co-operators:	Libor Hargaš, Dušan Koniar, Anna Simonová (DME)

VEGA 1/0367/15: Research and development of a new system for autonomous robot trajectory control	
Summary:	The scientific project is focused on the implementation of hybrid sensors – Inertial Navigation System (INS), into robot's control. A system with such a control can acquire a precise position of robot's effector in space. The application can be used for calibration of a robotic workplace. The calibration is necessary in order to adapt a simulated model of a production device to real geometric conditions. A simulation model of a production device and robot programming set represent an accurate representation of reality. However, an absolute correspondence with the reality cannot be expected. The deviations of reality from simulation occur because of several reasons. The implemented INS will be used for calibration without the use of calibration equipment, thereby enabling a significant simplification of calibration in

	praxis.
Realization:	01/2015 – 12/2017
Coordinator:	Pavol Božek, Institute of applied informatics, automation and mechatronics, MTF
Sub-Coordinator:	Rastislav Pirník (DCIS)
Co-operators:	Vojtech Šimák, Dušan Nemec (DCIS)

VEGA 1/0427/15: Access Network Structures and Their Research in Terms of Performance and Time Characteristics	
Summary:	Research project will work on modelling and emulation of access network in terms of required demands for network services (audio, video and data) in the relation to the qualitative and quantitative system parameters. Performance and time characteristics will be the subject of an analytical model. Necessary part of research project will be the technological model realized by modern network technology (including a modern emulator AVALANCHE 290 which allows to realize the real network traffic in the access network), the content of which will be a separate access network. The goal of proposed research project is the resolving of QoS problem for critical (real-time) network services (voice and video traffic). Because the part of the research project will be the real access network, the obtained results will be directly applicable in practice.
Realization:	01/2015 – 12/2017
Coordinator:	Vladimír Hottmar (DMICT)
Co-operators:	Bohumil Adamec, Martin Vestenický, Ladislav Schwartz, Daša Tichá, Peter Kortiš (DMICT)

VEGA 1/0263/16: Research of integrated localization system based on wireless systems and sensors implemented in smart mobile devices	
Summary:	With the increasing amount of localization based services (LBS) also demands on the quality of positioning systems increase. Providers try to provide such LBS without restrictions about environment in which the user is located. High demands on the quality can be fulfilled only by the systems that utilize combination of all available technologies. The project is focused on proposal of positioning system, which will integrate systems commonly used for positioning of mobile device (MD) - smartphones. Systems that are assumed to be utilized are based on wireless networks, GNSS and sensors which are integrated in MD. The project will be focused on research of localization algorithms based on fingerprinting method, which will utilize data from available sensors in order to improve the method performance. Crucial part of the research is algorithms development that will integrate all available data in order to estimate position of MD. Proposed algorithms will represent core of the developed integrated positioning system.
Realization:	01/2013 – 12/2015
Coordinator:	Peter Brída (DMICT)
Co-operators:	Vladimír Wieser, Juraj Machaj, Ján Račko, Michal Mlynka, Martin Paralič, Darina Jarinová (DMICT)

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

KEGA 003TU Z-4/2015: Development of conceptual thinking at technical universities	
Summary:	The goal is to create materials for modern interactive methods and their application in the teaching process. These methods will make the study of physics easier and will help students develop their imagination, creativity and will fill in missing logical and abstract thinking.
Realization:	01/2015 – 12/2017
Coordinator:	Peter Hockicko (DPh)
Co-operators:	Jozef Kúdelčík, Gabriela Tarjányiová, Marián Janek (DPh)

KEGA 012TU Z-4/2017: Interactive methods in Physics Education at Technical Universities	
Summary:	The goal is to create a comprehensive study material for core physics subjects of new study programmes for the bachelor degree at four faculties of the Technical University in Zvolen and at six faculties of University of Žilina. This material will use modern interactive teaching methods
Realization:	01/2017 – 31.12.2019
Coordinator:	Ľuboš Krišťák (TU Zvolen)
Sub-Coordinator from FEE:	Peter Hockicko (DPh)
Co-operators:	Jozef Kúdelčík, Gabriela Tarjányiová, Marián Janek (DPh)

KEGA 031ŽU-4/2016: Implementation of Geometric product specifications (GPS) into the teaching process of engineering study programs and putting them into the technical practice	
Summary:	The goal of the project is modernisation, improving and supplementing of teaching contents and form within the education of study programs at universities of technical orientation and support for students to achieve such level of knowledge's and skills, which increase their competitiveness at the labour market. The project deals with the implementation of the latest findings introduced in the latest international technical standards in the field of Geometrical product specifications (GPS) into the contents of teaching materials of subjects as Engineering Drawing, Design, Methodology of Design, Engineering metrology and Metrology. The project is multidisciplinary. It is aimed at problems of designing and tolerances prescription for dimension, for geometry and form prescription within the product designing. It is also aimed at the field of geometrical quantities measuring and evaluation as well as at using of latest measuring equipment. The goal of the project is creating of educating program and publishing of textbook for university students. The book will be supplemented with digital annexes available at the information system with exercises assignments and results. Within the annexes there will be teaching tools and tests for students. One part of exercises will be in English. Another result of the solution of the project will be completion of laboratory for 3D measurement. That will be a benefit for students preparing themselves for future occupation in international firms – mainly in the field of automobile and bearings industry.
Realization:	01/2016 – 12/2018
Coordinator:	Jozef Bronček, Faculty of Mechanical Engineering UNIZA
Co-operators:	Ivan Litvaj (DPES)
KEGA 008ŽU-4/2015: Innovation of HW and SW tools and methods for laboratory education with focus on ICT security aspects in safety-critical process control applications	

Summary:	The goal of the project is to focus on the research in the field of evaluation of cryptographic mechanisms used for safety-critical process control applications based on modelling approach. The outcomes will be presented in a form of collective publications and a prepared monograph, as well. One of the objectives of the project is also to build up workplaces in AB 315 and AB 320 laboratories for the needs of education of subjects focusing information security.
Realization:	01/2015 – 12/2017
Coordinator:	Mária Franeková (DCIS)
Co-operators:	Peter Holečko (Vice Coordinator), Karol Rástočný, Peter Vestenický, Emília Bubeníková, Alžbeta Kanáliková, Rastislav Pirník, Marián Hruboš, Kamila Kršíková, Jozef Balák (PhD. student) (DCIS) , Peter Peniak (Continental Matador Rubber, s,r.o. Púchov) Martin Šuták, (Aliga, s.r.o. Martin)

KEGA 034ŽU-4/2016: Implementation of modern technologies into education with focus on safety PLC control	
Summary:	The project is focused on bridging the shortcomings resulting from the growing demands of industry for the theoretical knowledge and practical experiences in deployment of control systems with safety PLC. The project aim is to build a laboratory in which control systems with safety PLC will be together with the physical models allowing simulation of real situations in industry. The laboratory will allow the emergence of a new subject "Control systems with safety PLC" and subsequent solution of bachelor's thesis, master's thesis and dissertations. Under the project will be developed the teaching materials supported by examples. This allows to make studying more attractive and to train students for the practical needs and finally to develop cooperation with practice primarily in the area of consultation about achieving the required safety integrity level (SIL - Safety Integrity Level) of realized applications.
Realization:	01/2016 – 12/2018
Coordinator:	Juraj Ždánsky (DCIS)
Co-operators:	Karol Rástočný (Vice Coordinator), Jozef Hrbček, Peter Holečko, Peter Nagy, Vojtech Šimák (DCIS)

KEGA 038ŽU-4/2017: Laboratory education methods of automatic identification and localization using radiofrequency identification technology	
Summary:	Automatic identification systems currently represent an irreplaceable role in the automation of industrial production, transport, logistics and trade. Among the technical means allowing automatic identification of persons, objects or animals a radio frequency identification (RFID) dominates. Taking the importance of this technology into account it is necessary that graduates of the study field "Automation" and "Telecommunication and Radio Communication Engineering" that are accredited on the Faculty of Electrical Engineering, University of Žilina, have gained deep knowledge of the principles and applications of this modern technology. The presented project sets a number of scientific and pedagogical objectives. In the scientific objectives the mathematical modelling of RFID systems and their data channels, and also the development of digital signal processing algorithms in the field of RFID are dominant. The dominant educational objectives are the building of several laboratory workplaces enabling to demonstrate the basic physical principles of identification and localization of the RFID tags and to demonstrate the data structures of most commonly used identification cards such as Mifare and Desfire.
Realization:	01/2017 – 12/2019

Coordinator:	Peter Vestenický (DCIS)
Co-operators:	Jozef Balák, Michal Gregor, Peter Kello, Peter Nagy, Dušan Nemec, Juraj Ždánsky (DCIS)

KEGA 071ŽU-4/2017: Key Competences Formation and Effective Support of Students Mobility at Technology Faculties: Modelling, Design and Assessment of Flexible Education Concept	
Summary:	The project is aimed at effective flexible digital educational environment for technical and technological education at technical faculties concentrated on the support of development of key competencies of graduates of technical faculties by means of massive technological support directed at synergy of components of knowledge base and its integration with competences of graduates of technical study fields in an actual working environment. To the main aims of the project is related the setting up of educational environment, the integration of the content of education and the support of effective transfer of knowledge into the actual environment of „the European working market". The solution of the project is directed at the main component of the educational process – the content of education and its compatibility with the technological trends in the actual working environment where digitization of the content of education and flexibility of design of educational modules with multimedia components is dominant and is compatible with the trends of flexible educational environment (eContent, eLearning, eMobile, Blended Learning, Connected Learning). The project responds to the outputs of the National Project "Universities as engines of development of the knowledge society" in the context of massive amount of active researchers who work and use knowledge and technology base for this project. The main contribution is the conceptual solution of flexible education, i.e. the proposal, the design and the verification of the open „online" educational modules to support the development of key competences of students in the specific field of technical science. The project will contribute to diversification of university education, mobility of graduates of technical universities that will contribute to increase of educational efficiency and will encourage arrival of foreign investment to Slovakia and, mainly, will help Slovak firms to succeed at world market by strengthening of the dominant subject which produces values – the technical field graduate with the key competences for the 21st century needs.
Realization:	01/2017 – 12/2019
Coordinator:	Pavel Pavlásek (DME)
Co-operators:	Anna Simonová, Pavol Špánik, Dušan Koniar, Libor Hargaš, Zuzana Loncová, Tomáš Uriča (DME)

KEGA 073ŽU-4/2017: Implementation of modern education tools for automotive electronics and electromobility education	
Summary:	This project is focused on utilization of modern research and educational methods for improvement of new study programme Automotive electronics at the University of Zilina. Since the study programme Autotronics emerged from discussion between experts from the academic and scientific sector and from industry sector, this project is focused on combination of modern technologies in practise and teaching process. In our department (mechatronics and electronics) we see the trend of increasing requirements for number of graduates of first and second degree with knowledge involving not only the area of mechatronics and electronics but also automotive electronics. In addition, the cooperating companies in automotive industry require students with knowledge of the car (either with internal combustion engine ICE and electric cars) in a broader context

	and deeper understanding. It is clear, that the new study programme Autotronics must include the most modern technical means not only at the hardware level (real vehicle systems of ICE and EV), but also at the software level (freely programmable ECUs, embedded processor systems). The educational process will be used by means of e-learning, online lab and multimedia access. Students will be using modern tools of learning, will acquire the knowledge needed for success in practice or in the higher levels of study. The project builds on previously successfully investigated projects at the Department of mechatronics and electronics. Main focus is to complete laboratory of Autotronics and electromobility with comprehensive applications and samples of automotive electronic and control systems for cars with internal combustion engine and electric cars. Another objective includes the release of two university textbooks focused on automotive electronic systems and control systems for automotive and industrial applications. Finally, a new educational website with course materials, practical guides and tutorials will be created. The educational portal will be designed not only for students of study programme Autotronics, but also for all students of the Electrical engineering.
Realization:	01/2017 – 12/2019
Coordinator:	Pavol Špánik (DME)
Co-operators:	Peter Drgoňa, Pavel Pavlásek, Michal Frivaldský, Anna Kondelová, Ondrej Hock, Slavomír Kaščák, Jozef Lakatoš, Marek Paškala, Roman Koňarik (DME)

Structural Funds

ITMS 313011B765: Universal virtual intelligent space for transport systems	
Summary:	The research objective is in creating a system environment of information sources based on IoE, its advanced processing, connection to other life areas, searching for correlations between things, processes (information), seemingly unrelated, using these discovered dependencies in technological innovations, decision making and process control in transport and in standard living of citizens.
Realization:	09/2017 – 08/2022 , Project is currently under hold
Coordinator / Project manager (UNIZA):	Rastislav Pirník (DCIS)
Co-operators:	Aleš Janota, Juraj Spalek, Mária Franeková, Pavel Přibyl, Peter Vestenický, Marian Hruboš, Peter Holečko, Emília Bubeníková, Vojtech Šimák, Jozef Hrbček, Michal Gregor, Alžbeta Kanáliková, Dušan Nemec (DCIS)

ITMS2014+313011B738: Research and development of wireless system for prediction of potential savings of heating energy in large buildings	
Summary:	The project is focussed on research and development of wireless monitoring system WHEMS (Wireless Heating Efficiency Monitoring System), which will consist of wireless agents for monitoring of physical parameters (provided heat, interior and exterior temperatures, humidity, etc.) at the room level and master ICT architecture for archiving and processing of data for prediction of potential reduction of heating energy costs in large buildings possible by use of optimal regulatory system. Successful development of the system will enable new services in area of energetics, which will enable development of optimal regulation system for a given building and estimation of investment return. Side effect of this service will be reduction of heating costs and protection of the environment. Activities of the project involve research and development of wireless agents and

	infrastructure from both hardware and software point of view, development of software for ICT infrastructure, as well as basic research of algorithms for estimation of energy savings. The system is assumed to be deployed in buildings of government, schools, hospitals and administrative buildings. Implementation of the project will be based on close cooperation of teams from University of Zilina and from Amicus SK company, this will enable improvement of regional cooperation of both institution with focus on new experiences in area if construction, development and operation of wireless agents and ICT infrastructure in areas of heating and cooling regulations.
Realization:	09/2017 – 02/2023, Project is currently under hold
Coordinator:	Martin Vestenický (DMICT)
Co-operators:	Peter Vestenický, Adamec Bohumil, Kuba Michal, Kortiš Peter, Vaculík Martin (DMICT)

Other National Research Projects

IBM-10/2016: Exploration of Smart City Services with IBM within UNIZA Campus	
Summary:	The aim of the project is to follow up the IOT activities within UNIZA Campus, bring new solutions & innovations and help more students to get familiar with IBM technology in this area (IOT, BigData, Analysis). It will also deepen the relation between IBM and UNIZA.
Realization:	10/2016 – 10/2018
Coordinator:	Peter Holečko (DCIS)
Co-operators:	Aleš Janota, Juraj Spalek (DCIS)

2016et017: Control of frequency management of the 5G communication network	
Summary:	Applied scientific research was focused on the partial tasks of modelling of multiplex switching into suitable free frequency channels, optimizing the efficiency of use of future 5G bandwidth, analysing manners of coding and modulation for real environments, selecting optimal advanced signal modulations, data protection and system reliability. In order to fulfil the technical objectives, a theoretical design was created due to the financial resources of the project, the initial technical realization of the basic set of hardware components and control software algorithms for the radio direction of the communication node.
Realization:	12/2016 – 11/2017
Coordinator:	Gabriel Cibira (IAS)
Co-operators:	Libor Ladányi, Ľubomír Scholtz, Michaela Solanská (IAS) Students: Marek Oravec, Tomáš Praskaj, Erik Sádovský, Michael Hruška, Michal Salák, Peter Púchovský
314/17_RT: Universal balancing system for traction batteries of electric vehicles	
Summary:	Creation of a universal balancer of traction lithium batteries of all types is a project goal. The balancer system includes an active-passive balancer with intelligent control system that ensures increased cyclability and safety of different battery types.
Realization:	09/2017 – 04/2018
Coordinator:	Peter Drgoňa (DME)
Co-operators:	Matúš Danko, Juraj Adamec, Michal Taraba (DME)

Other National Non-research Projects

HOOP – a playful form of OOP education for middle school teachers	
Summary:	The project focuses on a change of the Informatics course curricula at the secondary schools and a preparation of informatics teachers for OOP education, specifically in JAVA and Greenfood and BlueJ environments.
Realization:	09/2016 – 09/2018
Coordinator:	Michal Varga, Faculty of Management Science and Informatics UNIZA
Co-operators:	Alžbeta Kanáliková (DCIS), Emil Kršák, Michal Varga, Norbert Adamko, Ľubomír Sadloň (Faculty of Management Science and Informatics)

POPULAS 2	
Summary:	The POPULAS 2 project is aimed on popularisation of research and development in area of information and communication technologies by presentation activities for audience consisting of students and lecturers of regional schools focussed on informatics, electronics and transport. During the project seminar for secondary school lecturers, which will enable exchange of experiences and discussion in area of ICT, and teaching of young persons.
Realization:	01/2017 – 07/2017
Coordinator:	Róbert Hudec (DMICT)
Co-operators:	Vladimír Matyščák, Miroslav Benčo, Ján Hlubík, Peter Sýkora, Juraj Machaj, Jozef Dubovan, Patrik Kamencay, Peter Počta (DMICT)

Phenomenology and Outreach (FEPO), Agreement between Ministry of Education SR and University of Žilina	
Summary:	Department of Physics will collaborate with CERN in the area of research and outreach in particle physics. In the research part we will collaborate with the Theory Department in the area of Heavy Ion Physics and mechanism of Electroweak Symmetry Breaking. Our department will coordinate Particle Physics Masterclasses at the national level (Masterclasses, http://fyzika.uniza.sk/mc/) at 6 Slovak universities, will co-organize international competition Beamline for Schools and develop portal svetcastic.sk for outreach and communication of particle physics.
Realization:	01/2017 – 12/2020
Coordinator:	Ivan Melo (DPh)
Co-perators:	Mikuláš Gintner, Gabriela Tarjányiová, Jozef Kúdelčík (DPh)

K4 Žilina Childrens University 2017	
Summary:	Goal of the project is to focus the attention of school age children from Žilina area on STEM subjects and show them applications of research for everyday life.
Realization:	02/2017 – 11/2017
Coordinator:	Peter Hockicko (DPh)
Co-operators:	Teachers from UNIZA