

 **Tomas Bata University in Zlín**

Science Activity Annual Report

2020

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1 DEFENDED DOCTORAL THESES

In 2020, a total of 39 theses were defended: 15 at the Faculty of Technology, 7 at the Faculty of Management and Economics, 4 at the Faculty of Multimedia Communications, 10 at the Faculty of Applied Informatics, 2 at the Faculty of Humanities, and 1 at the University Institute.

1.1 Faculty of Technology

Degree Programme: CHEMISTRY AND MATERIALS TECHNOLOGY

Degree Course: Technology of Macromolecular Compounds

Smarak Bandyopadhyay, M.Sc, Ph.D.

Date of defence: 27. 8. 2020

Supervisor: prof. Ing. Petr Sába, Ph.D.

Hydrogel-based bioactive food packaging material for agro products

Abstract

Petroleum based food packaging materials increase the global carbon footprint due to their non-biodegradability. Moreover, the excessive use and improper disposal have caused enough harm to the aquatic and terrestrial lives. According to the European Parliament, the usage of single-use plastics (mainly used for food packaging) should be replaced with biodegradable packaging materials by 2022. Bio-based hydrogels are not only an alternative to the non-biodegradable packaging materials but also have the capability to enhance the shelf life of the product. This doctoral thesis is focused on the production of bacterial cellulose (BC) from waste apple juice and utilizing the BC to develop novel biodegradable hydrogel film (PVP-CMC-BC-GG). Furthermore, essential oils and anthocyanin were added to the films to make them functional packaging material. Among the evaluations done for the hydrogel film, SEM, FTIR, XRD, TGA, DMA, color assay, mechanical and biodegradation analysis are the notable ones. Mechanical tester Instron gave the Young's modulus, elongation

at break and tensile strength of the films. The physico-chemical analysis of the novel packaging material was done using FTIR and XRD methods. SEM provided an insight to the structural orientation of the film, and TGA gave the thermal stability of the materials. The determination of barrier properties is also an important parameter for food packaging material, hence the oxygen permeability and water vapour transmission rate were calculated following ASTM protocols. The analysis of freshness of food (berries and cheese) were done by packing in the hydrogel film and monitoring them over a period of time. The results from SEM revealed that the final film structure has characteristic hydrogel pores. The FTIR spectra support the presence of PVP-CMC, BC and GG in the final structure. PVP-CMC-BC-GG has the best barrier and mechanical properties among all the compositions tested. Further, the shelf life enhancement of berries and cheese by this film also supports its use as a packaging material. The addition of essential oil to the films has resulted in inhibition zones (antimicrobial properties) against an array of food spoilage microbes. Further, the incorporation of anthocyanin has made the films pH-sensitive and successful in detecting pH changes due to food spoilage. Finally, the newly developed hydrogel film was 80% degraded in compost bed in 30 days and complete degradation in 60 days. Thus it can be concluded from the achievements of the thesis that PVP-CMC-BC-GG hydrogel dried films can be an alternative to the petroleum based food packaging materials.

Probal Basu, M.Sc, Ph.D.

Date of defence: 30. 9. 2020

Supervisor: doc. Nabanita Saha, M.Sc. Ph.D.

Study on Calcium Reinforced Polymeric Hydrogel Scaffolds for Bone Tissue Regeneration

Abstract

Treatments for unwanted bone fractures have different limitations like potential infection risks and requirement of secondary surgery. Polymeric tissue engineering scaffold material can be a suitable alternative treatment device for the bone tissue regeneration due to its excellent biocompatibility, mechanical property and degradability. This thesis reports the pre-

paration and characterization of novel calcium reinforced bacterial cellulose (BC) based hydrogel scaffolds for its possible application in bone tissue regeneration. The scaffolds were developed by using a combination of natural polymer, BC and other synthetic polymers like polyvinylpyrrolidone (PVP), polyethylene glycol (PEG). The scaffolds were prepared in two forms. First, calcium phosphate (CaP) reinforced BC based hydrogel scaffolds were prepared, where CaP was used in the form of "beta"-tri calcium phosphate ("beta"-TCP) and hydroxyapatite (HA) in different concentrations. Second, calcium phosphate & calcium carbonate reinforced BC based hydrogel scaffolds were prepared through template mediated in vitro biomineralization of CaP filled BC based hydrogel scaffolds. The structural properties (physiochemical, morphological, mechanical and/or viscoelastic characterization) indicated the CaP reinforced scaffolds have demonstrated significant swelling ability, suitable porosity and other mechanical and viscoelastic properties. Furthermore, functional properties (involving the biocompatibility, cell viability, cell-biomaterial interaction and bone marker expression) indicated their better efficiency for bone tissue regeneration. Thus, the CaP reinforced BC based hydrogel scaffolds (BC-PVP-"beta"-TCP/HA_20:80 and BC-PVP-"beta"-TCP/HA_50:50) are recommended for further analysis (e.g. in vivo study) and application in soft bone tissue (ie. cancellous bone) regeneration.

Thaiskang Jamatia, M.Sc. Ph.D.

Date of defence: 15. 9. 2020

Supervisor: doc. Ing. et Ing. Ivo Kuřitka, Ph.D. et Ph.D.

Preparation and characterisation of fillers for polymer nanocomposite layers usable in electronics

Abstract

The work centred on the one-pot microwave-assisted polyol synthesis of undoped and Fe- and Al-doped ZnO nanoparticles from zinc acetate precursor diethylene glycol (DEG) solution in 15 minutes. The microwave reactor is advantageous over conventional heating due to its rapid and uniform heating of the reaction mixtures. The main advantage of the polyol synthesis is its ability to reduce metal ions and passivation of surface defects in ZnO nano-

particles. The roles of small stoichiometric amounts of water and oleic acid (OA) as a capping agent in the synthesis were studied. The average particle size of undoped ZnO nanoparticles increases with the addition of multiples of equivalent amounts of water to the precursor solution. Also, the addition of the long-chain organic ligand, OA, yielded well-dispersed products without agglomerations. Moreover, it allowed fine dispersion of ZnO and doped ZnO nanoparticles in toluene which is necessary for the preparation of nanocomposites. Doping of the ZnO nanoparticles was carried out for altering the band gap of the semiconductor nanoparticles to modify its optical and electronic properties. Fe³⁺ source ions were reduced to Fe²⁺ ions, and incorporated to the host crystal lattice of nanoparticles. This p-doping decreased the UV luminescence intensity of the host nanoparticles. Addition of Al³⁺ ion source to the reaction mixture resulted in n-doping of the host nanoparticles imparting them enhanced UV luminescent intensity. The particle crystallinity and size of the nanocrystallites were analysed by X-ray diffraction (XRD), and transmission electron microscopy (TEM) images confirmed the morphology and size of the nanoparticles produced. Ultraviolet-visible spectroscopy (UV-Vis) and fluorescence measurement were conducted to analyse the optical properties of the nanoparticles. Diffuse reflectance (DR) UV-Vis measured the reflectance, and the band gap was estimated by Tauc plot. Brus' model was utilised to study the relation between the size of the semiconductor nanoparticles and its electronic structure. Finally, polymer light-emitting diodes (PLEDs) were prepared to demonstrate the ability of the tailored nanoparticles as fillers for polymer-matrix nanocomposite-based electronic devices. The dispersions of pure or variously doped ZnO nanoparticles in toluene solutions of poly[2-methoxy-5-(2'-ethylhexyloxy)-1,4-phenylene vinylene] (MEH-PPV) were spin-cast to obtain thin nanocomposite films serving as emissive layers in PLEDs. Electroluminescence (EL) was increased by the introduction of the nanoparticles. Specifically, Fe-doping decreased the opening bias while Al-doping enhanced the EL intensity greatly. Moreover, the chromaticity characteristics were improved by nanoparticles addition as well.

Ing. **Kristýna Jelínková**, Ph.D.

Date of defence: 30. 9. 2020

Supervisor: doc. Mgr. Robert Vícha, Ph.D.

Synthesis and supramolecular behaviour of multitopic cubane-based ligands

Abstract

Multitopic ligands can bind different macrocycles to their binding sites. Due to interactions between different types of host molecules, they can display interesting binding behaviour. Therefore, we decided to prepare and study the supramolecular properties of tritopic cubane-based ligands. We also looked for a suitable structure, which would be able to form an inclusion complex with CB6. A simple 1,4-diaminocubane dihydrochloride was prepared followed by synthesis of 2,6-disubstituted spiro[3.3]heptane derivative. It was experimentally verified that the cubane cage is too bulky for CB6. Contrary, bisimidazolium derivative of spiro[3.3]heptane formed an inclusion complex with CB6. Six model (benz)imidazolium salts with one adamantane binding site were prepared. All six adamantane-based ligands formed complexes with "alfa"-, "beta"-, "gama"-CD, CB7 and CB8 with 1:1 stoichiometry. The selectivity of CB7/CB8 towards the 3,5-dimethyladamantane substituent was retained. The preparation of three tritopic bisimidazolium cubane-based ligands containing one central cubane and two terminal adamantane binding sites followed. The results showed that all three tritopic ligands are able to bind two "beta"-CD, two CB8 and one "gama"-CD unit. Tritopic ligands provided the most interesting differences in the presence of CB7. The results obtained within this work can be used for the design of a binding motif for CB6, new multitopic ligands or attractive ligands suitable for "gama"-CD.

M.Sc. **Jelica Kovačević**, Ph.D.

Date of defence: 28. 5. 2020

Supervisor: doc. Mgr. Robert Vícha, Ph.D.

Study of adamantane-based supramolecular cross-linkage agents for cyclodextrin-modified biopolymers

Abstract

Polysaccharide-based biopolymers are produced by living organisms or chemically synthesised from basic biomolecules. Biopolymers have a great potential to be employed in development of therapeutic devices for biomedical applications. The benefits of using naturally occurring polymers instead of synthetic materials are biocompatibility, biodegradability, lower antigenicity, and renewability. To combine the above mentioned advantages and reversible formation of higher aggregates in host-guest manner, biopolymers have been widely utilised in supramolecular chemistry. Among various host-guest partners, interaction based on cyclodextrins has been extensively investigated for the construction of supramolecular aggregates due to their hydrophobic cavities, biocompatibility, and low toxicity. The presented doctoral thesis is focused on the preparation of modified biopolymers (specifically, hyaluronane and chitosan) and study of their ability to form supramolecular networks with multitopic adamantane-based guest motifs. Due to low toxicity and sufficient biocompatibility, biopolymers like hyaluronic acid (HA) or chitosan (CS) are suitable for hydrogel preparation and make them excellent candidates for use in drug delivery, tissue engineering, etc. The new modified CD-HA polymer was prepared via a click reaction between propargyl-modified HA and monoazido-beta-cyclodextrin, whereas modified CD-CS polymer was prepared via a Schiff base reaction between 6-O-(4-formylphenyl)-beta-cyclodextrin and commercially available chitosan. Consecutively, we studied supramolecular behaviour of modified biopolymers with single-, two-, and three-site adamantane-based guest motifs to describe their ability to form supramolecular networks, which can be driven by competing signal molecules. The achieved results inferred that the modified biopolymers present promising components for construction of chemical stimuli-responsive architectures. The second aim of this work was preparation of 1-adamantylalkylimidazolium and bis(benz)imidazolium salts with bicyclo[2.2.2]octane as a centerpiece. According to their binding ability towards macrocyclic molecules, they can be employed as potential multitopic guests for the construction of supramolecular systems. Last but not least, selected single-site model guests based on adamantane imidazolium salts were prepared and examined. We studied how the prolongation of carbon chain length between non-polar part of the molecule and cationic moiety would influence their binding behaviour with macrocyclic hosts. Stoichiometry and stability of resulting complexes have been determined by means of ¹H NMR spectroscopy and isothermal titration calorimetry.

Peng Li, Ph.D.

Date of defence: 11. 11. 2020

Supervisor: prof. Ing. Lubomír Lapčík, Ph.D.

The Study of Functional Ingredients from Corn Silk

Abstract

The thesis studies the physicochemical and biochemical properties of the bioactive functional substances from the extracts of corn silk including flavonoids, polysaccharides and steroids, which are widely applied in the areas of food production, pharmacy, veterinary, animal feed and healthcare. There are three main parts of the research containing 1, corn silk flavonoids, polysaccharides and steroids extraction, determination (related to the technologies of UV-VIS, HPLC, NMR, FTIR and Fluorescence excitation/emission mapping) and extraction methods optimization. 2, corn silk physicochemical property analysis including thermal analysis (related to the technology of TG/DTA), microstructure research (related to the technology of SEM). 3, corn silk flavonoids, polysaccharides and steroids biochemical property analysis including anti-radical (related to the free-radicals of DPPH, ABTS and technology of EPR), anti-oxident capability (to the ferric ion and copper ion), vitro enzyme inhibition activity including the enzymes of "alfa"-glucosidase and "alfa"-amylase (anti-diabetes), thrombin (anti-coagulation), angiotensin converting enzyme(ACE) (anti-hypertension) and xanthine oxidase(XOD) (anti-gout). The whole research is based on the three different maturity stages of corn silk for the different content and proportion of flavonoids, polysaccharides and steroids in each maturity stage, which are silking stage (CS - S), milky stage (CS - M) and mature stage (CS - MS).

Ing. **Nikola Mikušová, Ph.D.**

Date of defence: 25. 6. 2020

Supervisor: doc. Ing. Petr Humpolíček, Ph.D.

The influence of surface properties of materials on biofilm formation

Abstract

To apply polymeric materials in either industry or biomedicine it is essential to know not only their material but also biological properties. Conducting polymers (CPs), have become the subject of intensive research thanks to their unique properties, such as conductivity, simple and low-cost synthesis or easy coating of various surfaces by CP. The potential application of CPs has huge diversity, e.g. they can be used for biosensors, neural implants, tissue engineering scaffolds or stimuli-responsive devices. Between the unique properties of CP can be assigned the easy modification either chemically (e.g. by using various doping acids), by plasma treatment or incorporation of antimicrobial agents onto their surface. The ability of easy surface modification is crucial for their application as biointerface materials. Due to these, CPs can be also used for the improvement of the surface properties of other materials. Improved surface properties may subsequently influence the reaction and attachment of various proteins, eukaryotic cells, tissues and especially microorganisms. The presence of microbial biofilm and overall the adhesion of microorganisms onto the material surfaces cause severe problems in many fields of industry or medicine. In the biofilm community, the cells are able to effectively protect themselves against external conditions and extracellular matrix prevents the penetration of any foreign substances such as biocides, antimicrobial agents (antibiotics, etc.). The surface properties of materials are a key factor influencing the reciprocal interaction between surface and microorganisms, e.g. in the context of microorganism attachment. Thus, in the continuity of this issue, the main aim of the doctoral study was to provide novel information about the possible anti-biofilm properties of pristine CPs or their modification. The present information can be applied in the design of materials that will subsequently be capable to prevent the adhesion of microorganisms onto their surfaces.

Ing. **Josef Osička**, Ph.D.

Date of defence: 15. 9. 2020

Supervisor: Ing. Miroslav Mrlík, Ph.D.

Composite materials with photo-responsive

Abstract

Photo-responsive materials belong among novel, fast-developing intelligent materials of modern era. They seem to be promising smart systems in many current and future technologies

i.e. in medicine, mechanical and construction engineering, energy harvesting, sensors etc. Very encouraging group of these materials is represented by photo-actuating (PA), shape-memory systems. Their main feature known as photo-actuation is capability to rapidly and reversibly change their shape after external light exposure. However, there are several limitations reducing their real-life utilization. Generally known A systems, mainly solid materials, suffer from not very significant dimension change that is usually in order of 0.001% of original shape. Hence, the main aim of this work is focused on composite systems, in which the combined PA effect of matrix and filler is frequently synergic, but those systems also possess many drawbacks that need to be solved, i.e. low compatibility of filler to the matrix related poor dispersibility in such system, resulting to the low thermal conductivity and finally poor mechanical properties as well as PA capabilities. The mentioned drawbacks can be reduced by modifying the filler with compact polymer layer possessing such surface properties those can significantly enhance particle/matrix compatibility and thus contribute to considerably improve overall properties.

Ing. **Lucie Urbánková**, Ph.D.

Date of defence: 25. 6. 2020

Supervisor: doc. Ing. Věra Kašpárková, Ph.D.

Stabilization of dispersion systems by polymeric emulsifiers

Abstract

Biopolymers and biopolymer-based particles are a natural alternative to replace potentially toxic synthetic surfactants stabilizing the oil-water interface in emulsions. These more friendly species allow for the preparation of biocompatible, surfactant-free emulsions for pharmaceutical and cosmetic uses. However, the application of bio-based emulsifiers may, in some cases, be insufficient to prepare stable emulsions. Under these conditions, the ability of some natural emulsifiers to form and stabilize emulsions in synergy with other biopolymers or particles can be advantageously utilized. Therefore, the thesis is at first focused on stabilization of emulsions by single emulsifying protein, sodium caseinate, and in the next step on the investigation of the interactions between the biopolymer and particles at the phase interface. More specifically, the emulsions stabilized by mixtures of sodium caseinate and

cellulose nanocrystals are investigated to understand processes of adsorption, complexation or layer-by-layer formation taking place at the oil-water interfaces. The knowledge gathered in the thesis enables to control the emulsion properties via variations in the composition of their stabilizing layer. The practical application of such stabilized emulsions is further verified through the preparation of emulsion-based oleogels, which can serve for delivery of bioactive lipophilic substances.

Degree Programme: FOOD CHEMISTRY AND TECHNOLOGY

Degree Course: Food Technology

Ing. **Eva Koubová**, Ph.D.

Date of defence: 25. 5. 2020

Supervisor: doc. Ing. et Bc. Daniela Sumczynski, Ph.D.

The influence of storage and technological treatments on the content of selected biological active substances in non-traditional cereals

Abstract

Currently, there is an increasing interest in non-traditional sources of raw materials for human nutrition, including non-traditional cereals. These include, for example, kamut, rice with black or red cover layers, wild rice, quinoa with colour cover layers etc. The dissertation deals with determination of the contents of basic nutritional and selected biologically active substances in non-traditional cereals, subsequently with determination of changes in their content during storage and after heat treatment. Selected samples of non-traditional cereals with pigmented coating layers showed higher content of polyphenols, fiber and vitamins when compared with common cereals.

Ing. **Hana Pištěková**, Ph.D.

Date of defence: 22. 9. 2020

Supervisor: Mgr. Petra Jančová, Ph.D.

Application of molecular biological methods for the detection of genes and degradation of selected microbial metabolites in foodstuffs

Abstract

This dissertation is focused on the detection and quantification of bacterial genes encoding enzymes involved in the degradation of biogenic amines (BA). The theoretical part of the presented work deals with the toxicity of BA, their occurrence in food, the factors that contribute to their formation and the possibility of degradation of these bacterial metabolites. In particular, it deals with molecular biological methods applied in the food industry, which are effectively used for the control of producers or degraders of these important low molecular weight nitrogenous substances. In the experimental part of the thesis, the ability of selected strains to degrade BA was verified. Based on the acquired knowledge, primers (for target and housekeeping genes) were designed for two bacterial species: *Bacillus subtilis* and *Lactobacillus casei*. In the tests, suitable primer sets were selected (in which the reactions proceeded with almost 100% efficiency, no dimers or nonspecific products formed) for monitoring the relative expression of target genes (*yobN* encoding amine oxidase in *B. subtilis* species; and MCO encoding multicopper oxidase in *L. casei* species). These genes encode enzymes involved in BAs degradation. Optimized reverse transcription quantitative PCR (RT-qPCR) methodologies were used for relative quantification of both target genes (*yobN*, MCO). The highest relative expression of the gene encoding amine oxidase (*yobN*) in the exponential growth phase (3.03 ± 0.13) was recorded in *B. subtilis* strains. This result was supported by monitoring the reduction (degradation) of BA in the mineral medium by HPLC/UV, which showed a 17% decrease in histamine and 18% cadaverine for strain CCM 2216 over 48 hours. Furthermore, 18% degradation of tyramine was demonstrated by strain CCM 2267 within 48 hours in the same medium. The results further suggested that the degradation of BA by *B. subtilis* may be affected by spore formation. Even with strain of *L. casei* CCDM 198 was monitored relative expression of the target gene (MCO) at time. The highest value of 5.04 ± 0.45 was also recorded in the exponential growth phase, with a decrease in the observed BAs of $21.22 \pm 4.17\%$. Later, the effect of redox reagents 1% cysteine (w/v) and 0.1% ascorbic acid (w/v) on the expression of the gene encoding multicopper oxidase, an enzyme involved in BA degradation, was tested. The results show that 1% cysteine (w/v) had a positive effect on bacterial growth, resulting in a slight increase in BA degradation ($22.64 \pm 3.13\%$). While the addition of 0.1% ascorbic acid (w/v) was

followed by a decrease in the amount of bacteria, expression of the target gene and lower degradation of BA at all monitored times. At the end of the experiment, it was verified that the strain CCDM 198 degrades the monitored BA also in real food - UHT milk.

Ing. **Irena Sytařová**, Ph.D.

Date of defence: 16. 3. 2020

Supervisor: doc. Ing. Jiří Mlček, Ph.D.

Influence of Vegetative and Storage Conditions on the Content of Bioactive Compounds in Non-traditional Fruit

Abstract

Consumers' demands on quality, nutritional composition and a wide range of food, such as fruits, have been constantly increasing. That is why, minor and new species of fruit has been taken into consideration as well. These include species that are rather unknown or species that have been neglected along with the development of agricultural production in recent decades. These non-traditional species are a valuable source of bioactive substances with their contents mostly significantly higher than those in traditional fruit species. Therefore, non-traditional fruits have been introduced onto the Czech market as an attractive commodity satisfying high consumers' demands. Another benefit is their considerable adaptability to variable environmental conditions, wide species diversity and different methods of processing and applications in the food, pharmaceutical or further industry. The aim of this dissertation thesis is to determine selected biologically active substances and to assess correlations between contents of biologically active substances in the samples of non-traditional fruits depending on different varieties, localities and storage periods.

Degree Programme: PROCESS ENGINEERING

Degree Course: Tools and processes

Keerthiwansa Gustinna Wadu Rohitha, Ph.D.

Date of defence: 18. 11. 2020

Supervisor: doc. Ing. Jakub Javořík, Ph.D.

Design and Validation of the Methods for Comprehensive Characterization of the Hyperelastic Properties of Elastomers

Abstract

This thesis and the research work surrounding it, is oriented towards finding a solution to a problem in obtaining accurate material constants whenever only a single data set (i.e. uniaxial tension test data) is available in hyperelastic material characterization. To begin with, the serious nature of the problem was highlighted through results of set of experiments. There, several material models were tried with two data fitting methods and the inaccuracy of data fitting with single data set could be proved beyond doubt from this exercise. At the next stage, as a preliminary solution to the problem, a suggestion was given in the way of secondary data set generation from available data. The question at this point was about the method which could be adopted to generate the second data set. As an initial trial, exponential function was used with several exponents in order to generate data which could be consequently used as biaxial data. Amid some minor discrepancies, method delivered some promising results. Second approach was sorted in order to get a better trajectory for the generated biaxial data. In this method, initial uniaxial data set was divided in to two segments and each segment was differently addressed. As a result, the trajectory of generated data nearly resembled the real biaxial data. Data fitting preceded the data generation, provided very encouraging results too. However, method had some serious shortcomings such as, unit incompatibility, and lack of use of uniaxial data in the later half. Due to these reasons, the method was not further examined for the use in the work. Final experiments were done with six materials. Base material and other constituents were different in each of these cases and it resulted in varied data distributions in both uniaxial and biaxial data. An exponential function was once again used with a different exponent in final tests. Proximity of generated data against real biaxial data was statistically tested. For the testing, 95% confidence interval was selected and most of the instances, generated data distribution was within the limit. Situations where, results differed, adjustment of confidence interval could be proposed with justification considering the hyperelastic material properties. Finally, Mooney-Rivlin model was used for data fitting as to further emphasize the results.

Ing. **Lukáš Mañas**, Ph.D.

Date of defence: 24. 9. 2020

Supervisor: doc. Ing. Soňa Rusnáková, Ph.D.

Development and Construction Solution of Composite Springs

Abstract

Composite materials have been known for decades during which they have contributed to a number of practical applications in global scale of production. This success was achieved mainly through the ability to move beyond the limits of conventional materials. Nevertheless, the thickness of the manufactured structure may be limiting for composite materials. For this reason, manufacturers of individual materials do not state how and under which recommended process conditions to produce thick-walled composite structures. Due to the rapid growth of individual industry sectors, new technological and process procedures are being sought. The motivation of established companies to produce new products also plays a major role. From a supplier perspective, it is important to learn new material combinations and manufacturing technologies. This fact enables individual corporate and research organizations to fully exploit the potential of composite materials, in particular for the sustainability of competitiveness and the development of new applications. This dissertation thesis is focused on the research of the development and construction solution of the composite springs. Above all, springs referred to as leaf and parabolic. In the production of individual structures, technologies, materials and semi-finished products, which are available and usable in the serial production of solved flexible structures, are also considered. In the first place, the manufacturability of components is investigated using known and laboratory-available technologies. The work deals with individual types of materials, their processing and usability in the production of the composite structures. Furthermore, it deals with the production of individual types of test specimens and springs. The thesis also marginally deals with the production of disc and coil springs. Moreover, the work is focused on the evaluation of mechanical testing results of manufactured structures and in the last part also the determination of conclusions and recommendations for the serial production of composite flexible elements.

Dieter Sedlacek, Ph.D.

Date of defence: 1. 12. 2020

Supervisor: prof. Ing. Berenika Hausnerová, Ph.D.

Cooling of Aluminium Coils by Forced Ventilation with Outdoor Air

Abstract

The subject of this doctoral thesis is the cooling of aluminium coils by forced ventilation with outdoor air. This method enables the coils to be cooled directly in the storage area of the intermediate storage after hot rolling, thus avoiding the need for relocation and the use of refrigeration machines. Free cooling with outdoor air, using mechanical ventilation, is widespread in the supply of air conditioning, but is rarely used in manufacturing, where the temperature level requirements are usually outside the available bandwidth. By using free cooling, the energy input, and thus the CO₂ emission for the cooling process is greatly reduced. The aim of this thesis is to adapt the process of free cooling to the cooling of aluminium coils, and thereby to better understand the thermal properties of the coils. A suitable air flow solution in an open warehouse that fits to the general conditions of the production process is proposed. For this purpose, a thermal model of the coils is created and the cooling behaviour as well as the required airflow is determined. The model and the calculations are verified in the process. The thesis provides a robust calculation model to determine the behaviour of the coils and a suitable method of airflow design.

1.2 Faculty of Management and Economics

Degree Programme: ECONOMICS AND MANAGEMENT

Degree Course: Management and Economics

Ing. **Martin Horák, Ph.D.**

Date of defence: 24. 6. 2020

Supervisor: prof. Ing. Ján Porvazník, CSc.

Application of Holistic Management Pillars in the Development of Competencies of Cluster Managers

Abstract

The dissertation deals with the topic of managerial competence in terms of cluster organizations. The main goal of the dissertation was to identify possible ways of developing desirable managerial competencies in the conditions of cluster organizations, based on the model of competencies of cluster manager. Competence is understood as a combination of properties, knowledge and skills that is needed for successful performance at cluster manager position. Firstly, key competencies of the cluster manager were identified with regard to the pillars of the holistic management. Using the analysis of information sources, questionnaire surveys, delphi method and consultations with practitioners, a model of competencies of the cluster manager was developed. Following competencies have been defined in the model: effective communication, strategic planning, creativity, motivation of others, credibility, cluster expertise, problem solving, cooperation, leadership. In the following phase, it was crucial to find the desirable level of defined competencies, including the creation of a tool for their evaluation and to identify suitable self-development methods. At this stage, the analysis of information sources, consultations with practitioners and semi-structured interviews were applied. The main output of the dissertation is a model of competencies of the cluster manager including identified possible ways of his/her development. The model includes 9 key competencies which are necessary for successful performance at the cluster manager position. The required level 4 (excellent level) was set for all competencies. Model also contains suggested recommendations for their development. It is recommended to assess defined competencies via self-evaluation using a set of statements regarding the behavior of the manager and the Likert's five-scale. The fundamental contribution of the thesis is the formulation of the theoretical framework of the cluster manager's model of competencies and the identification of possible ways for cluster manager development. The theoretical benefits of the dissertation can be seen in an innovative approach to the management of cluster organizations, because the principles of holistic management have not yet been applied in the terms of cluster organizations. The dissertation connects knowledge of holistic managerial competencies with the competencies of cluster managers. In the context of practical benefits, the competency model provides a tool to professionalize cluster managers.

In practice, the proposed model can be used to select the right person for this position, to evaluate the current level of his/her competencies and, last but not least, to design appropriate training and development activities.

Ing. **Viera Pechancová**, Ph.D.

Date of defence: 23. 1. 2020

Supervisor: prof. Ing. Milan Zelený, M.S. Ph.D.

Community-led Renewable Energy Business Models for the Czech Energy Sector Transition

Abstract

The global energy sector has been going through turbulent times. The disputes and uncertainties between the future of fossil fuel and that of renewable energy build the basis for energy transition. The transition to low carbon energy systems has been on the way with increasing intensity in recent years and is also supported by global policy outcomes, such as the Paris climate agreement. Many scientific questions have appeared in this context about the types and forms of stakeholder participation, ownership issues, financial consequences, and increasingly sociological aspects. Even though historically centralised energy systems used to be economically efficient, local energy systems are promising because of both energy self-sufficiency and sustainability perspectives. Being an important pillar of this dissertation thesis, emerging local energy systems could thus provide potential contribution towards climate objectives. Changing energy business models needs to also take interested customers into consideration, who represent a shift from passive consumers to active energy prosumers. Thus huge research opportunities have emerged in the area of energy business model set up, such as the roles of new entrants versus established industry players. As the Czech energy sector has been going through rapid transition in recent years as well, this dissertation thesis concentrates specifically on the aspects of energy transitions in the Czech Republic. Even though there has been some empirical evidence of sustainable energy initiatives at the local level, very few written sources are devoted to the emerging research area of local energy business models for the Czech Republic. Subsequently, this is reflected in the basic idea of the dissertation topic, which deals with the community-led renewable energy potential and the local sustainability initiatives in the Czech Republic.

Vo Thi Nga, Ph.D.

Date of defence: 13. 2. 2020

Supervisor: doc. Ing. Miloslava Chovancová, CSc.

Customer attitude and customer satisfaction towards luxury hotels in Vietnam

Abstract

On account of customer attitude (CA) and customer satisfaction (CS) through service quality, it is always one step ahead of customers, yet they get faster and more accurate with practice over the Internet. It is essential to believe that customers' expectation and experience are all about being excited about something. Seeing inspiring technology applications and pricing strategies helps a more social acceptance on CA and CS. The recent tools aim to reserve that pattern by using technology to make saving effortless as well as spending, resulting in both complicated and uncomplicated pleasures. The sequence of the event surrounding the collapse remains uncertain in many settings. Many researchers have proposed solutions, but they are debatable. Further, sustainable economic growth must be taken into consideration, especially in the hotel and tourism service. It is possible to serve better hotel' service quality in the online environment and room rate practice, hence the conditions are challenging. It can be the driving majors to record benefits but also serious needing to address a minimum negative effect on CA and CS towards luxury hotels in Vietnam. Assisting to expand visitors in a largely peaceful outcome would highly be positive and imperative.

Vu Hoang Duong, Ph.D.

Date of defence: 24. 6. 2020

Supervisor: doc. Ing. Zuzana Dohnalová, Ph.D.

Foreign Direct Investment Absorptive capacity of Vietnam

Abstract

FDI is one important source for development in Vietnam. FDI can generate positive and/or negative impacts on host countries. Hence, the main aim of the dissertation is to improve the

absorptive capacity of Vietnam at the provincial level in order to fully take advantage of the positive impacts of FDI. At the firm level, the author puts forward a new measurement of the absorptive capacity of firms. Then, it is constructed as one dimension of absorptive capacity at the provincial level. At the provincial level, there are six dimensions of absorptive capacity. They are the level of openness, infrastructure, financial development, human capital, institutions and absorptive capacity of domestic firms. By combining quantitative and qualitative methods, the dissertation shows the following findings. At the firm level, absorptive capacity can boost the effect of horizontal effects from FDI and there are thresholds of absorptive capacity of domestic firms. At the provincial level, the importance of the dimensions of provincial absorptive capacity is as follow infrastructure, the absorptive capacity of domestic firms, human capital and financial development. The dissertation brings three academic contributions which are the framework to analyse absorptive capacity, the new measurement of absorptive capacity of firms and the evidence to connect the absorptive capacity of firms and absorptive capacity of provinces. In terms of political contribution, the dissertation shows the list of prioritized dimensions of absorptive capacity of suggests several policy implications improve this capacity in Vietnam.

Degree Programme: ECONOMIC POLICY AND ADMINISTRATION

Degree Course: Finance

Ho Thanh Tri, Ph.D.

Date of defence: 26. 6. 2020

Supervisor: prof. Ing. Juraj Sipko, PhD. MBA

A comparison of FDI determinants in ASEAN3 and ASEAN5 countries: New evidence from financial integration factor analysis

Abstract

Foreign direct investment (FDI) contributes greatly to the economic development of the receiving country by providing an important source of finance for development and acting as a channel for the transfer of capital and new technology. On the one hand, FDI adds to the

stock of domestic capital and increases the productivity of production factors such as raw materials and labor. On the other hand, FDI also contributes to diversifying the economy by adding new economic actors and promoting competition to produce better products at lower prices in the host country. The literature has indicated that FDI inflows are determined by the market size, the degree of openness, the role of institutional factors and degree of economic integration. Besides, other factors such as labor costs, infrastructure, domestic tax rates, and institutional environment are correlated significantly with FDI inflows. Many studies about the factors were influenced by foreign direct investment inflows in developing countries as well as developed countries. However, none of the research articles compare FDI determinants in ASEAN3 and ASEAN5 with the new issue of the financial integration factor measured by the KAOPEN index to see whether or not it has an impact, along with other factors, on attracting FDI inflows in ASEAN3 and ASEAN5 member countries. Therefore, in this study, the author conducts a "a comparison of FDI determinants in ASEAN3 and ASEAN5," focusing on the new issue of the financial integration measure by KAOPEN index and a re-examination of the impact of other factors such as gross domestic product, infrastructure facility, trade openness, labor costs, interest rate, institutional stability, and exchange rate to FDI inflows. The author uses the quantitative research strategies by the panel ordinary least square estimation with the method of first differencing to address the critical research question and research hypotheses of this study. There are three stages of this study. In the first stage, the author identifies factors influencing FDI inflows in ASEAN countries. In the second stage, the author uses econometric models to give concrete empirical evidence. And in the third stage, the author draws a conclusion based on findings from the econometric models. The author also includes an interview conducted with experts on the impact of these factors on attracting FDI in ASEAN member countries, which can help policymakers improve the FDI attraction of ASEAN member countries as well the FDI attraction of Vietnam. This study collected data from eight ASEAN member countries during two financial crises from 1996 to 2016. The author divides ASEAN member countries into two groups, ASEAN3 and ASEAN5, based on their level of economic development. The findings indicate that the coefficient of financial integration is positive and statistically significant at a 1% level of significance on FDI capital inflows. The empirical results also support the hypothesis that foreign direct investment in ASEAN3 and ASEAN5 is positively correlated to market size and infrastructure facilities, and negatively correlated to labor costs as well as trade openness in ASEAN3.

Ashiqur Rahman, Ph.D.

Date of defence: 7. 9. 2020

Supervisor: prof. Ing. Jaroslav Belás, PhD.

Financial Constraints on Small and Medium Enterprises (SMEs): Evidence from the Czech and Slovak Republic

Abstract

Small and Medium Enterprises (SMEs) are considered to be one of the most important drivers of economic development for many developed and developing countries. Despite the significant contribution towards economic development, the existing literature on entrepreneurial finance shows that SMEs are facing more financial constraints compared to large firms. This thesis aims to examine financial constraints on SMEs from two different perspectives. The first goal of the thesis is to examine the determinants of collateral. The literature shows that the lack of collateral is one of the first and foremost problems for SMEs to access bank loans. Therefore, we would like to focus on the factors that affect collateral requirements on SME loans. The second aim of the thesis is to investigate whether innovative SMEs experience higher financial constraints compared to the non-innovative SMEs in the loan market. The existing studies show that innovative SMEs are facing more financial constraints compared to the non-innovative SMEs because of high asymmetric information, lack of collateral, and so on. In that regard, we would like to examine whether the loan application of the innovative SMEs is more likely to be rejected by banks or not. If the loan applications are more likely to be rejected by the banks, then we may infer that innovative SMEs face higher credit constraints compared to their non-innovative peers.

Ing. Lenka Výstupová, Ph.D.

Date of defence: 26. 6. 2020

Supervisor: doc. Ing. Roman Zámečník, Ph.D.

Using of selected cost controlling tools in relation to financial controlling in public sector with focus on public universities

Abstract

Doctoral thesis is concerning with the research in the area of using selected tools of cost controlling in relation to financial controlling with respect to multi-source financing at public universities. From the point of view of financial and cost management of public universities, this topic is current and necessary as the area of tertiary education has undergone significant reforms in recent years and public universities had to be able to react flexibly and to make the right financial strategic decision for which it is important to use selected tools of cost and subsequently financial controlling more effectively. Therefore the main objective of the research is focused first of all on the mapping the use of selected cost controlling tools, especially costing and related ways of cost allocation and then defining a certain effective approach to using these cost controlling tools with respect to relation to financial controlling taking into account multi-source financing at public universities which is also the main goal of the dissertation. However, the research also shows the complexity and problem areas in allocating the costs to individual activities of public universities. On the one hand, traditional costing methods are used to allocate costs that do not adequately reflect the link between costs and activities of public universities and the important finding of the necessity to differentiate between full cost and eligible full cost, always taking into account causal links to activities but also to sources of financing funding of public universities. Research focuses the attention on the possibility of using of Activity Based Costing in internal cost allocation methodologies with respect to terminology of public universities and funding sources. This part is followed by the proposal of an effective approach to the allocation of the costs for individual activities of public universities, taking into account the causal link and sources of financing. On the basis of them it can be effectively used among others also selected instruments of financial controlling. Several different research methods called triangulation have to be used in research activities, as the number of research objects, which are mainly Czech public universities, is too small and a mere statistical evaluation would be insignificant.?

1.3 Faculty of Multimedia Communications

Degree Programme: VISUAL ARTS

Degree Course: Multimedia and Design

Mgr. Eva Gartnerová, Ph.D.

Date of defence: 21. 9. 2020

Supervisor: doc. Mgr. Irena Armutidisová

University galleries and their potential for an international cooperation

Abstract

The main goal of the dissertation thesis is to analyze the environment and processes of university galleries and exhibition spaces through series of interviews and questionnaires at the selected art and design universities in the Czech Republic and Central Europe. The focus of the research project is to present and develop the phenomenon of university galleries in the Czech Republic through processed case studies. The research also compares and maps the benefits and limitations of international networks, the similarities and preferences in university galleries' approach within the field of public engagement and development, in order to better understand and specify how networking and internationalization affect collaboration among university galleries, but also between university galleries and their audience. The aim of the thesis is primarily to present the environment of university galleries in the Czech Republic, to place it in a broader European context and to find out the possibilities of cooperation at the local and international level. The purpose of the mapping is to compile basic data and disseminate the best practices of selected universities in the field of design and art in order to maintain and strengthen international cooperation and networking in the field of design, artistic practices and perception.

Mgr. Vít Jakubíček, Ph.D.

Date of defence: 21. 9. 2020

Supervisor: prof. PhDr. Zdeno Kolesár, PhD.

Between Tradition and Avant-Garde. The School of Arts in Zlín (1939-1949)

Abstract

The dissertation thesis deals with the history of the School of Arts in Zlín. This educational institution was the last one founded by the Baťa company. The time of its establishment falls into a difficult time at the end of interwar Czechoslovakia on the eve of World War II. It has emerged from the urgent needs of company to address not only the problems of manufacturing but also the aesthetic aspects of company products. In the second half of the 1930s, the articulation of such ideas significantly increased. Especially after the effects of the great economic crisis had subsided and the company was forced to adapt to a strong competition on market, where companies were used to cooperate with artists and stylists. The problems of insufficient care for promotion and generally the design of products and their packaging were updated by the Baťa presentation at the Paris Exhibition in 1937 which ended up in fiasco. At that time, the Czechoslovak proposals of the Baťa promotional department were rejected from the exhibition because of the obsolescence and conventionality of Zlín's advertising production. As a result of the situation, Jan Antonín Baťa, the director of the company, decided to solve the problem by foundation of his own art school on the basis of the recommendations of leading cultural personalities from Zlín. The aim of the School of Arts was to train qualified experts, so-called entrepreneurs in the arts industry, who would be able to carry out contracts in the field of fine arts. Not only from the point of view of the promotion and design of the products, but in general, to be able to influence art of public space. In addition to the advertising designs (posters, prints etc.), they also had to devote themselves to the traditional artisanal and applied techniques (glass painting, wood carving, mosaic or wall painting), which modern minimalist architecture almost excluded to the margins of interest. The common denominator of the school's aims was art creation, which impact would have a more global character and touch the wider social spectrum. The thesis also deals with the history of the School of Arts in years 1945-1949, which has been neglected so far. Nevertheless, from the point of view of Zlín and Czechoslovak history of design and visual culture, it played a very important role. At that time the institution underwent transformation to the School of Applied Arts. Despite a number of complications, the institution, especially thanks to the director František Kadlec, was able to consolidate soon after the war and prepare a new program which would reflect both changes in design and cultural politics. As a result, the institution was able to present a realistic and viable program early in the first two years after the war, which corresponded to the nation-wide orientation of industrial design. Despite these efforts, however, its activities have been suppressed by the national company

Svit since the spring of 1949, so that in the end only a torso remains of its comprehensive program.

MgA. **Irena Kocí**, Ph.D.

Date of defence: 21. 9. 2020

Supervisor: prof. Ing. ArtD. Ján Grečnár

Time in Film - Unconventional Working with Time in Dramatic Narrative Expressing Flashforwards

Abstract

The aim of the dissertation is to summarize the existing knowledge and to name the direction of development of nonlinear narrative structures, to reflect shifts from linear narrative to nonlinear and non-chronological narrative. Dissertation entitled Time in Film-Nontraditional Work with Time in Dramatic Narrative, Flashforward Expressions defines flashforward as narrative techniques in film dramatic narrative that appears in nonlinear narrative structures and causes non-chronological narration. So far, this scriptwriting and dramaturgical instrument has not been more fully reflected in literature. The dissertation brings the taxonomy of flashbacks based on the distinction between their functions and formal shape and offers some parallels for classification of flashforwards. There is also an overview of nonlinear narrative patterns. The creative output of the dissertation consists of a feature film scenario with a title Fragmentation, which is based on a combination of some nonlinear narrative principles and uses flashforwards.

MgA. **Přibík Martin**, Ph.D.

Date of defence: 21. 9. 2020

Supervisor: prof. MgA. Petr Stanický, MFA

The aspects a porcelain shaping rules and finding possible ways for usage of 3D printing methods in the porcelain product development

Abstract

The dissertation describes, analyzes and examines the real application of 3D printing in the porcelain industry. The entirely theoretical content is divided into four chapters, the first of which describes and then examines the 3D printing methods suitable for development and production of a porcelain product. The second chapter analyzes deformations of porcelain and provides ways to predict, control and what to work with those when designing. The third philosophical part of the thesis deals with the impacts that the use of printing in the real practice of the porcelain industry will bring in the future and what changes developers and producers can expect in parallel with designers. The last fourth chapter describes several experiments in the application of 3D printing from the perspective of innovative porcelain processes that confront traditional development techniques. Together with the experiments, a non-traditional view is used to develop ideas and theories for solving some current problems in the ceramics industry.

1.4 Faculty of Applied Informatics

Degree Programme: ENGINEERING INFORMATICS

Degree Course: Automatic Control and Informatics

Ing. **Pavel Drábek**, Ph.D.

Date of defence: 4. 11. 2020

Supervisor: prof. Ing. Roman Prokop, CSc.

Research of Acoustic Properties of Selected Elements of HVAC Systems

Abstract

This doctoral thesis is focused on the elements of HVAC systems that are installed in the pipeline network in order to reduce the transmission of noise to the indoor and outdoor space. The work deals with the possibilities of determining the influence of the mutual interaction of hydraulic and acoustic parameters, specifically in relation to the amount of regenerated noise. To determine this interaction, a round silencer was used, where various geometric variants of the central core were tested. The solution is based on existing computational aero-

acoustics methods, and the outputs from the numerical simulation are compared with experimentally obtained data. All partial steps leading to the fulfilment of the set goals are discussed in work.

Ing. **Stanislav Sehnálek**, Ph.D.

Date of defence: 4. 11. 2020

Supervisor: prof. Ing. Roman Prokop, CSc.

Investigation of aerodynamic parameters of specialized duct systems

Abstract

This dissertation thesis deals with fluid flow, and pressure loss of particular types of equipment at the newly build tract for measuring heat recovery exchangers. At the beginning of his work is summarised form of measuring heat recovery exchangers, parameters of heat recovery exchangers and conditions of measurements. Particular emphasis is on measuring box in which are exchangers measured. The measurement of pressure loss in various configurations of this box is described. Among other things, the performed visualization of the flow is described, which is compared with the numerical simulation. Based on this knowledge, a new optimal box is designed. The possibilities for reducing the pressure loss of the new box in the form of modifications of the internal parts are outlined, on the basis of theoretical calculations and numerical simulations, the mentioned modifications are realized. Description of comparative measurement with a certified laboratory is at the end of this thesis.

Ing. **Petr Skočík**, Ph.D.

Date of defence: 4. 12. 2020

Supervisor: doc. RNDr. Vojtěch Křesálek, CSc.

Resistant Camera System Designed for Operation in Anechoic Shielded Chambers

Abstract

The dissertation thesis deals with design and implementation of resistant structure for camera systems used in operation in anechoic shielded chambers, i.e. in the environment of strong electromagnetic fields, which are generated during testing of devices for electromagnetic susceptibility or by the device itself during measurement of electromagnetic interference. In connection with the continuous development of mobile and wireless networks, measurements are also aimed at verifying the radiation characteristics of antennas and access points. These measurements are made in accordance with the relevant standards applicable to the commercial, wireless, automotive and military application areas. At the same time, undesirable propagation of interfering signals by the CCTV system, which could negatively affect sensitive measurements and tests, must be prevented. The main aim of the thesis is to design, realize and put into operation a resistant CCTV system, which monitors the ongoing measurements and workplace inside the chamber for safety reasons. It is a very specific solution, which is subjected to a number of individual modifications, tests and measurements to verify the suitability of its use and correct function in the electromagnetic environment of the chamber.

Degree Programme: ENGINEERING INFORMATICS

Degree Course: Engineering Informatics

Ing. **Stanislav Kovář**, Ph.D.

Date of defence: 15. 9. 2020

Supervisor: doc. Mgr. **Milan Adámek**, Ph.D.

Immunity of camera systems against electromagnetic interference

Abstract

The primary goal of the doctoral thesis is to increase an immunity of security cameras against electromagnetic interference. Security cameras constitute one of the fundamental techniques of physical guarding how to detect and eliminate crime. Unfortunately, increasing use of electronic and electric devices causes an increase in electromagnetic interference which may affect the correct function of the devices. This is particularly the problem for security devices where the great emphasis is placed on the reliability. The work aimed at the design and implementation of shielding enclosure for security cameras. The draft is verified by CST

Microwave Studio electromagnetic simulation software which allows determining expected shielding effectiveness and distribution of electromagnetic radiation. The final product is validated by testing them in both a GTEM cell and in a semi-anechoic chamber.

Ing. **Josef Kudělka**, Ph.D.

Date of defence: 27. 8. 2020

Supervisor: doc. RNDr. Vojtěch Křesálek, CSc.

Fabrication of Security Features Using Atomic Force Microscopy

Abstract

This dissertation thesis deals with the creation and characterization of security marks using AFM scratching technique. These security marks could be used for invisible objects marking, possibly even for secret information transfer (steganography). A security mark in this work means any structure that enables these goals to be met. It may be a symbol (e.g. an organization sign), a regular font or even a code. In addition to the marks themselves, the thesis describes how presented polymer structures are affected by individual scratching parameters (direction, speed and force of scratching) and their stability when exposed to higher temperature.

Ing. **Milan Oulehla**, Ph.D.

Date of defence: 26. 2. 2020

Supervisor: doc. Ing. Zuzana Komínková Oplatková, Ph.D.

Security Issues on Mobile Platform, Their Exploiting and Proactive Measure Using Artificial Intelligence

Abstract

This dissertation deals with three main areas of research: security of current mobile applications, mobile malware and detection of mobile malware using artificial intelligence, especially neural networks. This dissertation describes mechanisms by which attackers and mobile malware creators obtain APK packages of legitimate applications, analyse them and

exploit found vulnerabilities. The work is unique not only in its scope and systematic processing but mainly in the depth of presented findings. The published information is not only of a theoretical character, but it also contains unique source code samples (in both high-level and low-level programming languages), diagrams as well as screenshots capturing crucial situations. The first part of the dissertation covers all major areas of mobile application security issues, from different ways how vulnerabilities found in mobile applications are exploited by attackers and mobile malware creators, through the issue of APK packages and their analysis, to vulnerabilities found in investigated mobile applications. Examination of vulnerabilities in investigated mobile applications has revealed a number of serious security threats which have been systematized into four categories: attacks based on analysis of data from APK packages, APK repackage, attacks on local security of mobile applications and attacks on network security of mobile applications. In the field of mobile malware, the dissertation is focused on mobile malware analysis and mobile malware characteristics. The analytical part describes the acquisition of mobile malware samples and their investigation methods in which the work brings new, unpublished procedures. Unique findings are also published in the part dealing with characteristics of mobile malware. The dissertation is not only limited to the research of attack techniques but it also tries to contribute to the improvement of the security situation by a proactive measure which is the design and experimental verification of a new way of mobile malware detection using artificial intelligence, especially neural networks. Data analysis and creation of input vectors for neural networks proved to be the key here, especially the suggested method of identification and reduction of problematic vector components. Cooperation with AVG Technologies CZ, whose data set was used for detection experiments, had a positive effect on the quality of the research. The achieved detection accuracy of 99.5% during training and 98.23% during testing can be regarded as highly successful and relevant considering the size and quality of the dataset. The achieved detection results show the power of machine learning and at the same time indicate one of the promising directions which should be taken in the mobile malware detection.

Ing. **Pavel Tomášek**, Ph.D.

Date of defence: 23. 7. 2020

Supervisor: doc. RNDr. Vojtěch Křesálek, CSc.

Estimation of Material Permittivity in Free Space by Means of Inverse Problem Techniques

Abstract

The aim of the doctoral thesis is to design and implement a system for solving the inverse problem of estimation of electric permittivity of an unknown material or multiple layers of unknown materials. The proposed solution is based on the combination of an evolutionary algorithm and a direct mathematical model computing transmission and reflection coefficients of a defined material or a multi-layered structure of defined materials. Synthetic data as well as real data obtained by direct measurement of transmission and reflection coefficients in free space (frequency range: single units of gigahertz and higher) serve as the system input. Uncertainty and sensitivity analyses are also part of the study. Included experiments present reasonable estimations of complex permittivity with rather low uncertainties and low sensitivity on the error of the input data.

Ing. **Tomáš Urbánek**, Ph.D.

Date of defence: 4. 12. 2020

Supervisor: doc. Ing. Zdenka Prokopová, CSc.

Usage of analytical programming for effort estimation

Abstract

This thesis is focused on research in the field of software engineering; specifically on obtaining estimates of time effort. Obtaining more accurate estimates is one of the critical parts of the software development cycle. This work as a whole is intended to contribute to the creation of a framework for more accurate effort estimation. Presented effort estimation framework using symbolic regression methods. This work deals mainly with the properties and settings of this new framework, so as to provide a refinement of estimates of time effort. The issues of linearity between the estimate and the actual time effort were being undertaken, as well as the possibilities of optimizing the framework. Furthermore, this thesis compares the estimates using a new framework with estimates providing other models used in this field. This new framework was tested on two datasets with a cross-validation technique. On a dataset with a smaller number of samples, the presented framework achieves an average

relative error of 40 %. This result is up to 20 % on average more accurate compared to other methods. And also up to 18 % more accurate compared to the standard UCP equation. On a larger dataset, the average relative error is around 8 %, which is comparable to the other methods used. Moreover, these results on a larger dataset are also a refinement of up to 18 % compared to the UCP equation.

Ing. **Jan Vávra**, Ph.D.

Date of defence: 10. 12. 2020

Supervisor: doc. Ing. Luděk Lukáš, CSc.

Design and verification of anomaly detection system based on machine learning in industrial control systems

Abstract

Technology has become an integral part of contemporary society. The current transition from an industrial society to the information society is accompanied by the implementation of new technologies in every part of human activity. Increasing pressure to apply ICT in critical infrastructure and their control systems creates new vulnerabilities. Traditional safety approaches are becoming ineffective. From this perspective, the use of artificial intelligence is another evolutionary step that provides robust solutions for extensive and sophisticated systems. This dissertation focuses on the field of cybersecurity research for industrial control systems that are widely used in critical information infrastructure. Cybernetic protection for industrial control systems is one of the most important types of security for a modern state. The main core of the thesis is to create an anomaly detection system based on machine learning methods in a specific area of cyber security of industrial control systems. Special attention is then paid to optimization. The resulting anomaly detection system is created concerning its autonomous operation and some degree of cyber-attack interpretation.

Ing. **Kateřina Víchová**, Ph.D.

Date of defence: 10. 12. 2020

Supervisor: doc. Ing. Martin Hromada, Ph.D.

Algorithmization of Healthcare Facilities Preparedness Assessment to Solve the Power Outage

Abstract

The thesis deals with Algorithmization of Healthcare Facilities Preparedness Assessment to Solve the Power Outage. The thesis first deals with the analysis of the current state, which forms an insight into the field of state security, disaster management, threats to critical infrastructure, information support, and their links to the healthcare facilities. The following part deals with assessing the occurrence of disasters, the analysis of risks for healthcare facilities the procedural expression of threats related to the failure of a large-scale power outage. As the main part of the work, which follows from the work's primary goal, is the design of an algorithm for the assessment of healthcare facilities to solve a large-scale power outage. This algorithm was subsequently implemented in the form of evaluation and analytical tool, as a particular form of information support, which also verifies the created algorithm. At the end of the thesis are specified scenarios of possible solutions to a selected aspect of healthcare facilities' power outage.

1.5 Faculty of Humanities

Degree Programme: PEDAGOGY

Degree Course: Pedagogy

PhDr. **Iva Staňková**, Ph.D.

Date of defence: 27. 8. 2020

Supervisor: doc. PhDr. Mgr. Jaroslav Balvín, CSc.

Analysis of the Influence of Roma Culture on the Pupils' Value System

Abstract

This dissertation deals with culture in a broader perspective as one of the determinants of the education of Roma pupils. The theoretical part of the thesis anchors the basic concepts related to the topic, defines the key concepts related to culture and values, and explains their role

in education. Subsequently, the Roma ethnic group in a broader context and the situation of Roma pupils in schools come to the centre of interest. Emphasis is placed on the difficulties in the education of these pupils and on the causes of their failure in the educational process. The theoretical framework culminates in the topic of the socio-cultural determinants of education and the possibilities for supporting Roma pupils. The aim of the research was to describe the specifics of Romani culture in relation to the values that a Romani pupil prefers. The view was focused primarily on value, whose preference is a prerequisite for successful education - the value of education. The purpose of the research was to understand and then describe how students and their parents perceive the value of education, and how aspects of their daily lives are reflected in the attribution of importance to this value. Due to the nature of the research problem, where culture and the individual / group are at the centre, ethnographic design seemed to be a suitable research approach. In an effort to capture the issue in a more comprehensive way, two perspectives were combined. The perspective of the members of the given culture and the perspective of experts, the view of experts who come into contact with the Roma community (children, youth, or adults) on a daily basis within the framework of their professional interest. The conclusions of the research describe not only the values of Roma pupils, but also the elements that play an important role in how students perceive the value of education. The clearly dominant negative role in relation to this value and in general to the upbringing and education of children has created a disadvantaged environment, especially life in social exclusion.

Mgr. **Lenka Venterová**, Ph.D.

Date of defence: 27. 8. 2020

Supervisor: doc. PhDr. Mgr. Jaroslav Balvín, CSc.

Value Orientation of Youth from Intercultural Family Background

Abstract

The presented dissertation deals with young people with an intercultural family environment background who live in the Czech Republic. The selected research sample is Czech-South African families with children who have been growing up in the Czech Republic since birth. These families are confronted with a different culture on a daily basis. We dare to say that this is a relatively new topic within the Czech Republic. In this we deal with their value

orientation and the influence of surrounding cultures on the orientation. The selected issue is first anchored in the theoretical part, where we note the influence of cultural capital on the value of education and we try to settle the value orientation in the process of education and in pedagogical theory. In the practical part we present the background of the author's research, including results. The main goal of the research was to describe the importance of education through the prism of young people from an intercultural family environment. Since the values are not measurable and it is relatively difficult to read them, we decided to take the qualitative path, specifically ethnographic research, to achieve the most accurate results. The data obtained were subsequently analysed by thematic analysis. Through the values of individual participants, we look at their relationship to individual forms of education. Based on the conclusions drawn, the application dimension of the work is outlined, and the possibilities of further research in the selected area are discussed.

1.6 University Institute

Degree Programme: MATERIAL SCIENCES AND ENGINEERING

Degree Course: Biomaterials and Biocomposites

Haijun Xiao, Ph.D.

Date of defence: 20. 11. 2020

Supervisor: prof. Ing. Vladimír Sedlařík, Ph.D.

Drug Self-Delivery Systems for Enhanced Targeted Cancer Therapy

Abstract

This research work is focused on development and characterization of the easily manufacturing nanostructured systems for enhanced delivery of cytostatic agents based on irinotecan and curcumin. Developed nano-systems only consist of active therapeutic substances and possess good physiochemical stability and redispersibility of its lyophilisates. Both in vitro and in vivo tests showed improved effectivity of the prepared nanoformulations in comparison with pure cytostatic analogues with simultaneous significant suppressing of the side effects that is promising for further clinical trials.

2 DEFENDED HABILITATION THESES

In 2020, 5 habilitation theses were defended: 2 at the Faculty of Technology, 1 at the Faculty of Management and Economics and 2 at the Faculty of Multimedia Communications.

2.1 Faculty of Technology

Course: Technology of Macromolecular Compounds

doc. Ing. **Alena Kalendová**, Ph.D.

Appointed with effect from: 1st November 2020

Nanocomposites Based on Montmorillonite: Processing, Structure and Properties

Abstract

The field of polymer nanocomposites presents a class of multiphase materials, where at least one of the phases has at least one dimension less than 100 nm. Typical is low content of clay compared to conventional composites. The aim of this work is processing and characterization of a hybrid organic/inorganic system based on polymer and montmorillonite (MMT). As the polymer matrix, polyvinylchloride (PVC), polyolefin, polylactic acid (PLA) and polyamide 12 (PA12) were used. In addition to a brief introduction, the work contains another 4 chapters, which reflect the study of the mentioned polymers: PVC/MMT, Polyolefin/MMT, PLA/MMT and PA12/MMT nanocomposites. Further one part of this work deals with intercalation and co-intercalation process. Next, the prepared polymer compositions were characterized mainly from the viewpoint of mechanical properties, barrier properties and morphology. Furthermore, the influence of additives on the degradation of prepared nanocomposites was studied.

doc. Ing. **David Veselý**, Ph.D.

Appointed with effect from: 1st July 2020

Formulation of paints

Abstract

The presented work is divided into three logical parts reflecting the results of the applicant's scientific and research activities. The first part of the thesis is devoted to the synthesis of functional pigments and fillers for organic coatings and the study of the mechanism of their activity in organic binders. The second part is focused on the description and achieved results in the field of the study of catalytic systems for cross-linking of organic binders. The third chapter deals with the formulation of paints and organic coatings.

2.2 Faculty of Management and Economics

Course: Management and Business Economics

doc. **Adam Przemysław Balcerzak**, Ph.D.

Appointed with effect from: 1st March 2020

Institutional determinants of entrepreneurship conditions and productivity growth in the European Union

Abstract

The last thirty years have been a period of a transformation of economic conditions for the European countries. Additionally, the emergence of global knowledge-based economy has significantly changed the economic relations. All these fundamental processes have also influenced significant institutional changes, which has resulted in a much higher current role of entrepreneurship and entrepreneurial environment. Therefore, the scientific problem of the thesis relates to the short or middle term formal institutional determinants of entrepreneurship conditions and entrepreneurial environment and their influence on the total factor productivity growth (TFP). Additionally, the issue of institutional convergence process in the EU is in the scope of the thesis.

The main objective of the work is to analyse the quality of institutions influencing entrepreneurship conditions in the EU in the years 2000-2015 and their influence on TFP, within special attention devoted to the heterogeneity between the “old” and “new” EU members.

The definition of the quality of institutions is based on the postulates of the transaction cost theory.

The quantitative research is based on three stages. First, the multiple-criteria analysis of the quality of institutions influencing entrepreneurial conditions at two analytical levels – at the overall analytical level, the synthetic measure of development for all institutional aspects was assessed with application of TOSPIS method based on GDM distance measure. Then, at the lower aggregation level, the specific synthetic measures for five institutional aspects were obtained, which enabled to compare the differences in their potential importance with respect to the TFP. For both levels, the grouping of the countries into homogenous subsets was conducted with application of natural breaks method. Second, the econometric dynamic panel analysis of institutional convergence was conducted. The process of institutional convergence for all the European economies was analysed. Then, β -convergence and sigma institutional convergence modelling within club convergence framework was conducted. Finally, the dynamic panel analysis of influence of quality of entrepreneurial institutions on the TFP was verified within two spatial regimes for “old” and “new” EU.

The research confirmed the significant influence of the quality of institutions forming entrepreneurial environment on the TFP in the EU. The differences between the „old” and ”new” EU members were confirmed. The process of institutional convergence was also confirmed, where the “new” members of the EU change their institutional systems, which decreases enterprise transaction costs and improves the speed of capital reallocation.

2.3 Faculty of Multimedia Communications

Course: Multimedia and Design

doc. Mgr. MgA. **Jan Gogola**

Appointed with effect from: 1st April 2020

One author, various films: Documentary film not as a reality record but rather a reality change

Abstract

The reflection of Jan Gogola Jr.'s filmmaking, known in the Czech Republic and abroad, and his educational activity as a diffusion of cinematographic and social phenomena, methods, topical links and genres: a fake-fiction portrait "Panenka Against the Rest of the World", a performance "České Velenice Infinity", a meditation "I Love My Boring Life" and a natural scientific film about a man "František of His Own Kind".

Gogola elaborates on the context of his base idea that the appearance of the film should correspond to what it is about. This represents the chameleon principle, according to which the authors approach varies pursuant to the characteristics of his subject. Reality is not an objective entity but rather a substance influenced by our perception. That is why Gogola problematizes the established term "documentary film", which has, according to his belief, become a false synonym for reality record. The thesis also introduces the role of the individuals, and their ways of thinking, who had an impact on Gogola, and the theoretical and practical context of the almost twenty years of his university-level educational activity. The final chapter of this text focuses on Gogola's intention to visualize the invisible, illustrated on the example of his film in the making, „Eternal Jožo“.

doc. MgA. **Josef Šafařík**, DiS., Ph.D.

Appointed with effect from: 1st April 2020

Multimedia Design - interpretation of multimedia content on transparent screen format

Abstract

The turn of the 20th and 21st centuries is characterized by the development of multimedia technologies and the Internet or the so-called Internet of Things. Most processes are now being visualized in a two-dimensional format (monitor, projection screen). However, the development of new multimedia interfaces associated with consumer design or professional spheres (scientific or technological) brings new challenges.

„New forms of presentation and visualization of data sources and information also require new forms of interaction that need to be designed.“²

An example of a work environment with a complicated user interface is, for example, a control center or dispatching center. Particular interactions with multimedia content place considerable demands on the user in terms of his spatial and judgmental orientation and concentration. Locations, such as the operational center of the Czech police, contain a large

number of displays (visualized information) and the user operating them must be well versed in both physical and information space. Two-way navigation, its control, choice of functions for displaying data, its analysis and subsequent evaluation create stressful situations. And as the users themselves declare, the current state of affairs with the increasing amount of information is insufficient.

Design as a dynamically developing industry requires professionals and specialists in the field with a broad professional and interdisciplinary scope. The designer has to become increasingly familiar with new technologies and new user interface designs. Cooperation with specialists from partner fields such as psychology or ergonomics is logical and necessary. New technologies and increasingly sophisticated devices and aids in everyday life require a deeper analysis of the impact on the psyche of the user and his surroundings.

My lecture will focus on the issues that accompany my work and professional activities in the studio of experimental design at the Institute of Industrial Design CTU in Prague. Here I will try to summarize why and to what extent it is necessary to address the interpretation of data and multimedia patterns, which are ubiquitous and overwhelming for users (directly or behaviorally).

I find the transparent and atypical format of the projection screen ideal for a possible interaction between a user and an interface that contains complex data and information structure. Here I refer to inspiration by Rudolf Arnheim's form-forming (perceptual) theories, which are a reinterpretation of the form (Gestalt) psychology of its founder Max Wertheimer.

The principles of ideology and solved challenges, summarized in the theoretical part, are demonstrated on real projects in which I participated as an author or co-author and in collaboration with colleagues from the scientific research institutes of CTU.

Among other things, I consider my author's and pedagogical participation in important student projects dealing with the issue of non-traditional format and application of new media in design as an important part of my work at the Czech Technical University in Prague.

3 QUALIFYING LECTURES FOR PROFESSORSHIP

3.1 Faculty of Technology

Course: Technology of Macromolecular Compounds

prof. Ing. **Petr Humpolíček**, Ph.D.

Qualifying Lecture for Professorship in front of the Scientific Board of TBU in Zlín: 22nd September 2020

Appointed with effect from: 15th December 2020

Biocompatibility of polymers

Abstract

Thanks to their unique properties, polymers are traditionally used in a wide range of medical devices. However, the unique properties of polymers can also be exploited in biomedicine, in regenerative medicine, and mainly in tissue engineering. Knowledge of the biological properties of polymers and their interactions with living systems is, therefore, a crucial prerequisite for developing the above mentioned applications. The following aspects must be taken into account within the process of understanding the complexity of the interactions between materials and living objects: 1) the elimination of the negative impact of materials on living objects; 2) the determination of material properties influencing the interaction of living objects with biointerfaces; and 3) the definition of material properties influencing the response of living systems within 3-D structures. With respect to the testing of the biological properties of polymers and materials, the standard in vitro techniques for cell culture will be discussed in the thesis in correlation with techniques simulating in vivo conditions used for cell culture. The topics defined above have been systematically studied thanks to the founding of the Laboratory of Cell Biology and Biomaterials at the Tomas Bata University in Zlín. This Laboratory was established on the initiative of the applicant in 2009 and is closely connected with his professional development. The further expansion of the Laboratory was made possible through the support of projects and cooperation with many colleagues from the Czech Republic and abroad. Since 2011, a number of undergraduate and post-graduate students supervised by the applicant have also been involved in the research conducted in the Laboratory. Due to the knowledge and experience gained in the course of the

operation of the laboratory, new courses guaranteed by the applicant were introduced into the teaching at Tomas Bata University in Zlín. These new competencies, which were previously absent at the University, also contributed to the successful accreditation of new study programs that are currently taught there.

prof. Ing. Bc. **Pavel Mokrejš**, Ph.D.

Qualifying Lecture for Professorship in front of the Scientific Board of TBU in Zlín: 18th February 2020

Appointed with effect from: 17th June 2020

Biotechnological Processing of Protein By-Products into Gelatines and Hydrolysates

Abstract

The population growth and raising of the population living standards lead to higher consumption of food and consumer products. A significant part is represented by products made from natural polymers and proteins. The most important animal proteins, which are processed in many industries (e.g. food, tanning, leather, pharmaceutical, human medicine, cosmetics), include collagen and keratin, less often elastin. Their processing results in a large number of by-products at different stages of processing, which can have a high application potential.

The methods of processing collagenous and keratinous protein by-products from the meat and food industries, the tanning and leather industries into gelatines and hydrolysates are described. The innovative and highly progressive elements of processing technologies include the use of commonly available proteolytic enzymes. Under appropriate technological conditions, protein by-products can be processed in an environmentally friendly manner (e.g. waste water and solid waste reduction, lower energy and time consumption) and produce products of comparable quality to products produced from primary slaughter and other food raw materials. The economic appreciation of waste materials (state authorities, producers and processors aspect) is also worth mentioning.

The proposed possibilities of application of prepared gelatines and hydrolysates are as follows: i) collagen hydrolysate prepared from collagen wastes from the leather industry as a nitrogenous NPK fertiliser, or used for the preparation of biodegradable films and gels;

ii) keratin hydrolysate prepared from chicken feathers and sheep wool as a humectant and an occlusive in cosmetic formulations; iii) gelatine prepared from chicken by-products of slaughter as a constituent of confectionery and as a functional additive in meat products.

The results of scientific activities and personal contribution to the development of the field of study of Technology of Macromolecular Substances and related fields (Environmental Technology and Food Technology) are also reflected in the development of the concept of teaching in the subjects provided in the field of study of Technology of Macromolecular Substances taught at the Faculty of Technology of Tomas Bata University in Zlín.

Course: Food Technology

prof. Ing. **Jiří Miček**, Ph.D.

Qualifying Lecture for Professorship in front of the Scientific Board of TBU in Zlín: 22nd September 2020

Appointed with effect from: 15th December 2020

Non-traditional types of food - their importance, properties and utilization

Abstract

Nowadays, the search for alternative sources of nutrition is a very important topic of many scientific teams due to the increasing demand of consumers for quality, nutritional composition, and a wide assortment of foodstuffs and also due to the increase of the world population and civilization diseases.

This raises the demand for minor, lesser-known, non-traditional or new types of plant or animal products. These are species that are not very well known in our society, or species that had got in the background in recent decades along with the development of agricultural production.

These non-traditional foods, however, bring a new benefit - a very important source of vitamins, minerals, fiber, enzymes, other bioactive substances, and more substances, in most cases with a far higher content than found in conventional foods.

Uncommon types of food include non-traditional fruits with an often unique composition, edible insects with appropriate composition, economic and ecological benefits over livestock

breeding; edible flowers or other commodities. Other advantages of non-traditional plant species and edible insect species are their great adaptability, low environmental demands, wide species diversity and various processing methods, and at present very high application potential in the food, pharmaceutical, cosmetics, and other sectors.

The area of scientific interest is focused on chemical composition, use of various methods in determining ingredients, technological parameters, sensory properties, changes during storage, processing, comparison of individual species and cultivars, comparison with conventional foods, monitoring of relationships between bioactive ingredients and antioxidant effect, comparison of localities in terms of composition, influence monitoring of climatic factors, breeding factors, safety, harvest time, etc.

Much of the content of the submitted theses were published in scientific journals listed in the WoS and SCOPUS databases. The interest in the results of these scientific activities is reflected mainly in the citability of individual publications and creates a prerequisite for further development of food, nutrition or related fields provided by the Faculty of Technology of TBU in Zlín.

Course: Tools and Processes

prof. RNDr. **Petr Ponížil**, Ph.D.

Qualifying Lecture for Professorship in front of the Scientific Board of TBU in Zlín: 18th February 2020

Appointed with effect from: 17th June 2020

Models for description of structure and properties of materials

Abstract

The thesis is focused on Voronoi tessellations as one of the very promising methods of material structure simulation. The first part deals with the concept of tessellation as well as the properties and use of Voronoi, Delaunay and Johnson-Mehl tessellations. In other parts, Voronoi tessellations are used to design a method for estimating the pore size in porous materials or for metal grain size estimation.

3.2 Faculty of Applied Informaticst

Course: Machine and Process Control

prof. Ing. Alena Galajdová, PhD.

Qualifying Lecture for Professorship in front of the Scientific Board of TBU in Zlín: 18th February 2020

Appointed with effect from: 17th June 2020

Modeling and control of nonlinear dynamic systems with application on human gait

Abstract

In the modeling, simulation and processing of physiological data from wireless sensors networks, there are also other methods in addition to classical data processing approaches. These methods reveal the complexity of physiological data, taking into account the central nervous system function. The use of non-linear gait analysis reveals the non-linear and chaotic dynamics of gait signals. Nonlinear analysis of time series data has the potential to find hidden signal changes, trends in development that cannot be found using linear methods.

Human gait has characteristics typical for deterministic chaotic systems. That is why, the system that generates chaotic data was designed and further was used for motors control in a rehabilitation mechatronic device - shoes. The system was used for training of seniors gait, while during training are generated random chaotic perturbations from the steady state applied to walking.

For simulation of nonlinear systems it is very suitable to use artificial intelligence tools. A system for prediction of lower limb muscles electromyographic (EMG) activity during gait from kinematic gait data is the result of simulations using a neural network. The proposed neural network model has demonstrated the ability to transform the kinematic motion plan into the activation of the desired muscles, and also it is possible to model the predicted functional relationship between the kinematic gait parameters and the EMG envelope of the lower limb muscles.

4 QUALIFYING LECTURES FOR ADJUNCT PROFESSORSHIP

4.1 Faculty of Technology

Course: Chemistry

Adjunct prof. Ing. **Natalia Kazantseva**, CSc.

Qualifying Lecture for Adjunct Professorship in front of the Scientific Board of TBU in Zlín:
22nd September 2020

Appointed with effect from: 1st October 2020

Magnetic polymeric composites as absorbers of electromagnetic energy

Abstract

The lecture book contains a literature survey and the authors' data on the application of magnetic polymeric composites as absorbers of electromagnetic energy. The first part of the book is devoted to the development of single-layer RAs. It is shown that effective, compact, and, most importantly, economical RAs can be produced by using elastomers filled with core-shell particles, where core is multi-domain particles of low-anisotropy ferrite (e.g., MnZn) and shell is a conducting polymer (e.g., PANI). It is established that the operating frequency range of the RAs of this type can be adjusted by changing the properties of PANI. The author explained this phenomenon by the dual effect of PANI grown as a monolayer on the surface of a ferrite particle during in-situ polymerization. First, this increases the effective magnetic anisotropy of the ferrite, which leads to a shift in magnetic losses maximum (the resonance frequency) of the composite to the high-frequency region. Second, since the conductivity of PANI is determined by the synthesis conditions, its control allows one to change the complex permittivity of the composite and, thus, to improve the impedance matching conditions of RAs. The second part of the book deals with the development of embolic agents with complex of rheological and magnetic properties for conducting AEH. To reach the goal, the author drew the attention of the research team on the preparation of silicone-based magnetic composites to ensure safe delivery and filling of the vascular system of the tumour with subsequent occlusion due to the formation of a soft embolus. The high heating rate (tens of °C min⁻¹) of composites in alternating magnetic fields (AMFs) was achieved by addition

of uniform NPs of chemically stable maghemite. The materials obtained show a significant antitumor effect, which was studied in-vitro and in-vivo.

5 IMPORTANT SCIENTIFIC AND SPECIALIZED ASSIGNMENTS

5.1 Projectst financed by the Czech Science Foundation (GACR)

In 2020, 13 projects financed by the Czech Science Foundation were implemented at the TBU in Zlín. Total eligible costs amounted CZK 11,638 thousand for TBU in Zlín in 2020.

5.1.1 Faculty of Technology

Junior grants

GJ20-27735Y Nanotechnologies in flow-through electrochemical sensors applied in environmental engineering

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Jaroslav Filip

Implementation period: 2020 - 2021

Total project cost (CZK thous.): 3 268

Total project cost – TBU (CZK thous.): 3 268

Project cost of TBU in 2020 (CZK thous.): 1 634

5.1.2 Faculty of Management and Economics

Standard projects

GA16-25536S Methodology of Developing a Predictive Model of Sector and Company Performance in the Macroeconomic Context

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Drahomíra Pavelková

Implementation period: 2016 – 2020

Total project cost (CZK thous.): 2 940

Total project cost – TBU (CZK thous.): 2 940

Project cost of TBU in 2020 (CZK thous.): 0

GA17-13518S Determinants of budgeting and performance measurement systems design and impact of these systems on organizational behavior and organizational perform

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Boris Popesko

Implementation period: 2017 – 2021

Total project cost (CZK thous.): 3 354

Total project cost – TBU (CZK thous.): 1 716

Project cost of TBU in 2020 (CZK thous.): 0

5.1.3 Faculty of Humanities

Standard projects

GA17-04816S The Dynamics of Self-Regulation in Socially Excluded Pupils

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Karla Hrbáčková

Implementation period: 2017 - 2021

Total project cost (CZK thous.): 1 872

Total project cost – TBU (CZK thous.): 1 872

Project cost of TBU in 2020 (CZK thous.): 0

GA19-00987S Blind Spots in Non-Formal Education of Adults in the Czech Republic: Non-Participants and their Social Worlds

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Jan Kalenda

Implementation period: 2019 - 2021

Total project cost (CZK thous.): 3 023

Total project cost – TBU (CZK thous.): 3 023

Project cost of TBU in 2020 (CZK thous.): 1 317

5.1.4 Faculty of Applied Informatics

Junior grants

GJ20-00091Y Development of Sustainable Waste Management: Methods and Operations Research Perspectives

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Dušan Hrabec

Implementation period: 2020 - 2022

Total project cost (CZK thous.): 3 327

Total project cost – TBU (CZK thous.): 3 327

Project cost of TBU in 2020 (CZK thous.): 1 071

5.1.5 University Institute

Standard projects

GA19-16861S Interaction of biomaterials with stem cells under in vivo simulated conditions

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Petr Humpolíček

Implementation period: 2019 - 2021

Total project cost (CZK thous.): 7 496

Total project cost – TBU (CZK thous.): 4 555

Project cost of TBU in 2020 (CZK thous.): 1 552

GA19-17457S Manufacturing and analysis of flexible piezoelectric layers for smart engineering

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Miroslav Mrlík

Implementation period: 2019 - 2021	
Total project cost (CZK thous.):	8 641
Total project cost – TBU (CZK thous.):	2 820
Project cost of TBU in 2020 (CZK thous.):	952

GA19-23513S Towards New Electroluminescent Materials: Borane Cluster Compounds in Thin Polymer Films within an Electric Field

Principal investigator: TBU in Zlín
 Project investigator on behalf of TBU: Ivo Kuřitka
 Implementation period: 2019 - 2021

Total project cost (CZK thous.):	5 317
Total project cost – TBU (CZK thous.):	5 317
Project cost of TBU in 2020 (CZK thous.):	1 822

GA19-23647S Investigation of Correlation Among Cation Distribution, Particle Size and Physical Properties of Intelligent Spinel Ferrite Nanomaterials

Principal investigator: TBU in Zlín
 Project investigator on behalf of TBU: Raghvendra Singh Yadav
 Implementation period: 2019 - 2021

Total project cost (CZK thous.):	4 878
Total project cost – TBU (CZK thous.):	4 878
Project cost of TBU in 2020 (CZK thous.):	1 629

GA20-28732S Colloidal systems for topical formulations. Pickering emulsions and polymer based colloids

Principal investigator: TBU in Zlín
 Project investigator on behalf of TBU: Petr Humpolíček
 Implementation period: 2020 - 2022

Total project cost (CZK thous.):	4 978
Total project cost – TBU (CZK thous.):	4 978
Project cost of TBU in 2020 (CZK thous.):	1 629

Projects where TBU acts as a co-investigator

GA16-05961S Advanced Carriers for Platinum Drugs

Principal investigator: Masaryk University
 Project investigator on behalf of TBU: Jan Vícha
 Implementation period: 2016 - 2020

Total project cost (CZK thous.):	9 763
Total project cost – TBU (CZK thous.):	1 983
Project cost of TBU in 2020 (CZK thous.):	0

The project was solved in cooperation with FT

GA17-10813S Novel plasma polymers with tunable stability and permeability

Principal investigator: Charles University in Prague
 Project investigator on behalf of TBU: Marián Lehocký
 Implementation period: 2017 - 2020

Total project cost (CZK thous.):	7 608
Total project cost – TBU (CZK thous.):	3 144

Project cost of TBU in 2020 (CZK thous.): 1 060

5.2 Projects financed by the Ministry of Industry and Trade of the Czech Republic

In 2020, 18 projects financed by the Ministry of Industry and Trade of the Czech Republic were implemented at the TBU in Zlín. Total eligible costs amounted CZK 25,099 thousand for TBU in Zlín in 2020.

5.2.1 Faculty of Technology

Projects where TBU acts as a co-investigator

The Operational Programme Enterprise and Innovations for Competitiveness (OP PIK)

EG17_107/0012417 MIOMOVE

Principal investigator: HD GEO s.r.o.

Project investigator on behalf of TBU: Petr Slobodian

Implementation period: 2017 – 2021

Total project cost (CZK thous.): 18 269

Total project cost – TBU (CZK thous.): 4 511

Project cost of TBU in 2020 (CZK thous.): 1 725

5.2.2 Faculty of Management and Economics

Projects where TBU acts as a co-investigator

The Operational Programme Enterprise and Innovations for Competitiveness (OP PIK)

EG17_107/0011225 Smart factory in a factory environment

Principal investigator: ALPS Electric Czech, s.r.o.

Project investigator on behalf of TBU: Aleš Gregar

Implementation period: 2019 - 2021

Total project cost (CZK thous.): 21 602

Total project cost – TBU (CZK thous.): 2 610

Project cost of TBU in 2020 (CZK thous.): 1 030

5.2.3 Faculty of Applied Informatics

The Operational Programme Enterprise and Innovations for Competitiveness (OP PIK)

Projects where TBU acts as a co-investigator

EG16_084/0008839 Application of Research Results Focused on the Introduction of New Technologies and Procedures into the Production of Large Workpieces

Principal investigator: Slovácké strojírny, a. s.

Project investigator on behalf of TBU: Vladidír Vašek

Implementation period: 2017 – 2020

Total project cost (CZK thous.): 35 700

Total project cost – TBU (CZK thous.): 9 600

Project cost of TBU in 2020 (CZK thous.): 8 092

EG16_084/0010327 Security System for Navigation and Communication of Airport Vehicles

Principal investigator: Masaryk University, TECHNISERV, spol. s r.o.

Project investigator on behalf of TBU: Vojtěch Křesálek

Implementation period: 2017 – 2020

Total project cost (CZK thous.): 35 515

Total project cost – TBU (CZK thous.): 3 697

Project cost of TBU in 2020 (CZK thous.): 3 697

EG17_107/0012477 Expert system for custom manufacturing enterprises with Industry 4.0 support

Principal investigator: CATHEDRAL Software, s.r.o.

Project investigator on behalf of TBU: Tomáš Dulík

Implementation period: 2016 – 2020

Total project cost (CZK thous.): 8 142

Total project cost – TBU (CZK thous.): 2 043

Project cost of TBU in 2020 (CZK thous.): 1 712

EG15_019/0004580 INFOS Platform

Principal investigator: Cominfo

Project investigator on behalf of TBU: Milan Adámek

Implementation period: 2017 – 2020

Total project cost (CZK thous.): 34 727

Total project cost – TBU (CZK thous.): 5 251

Project cost of TBU in 2020 (CZK thous.): 0

EG15_019/0004635 E-Line Fuel Dispenser

Principal investigator: Adast Systems, a. s.

Project investigator on behalf of TBU: Tomáš Dulík

Implementation period: 2015 - 2021

Total project cost (CZK thous.): 20 205

Total project cost – TBU (CZK thous.): 2 070

Project cost of TBU in 2020 (CZK thous.): 0

EG16_084/0009949 Research and development of advanced LED luminaires for industrial use

Principal investigator: TREVOS, a. s.

Project investigator on behalf of TBU: Miroslav Mañas

Implementation period: 2017 – 2020

Total project cost (CZK thous.): 18 582

Total project cost – TBU (CZK thous.): 3 074
Project cost of TBU in 2020 (CZK thous.): 0

EG17_107/0012503 Research and development of eHealth Integrated Telemedicine Application Platform

Principal investigator: Euro Enterprise Development s. r. o.

Project investigator on behalf of TBU: Roman Jašek

Implementation period: 2018 – 2021

Total project cost (CZK thous.): 15 710

Total project cost – TBU (CZK thous.): 1 569

Project cost of TBU in 2020 (CZK thous.): 1 215

CZ.01.1.02/0.0/0.0/19_262/0020111 Navigation and tracking system TEVOGS 3.0

Principal investigator: Techniserv, spol. s. r. o.

Project investigator on behalf of TBU: Tomáš Dulík

Implementation period: 2020 – 2022

Total project cost (CZK thous.): 31 000

Total project cost – TBU (CZK thous.): 5 750

Project cost of TBU in 2020 (CZK thous.): 1 150

EG19_262/0020292 Expert system for custom manufacturing companies with artificial intelligence support

Principal investigator: CATHEDRAL Software, s.r.o.

Project investigator on behalf of TBU: Tomáš Dulík

Implementation period: 2020 – 2023

Total project cost (CZK thous.): 17 521

Total project cost – TBU (CZK thous.): 6 803

Project cost of TBU in 2020 (CZK thous.): 0

TRIO Programme

FV20419 Intelligent System For Advanced Sorting of Forest Plants

Principal investigator: DENESA s. r. o.

Project investigator on behalf of TBU: Vladimír Vašek

Implementation period: 2017 – 2020

Total project cost (CZK thous.): 19 006

Total project cost – TBU (CZK thous.): 7 744

Project cost of TBU in 2020 (CZK thous.): 1 037

FV40233 Research and development of processes of microbial hydrolysis for the preparation of components with high biological value

Principal investigator: KORTAN spol. s r.o.

Project investigator on behalf of TBU: Karel Kolomazník

Implementation period: 2019 – 2022

Total project cost (CZK thous.): 27 171

Total project cost – TBU (CZK thous.): 2 682

Project cost of TBU in 2020 (CZK thous.): 682

5.2.4 Faculty of Logistic and Crisis Management

TRIO Programme

Projects where TBU acts as a co-investigator

FV30337 Bioactive glass matrices for effective water hygienization

Principal investigator: NEDFORM s.r.o.

Project investigator on behalf of TBU: Pavel Valášek

Implementation period: 2018 – 2020

Total project cost (CZK thous.): 10 912

Total project cost – TBU (CZK thous.): 5 313

Project cost of TBU in 2020 (CZK thous.): 2 512

5.2.5 University Institute

The Operational Programme Enterprise and Innovations for Competitiveness (OP PIK)

Projects where TBU acts as a co-investigator

EG15_019/0004549 Imflamable systems according to EN 45545 for composite fabrication

Principal investigator: 5M s. r. o.

Project investigator on behalf of TBU: Michal Sedlačík

Implementation period: 2015 - 2020

Total project cost (CZK thous.): 14 116

Total project cost – TBU (CZK thous.): 2 116

Project cost of TBU in 2020 (CZK thous.): 629

TRIO Programme

Projects where TBU acts as a co-investigator

FV30048 New additives for multifunctional modification of polymer surfaces

Principal investigator: Synthesia, a.s.

Project investigator on behalf of TBU: Vladimír Sedlařík

Implementation period: 2018 - 2021

Total project cost (CZK thous.): 19 978

Total project cost – TBU (CZK thous.): 3 200

Project cost of TBU in 2020 (CZK thous.): 3 688

FV10756 Development of polymer carriers in sub-micro and nano-forms

Principal investigator: MVDr. Jiří Pantůček

Project investigator on behalf of TBU: Vladimír Sedlařík

Implementation period: 2016 - 2020

Total project cost (CZK thous.): 3 822

Total project cost – TBU (CZK thous.): 1 909

Project cost of TBU in 2020 (CZK thous.): 250

FV40377 Research and development of a biocompatible material for controlled drug release and transport into the cornea

Principal investigator: GEMINI eye clinic, a. s.

Project investigator on behalf of TBU: Pavel Urbánek

Implementation period: 2019 - 2022

Total project cost (CZK thous.): 10 152

Total project cost – TBU (CZK thous.): 3 095

Project cost of TBU in 2020 (CZK thous.): 1 020

5.3 Projects financed by the Ministry of Education, Youth and Sports of the Czech Republic

In 2020, 13 projects financed by the Ministry of Education, Youth and Sports of the Czech Republic were implemented at the TBU in Zlín. Total eligible costs amounted CZK 39,190 thousand for TBU in Zlín in 2020.

5.3.1 Faculty of Management and Economics

INTER-EXCELLENCE Programme (2016 – 2024)

LTC20047 Regional development and public policy under creative economy: Mapping, knowledge sharing and management of New Working Spaces in the Czech Republic

Project investigator on behalf of TBU: Pavel Bednář

Implementation period: 2020 - 2023

Total project cost (CZK thous.): 162

Total project cost – TBU (CZK thous.): 162

Project cost of TBU in 2020 (CZK thous.): 0

MOBILITY Programme

8J19UA010 EU Environmental Policy on Solid Domestic Waste Management and its Implementation in Ukraine and the Czech Republic

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Jiří Zícha

Implementation period: 2019 - 2020

Total project cost (CZK thous.): 3 620

Total project cost – TBU (CZK thous.): 3 620

Project cost of TBU in 2020 (CZK thous.): 697

5.3.2 Faculty of Applied Informatics

MOBILITY Programme

8JCH1001 Optimization of consumption water, electric power and heat in the processes in which raw hide is transformed into leather

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Dagmar Janáčková

Implementation period: 2019 - 2020

Total project cost (CZK thous.): 298

Total project cost – TBU (CZK thous.): 298

Project cost of TBU in 2020 (CZK thous.): 0

INTER EUREKA Programme

LTE2019003 FERTI-MAIZE foliar fertilizer for maize based on protein by-products

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Karel Kolomazník

Implementation period: 2019 - 2022

Total project cost (CZK thous.): 4 920

Total project cost – TBU (CZK thous.): 1 584

Project cost of TBU in 2020 (CZK thous.): 550

5.3.3 Faculty of Logistic and Crisis Management

COST Programme

Projects where TBU acts as a co-investigator

LTC18067 Geographical aspects of Citizen Science: mapping trends, scientific potential and societal impacts in the Czech Republic

Principal investigator: AV ČR

Project investigator on behalf of TBU: Jakub Trojan

Implementation period: 2018 – 2020

Total project cost (CZK thous.): 2 805

Total project cost – TBU (CZK thous.): 1 228

Project cost of TBU in 2020 (CZK thous.): 357

5.3.4 University Institute

National Programme for Sustainability

LO1504 Centre of Polymer Systems Plus

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Vladimír Sedlařík

Implementation period: 2015 - 2020

Total project cost (CZK thous.): 325 202

Total project cost – TBU (CZK thous.): 325 202
Project cost of TBU in 2020 (CZK thous.): 33 354

MOBILITY Programme

8JPL19031 Development of novel additives for thermoplastic processing of biodegradable polymers

Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Vladimír Sedlařík
Implementation period: 2019 - 2020
Total project cost (CZK thous.): 165
Total project cost – TBU (CZK thous.): 165
Project cost of TBU in 2020 (CZK thous.): 0

8J20PL026 Biodegradable polymer nanocomposite systems with improved thermal and mechanical properties

Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Martina Pummerová
Implementation period: 2020 - 2022
Total project cost (CZK thous.): 120
Total project cost – TBU (CZK thous.): 120
Project cost of TBU in 2020 (CZK thous.): 0

INTER EXCELLENCE - INTER ACTION Programme

LTAB19019 Preparation of nano- and micro-structured materials using self-organized protein fibrillar systems

Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Antonín Minařík
Implementation period: 2019 - 2021
Total project cost (CZK thous.): 1 170
Total project cost – TBU (CZK thous.): 1 170
Project cost of TBU in 2020 (CZK thous.): 390

LTAUSA19066 A study of polymeric memristors based on methacrylate polymers with pendant carbazole moieties

Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Jarmila Vilčáková
Implementation period: 2020 - 2022
Total project cost (CZK thous.): 5 756
Total project cost – TBU (CZK thous.): 2 850
Project cost of TBU in 2020 (CZK thous.): 950

INTER EXCELLENCE - INTER TRANSFER Programme

LTT20005 Collaboration with the EASE association on the development of a hybrid supercapacitor

Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Petr Sáha

Implementation period: 2020 - 2022	
Total project cost (CZK thous.):	4 913
Total project cost – TBU (CZK thous.):	4 913
Project cost of TBU in 2020 (CZK thous.):	1 567

LTT20010 Surface functionalized glass: Concept of heterostructured nanoparticles inspired by arteficial photosynthesis

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Michal Machovský

Implementation period: 2020 - 2024

Total project cost (CZK thous.):	7 765
Total project cost – TBU (CZK thous.):	7 765
Project cost of TBU in 2020 (CZK thous.):	1 325

Programme for Funding Multilateral Scientific and Technological Cooperation in the Danube Region

8X20041 Design and preparation of multifunctional magnetic nanoparticles for cancer cell detection / Development of biocompatible multifunctional magnetic nanoparticles and evaluation of their diagnostic and therapeutic potential for the application in oncology

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Jarmila Vilčáková

Implementation period: 2020 - 2022

Total project cost (CZK thous.):	296
Total project cost – TBU (CZK thous.):	296
Project cost of TBU in 2020 (CZK thous.):	0

5.4 Projects financed by the Ministry of the Interior of the Czech Republic

In 2020, 3 projects financed by the Ministry of the Interior of the Czech Republic was implemented at the TBU in Zlín. Total eligible costs amounted CZK 4,077 thousand for TBU in Zlín in 2020.

5.4.1 Faculty of Applied Informatics

Security Research Programme in the Czech Republic 2015 - 2022

VI20192022134 System of more accurate prediction of convective precipitation over the regional territorial unit

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: David Šaur

Implementation period: 2019 - 2022

Total project cost (CZK thous.):	13 273
Total project cost – TBU (CZK thous.):	7 887

Project cost of TBU in 2020 (CZK thous.): 2 356

VI20192021163 Built-up and operation development of security systems at mass events

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Dora Lapková

Implementation period: 2019 - 2021

Total project cost (CZK thous.): 2 118

Total project cost – TBU (CZK thous.): 2 118

Project cost of TBU in 2020 (CZK thous.): 832

Projects where TBU acts as a co-investigator

VI20192022118 Soft targets protection in the security environment of the Czech Republic

Principal investigator: VUT Brno

Project investigator on behalf of TBU: Martin Hromada

Implementation period: 2019 - 2022

Total project cost (CZK thous.): 16 781

Total project cost – TBU (CZK thous.): 2 989

Project cost of TBU in 2020 (CZK thous.): 899

5.5 Projects financed by the Ministry of Agriculture of the Czech Republic

In 2020, 3 projects financed by the Ministry of Agriculture of the Czech Republic was implemented at the TBU in Zlín. Total eligible costs amounted CZK 3,149 thousand for TBU in Zlín in 2020.

5.5.1 Faculty of Technology

Projects where TBU acts as a co-investigator

ZEMĚ Programme

QK1710156 New approaches and methods of analysis to ensure the quality, safety and health perfection of cheeses, the optimization of their manufacturing and the perfection of hygiene and sanitation together with the lowering of environmental load by waste water

Principal investigator: Výzkumný ústav mlékárenský s. r.o.

Project investigator on behalf of TBU: František Buňka

Implementation period: 2017 - 2021

Total project cost (CZK thous.): 18 838

Total project cost – TBU (CZK thous.): 3 252

Project cost of TBU in 2020 (CZK thous.): 700

QK1920190 Meat cooking loss: effect of fresh meat characteristics, cooking technology and parameters of cooking

Principal investigator: Veterinární a farmaceutická univerzita Brno

Project investigator on behalf of TBU: Robert Gál

Implementation period: 2019 - 2021

Total project cost (CZK thous.): 6 488

Total project cost – TBU (CZK thous.): 2 937

Project cost of TBU in 2020 (CZK thous.): 964

5.5.2 University Institute

ZEMĚ Programme

QK1910392 Environmentally friendly soil conservation materials for the crop production intensification based on renewable resource

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Vladimír Sedlařík

Implementation period: 2019 - 2023

Total project cost (CZK thous.): 16 511

Total project cost – TBU (CZK thous.): 6 952

Project cost of TBU in 2020 (CZK thous.): 1 485

5.6 Projects financed by the Technology Agency of the Czech Republic

In 2020, 28 projects financed by the Technology Agency of the Czech Republic were implemented at the TBU in Zlín. Total eligible costs amounted CZK 30,561 thousand for TBU in Zlín in 2020.

5.6.1 Faculty of Technology

THÉTA Programme

TK03020129 Rubber sealing materials development for hermetic systems of nuclear power plants

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Simona Mrkvičková

Implementation period: 2020 - 2024

Total project cost (CZK thous.): 17 022

Total project cost – TBU (CZK thous.): 4 526

Project cost of TBU in 2020 (CZK thous.): 538

Projects where TBU acts as a co-investigator

TK01030054 Controlled biological methane production in situ

Principal investigator: EPS biotechnology, s. r. o.

Project investigator on behalf of TBU: Marek Koutný

Implementation period: 2018 - 2022	
Total project cost (CZK thous.):	15 464
Total project cost – TBU (CZK thous.):	3 490
Project cost of TBU in 2020 (CZK thous.):	756

ZÉTA Programme

Projects where TBU acts as a co-investigator

TJ04000226 Combined procedure of elimination of chloroacetanilide pesticides from contaminated water and soil

Principal investigator: Univerzita Pardubice	
Project investigator on behalf of TBU: Štěpán Vinter	
Implementation period: 2020 - 2022	
Total project cost (CZK thous.):	8 053
Total project cost – TBU (CZK thous.):	2 002
Project cost of TBU in 2020 (CZK thous.):	712

5.6.2 Faculty of Management and Economics

ZÉTA Programme

TJ02000339 Knowledge of Behavioral Economics and its Application at the Level of Municipalities and Regions in the Czech Republic

Principal investigator: TBU in Zlín	
Project investigator on behalf of TBU: Filip Kučera	
Implementation period: 2019 - 2021	
Total project cost (CZK thous.):	1 927
Total project cost – TBU (CZK thous.):	1 763
Project cost of TBU in 2020 (CZK thous.):	868

ÉTA Programme

TL03000319 Economics and ethics of foreign investors in the Czech Republic

Principal investigator: TBU in Zlín	
Project investigator on behalf of TBU: Adriana Knápková	
Implementation period: 2020 - 2023	
Total project cost (CZK thous.):	4 753
Total project cost – TBU (CZK thous.):	4 753
Project cost of TBU in 2020 (CZK thous.):	1 016

TL03000525 Design of a Model of Metropolitan Areas in the Czech Republic affected by depopulation

Principal investigator: TBU in Zlín	
Project investigator on behalf of TBU: Pavel Bednář	
Implementation period: 2020 - 2022	
Total project cost (CZK thous.):	8 428
Total project cost – TBU (CZK thous.):	1 489

Project cost of TBU in 2020 (CZK thous.): 469

TL03000737 Use of behavioral economics to society activation to achieve financial safety by using banking products

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Lubor Homolka

Implementation period: 2020 - 2022

Total project cost (CZK thous.): 1 072

Total project cost – TBU (CZK thous.): 1 014

Project cost of TBU in 2020 (CZK thous.): 280

Projects where TBU acts as a co-investigator

TJ01000191 Innovation of tourism management systems by means of process management tools

Principal investigator: ZČU Plzeň

Project investigator on behalf of TBU: Zuzana Tučková

Implementation period: 2018 - 2022

Total project cost (CZK thous.): 11 933

Total project cost – TBU (CZK thous.): 1 387

Project cost of TBU in 2020 (CZK thous.): 368

5.6.3 Faculty of Multimedia and Communications

ÉTA Programme

TL02000255 A Managerial Model of Design Value for Competitiveness of SME in the Czech Republic

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Eva Šviráková

Implementation period: 2019 - 2020

Total project cost (CZK thous.): 1 965

Total project cost – TBU (CZK thous.): 1 251

Project cost of TBU in 2020 (CZK thous.): 555

TL03000367 USING VIRTUAL REALITY IN ART: CREATING AN EXPERIENCE IN THE WORLD OF FANTASY AND INSPIRATION OF KAREL ZEMAN

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Peter Štarchoň

Implementation period: 2020 - 2022

Total project cost (CZK thous.): 9 817

Total project cost – TBU (CZK thous.): 2 208

Project cost of TBU in 2020 (CZK thous.): 662

5.6.4 Faculty of Applied Informatics

EPSILON Programme

TH02020979 Distributed control system for regional heat and cooling supply conceived as Smart Energy Grid

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Vladimír Vašek

Implementation period: 2017 - 2020

Total project cost (CZK thous.): 9 383

Total project cost – TBU (CZK thous.): 2 027

Project cost of TBU in 2020 (CZK thous.): 694

Projects where TBU acts as a co-investigator

TH04010377 Development of methods of identification and protection of soft targets within transport infrastructure to increase their security and resistance to terrorist threats

Principal investigator: VUT Brno

Project investigator on behalf of TBU: Dora Lapková

Implementation period: 2019 - 2022

Total project cost (CZK thous.): 10 701

Total project cost – TBU (CZK thous.): 5 224

Project cost of TBU in 2020 (CZK thous.): 1 389

TREND Programme

Projects where TBU acts as a co-investigator

FW01010381 Intelligent robotic protection of the health of the hydroponic greenhouse ecosystem

Principal investigator: NWT a. s.

Project investigator on behalf of TBU: Roman Jašek

Implementation period: 2020 - 2023

Total project cost (CZK thous.): 38 006

Total project cost – TBU (CZK thous.): 19 810

Project cost of TBU in 2020 (CZK thous.): 5 153

5.6.5 Faculty of Humanities

ÉTA Programme

TL02000331 The Conception of Education for the Alpha Generation with Using Research-Based Principles of Learning at Nursery Schools

Principal investigator: TBU in Zlín

Project investigator on behalf of TBU: Jana Majerčíková

Implementation period: 2019 - 2020

Total project cost (CZK thous.): 2 215

Total project cost – TBU (CZK thous.): 2 215

Project cost of TBU in 2020 (CZK thous.): 1 219

TL03000191 Labelling of intellectually gifted children at school environment

Principal investigator: TBU in Zlín
 Project investigator on behalf of TBU: Eva Machů
 Implementation period: 2020 - 2023
 Total project cost (CZK thous.): 3 645
 Total project cost – TBU (CZK thous.): 3 645
 Project cost of TBU in 2020 (CZK thous.): 715

5.6.6 Faculty of Logistic and Crisis Management

ÉTA Programme

TL03000007 Strengthening rural resilience through the mobilisation of local actors and landowners

Principal investigator: TBU in Zlín
 Project investigator on behalf of TBU: Jiří Lehejček
 Implementation period: 2020 - 2023
 Total project cost (CZK thous.): 9 089
 Total project cost – TBU (CZK thous.): 2 342
 Project cost of TBU in 2020 (CZK thous.): 585

5.6.7 University Institute

EPSILON Programme

TH02020836 Development of novel plastic based environmentally friendly food packaging materials with added value

Principal investigator: TBU in Zlín
 Project investigator on behalf of TBU: Vladimír Sedlařík
 Implementation period: 2017-2020
 Total project cost (CZK thous.): 3 984
 Total project cost – TBU (CZK thous.): 1 584
 Project cost of TBU in 2020 (CZK thous.): 396

Projects where TBU acts as a co-investigator

TH03020117 Conductive materials and their application for antistatic and dissipative treatment of the paper and polymeric products

Principal investigator: Centrum organické chemie s. r. o.
 Project investigator on behalf of TBU: Vladimír Sedlařík
 Implementation period: 2018-2021
 Total project cost (CZK thous.): 19 910
 Total project cost – TBU (CZK thous.): 2 800
 Project cost of TBU in 2020 (CZK thous.): 700

TH04020466 REAKTIN - Longfiber composites for serial production

Principal investigator: 5M s. r. o.
 Project investigator on behalf of TBU: Tomáš Sedláček

Implementation period: 2019-2022	
Total project cost (CZK thous.):	10 074
Total project cost – TBU (CZK thous.):	2 065
Project cost of TBU in 2020 (CZK thous.):	596

GAMAII Programme

TG03010052 Commercialization at the Tomas Bata University in Zlin II

Project investigator on behalf of TBU: Miroslava Komínková	
Implementation period: 2020 - 2022	
Total project cost (CZK thous.):	11 099
Total project cost – TBU (CZK thous.):	11 099
Project cost of TBU in 2020 (CZK thous.):	3 321

M-ERA.NET Programme

TH71020006 Li-ion BAattery-SupErcapacitor Hybrid Device

Project investigator on behalf of TBU: Petr Sáha	
Implementation period: 2020 - 2023	
Total project cost (CZK thous.):	2 036
Total project cost – TBU (CZK thous.):	2 036
Project cost of TBU in 2020 (CZK thous.):	248

Projects where TBU acts as a co-investigator

TH71020005 Bioactive injectable hydrogels for soft tissue regeneration after reconstructive maxillofacial surgeries INJECT-BIO

Principal investigator: Riga Technical University	
Project investigator on behalf of TBU: Nabanita Saha	
Implementation period: 2020 2023	
Total project cost (CZK thous.):	1 534
Total project cost – TBU (CZK thous.):	1 534
Project cost of TBU in 2020 (CZK thous.):	160

THÉTA Programme

TK03030157 Next generation all-solid-state Li-ion batteries

Project investigator on behalf of TBU: Petr Sáha	
Implementation period: 2020 - 2025	
Total project cost (CZK thous.):	24 607
Total project cost – TBU (CZK thous.):	24 607
Project cost of TBU in 2020 (CZK thous.):	2 103

TREND Programme

Projects where TBU acts as a co-investigator

FW01010588 Filters for removal of biologically active molecules from the drinking water

Principal investigator: Nedform s. r. o.

Project investigator on behalf of TBU: Vladimír Sedlařík

Implementation period: 2020 - 2022

Total project cost (CZK thous.): 11 003

Total project cost – TBU (CZK thous.): 4 371

Project cost of TBU in 2020 (CZK thous.): 1 178

FW01010620 Research and development of materials and technology of small batch production of structural and sealing elements

Principal investigator: G 3, s.r.o.

Project investigator on behalf of TBU: Michal Machovský

Implementation period: 2020 - 2023

Total project cost (CZK thous.): 20 096

Total project cost – TBU (CZK thous.): 5 009

Project cost of TBU in 2020 (CZK thous.): 1 211

FW01010327 Advanced polymer and composite materials for additive manufacturing

Principal investigator: SPA 2000 s. r. o.

Project investigator on behalf of TBU: Jarmila Vilčáková

Implementation period: 2020 - 2024

Total project cost (CZK thous.): 18 134

Total project cost – TBU (CZK thous.): 4 376

Project cost of TBU in 2020 (CZK thous.): 925

ZÉTA Programme

TJ02000125 Hi-tech footwear skin

Project investigator on behalf of TBU: Zuzana Bahulová

Implementation period: 2019 - 2021

Total project cost (CZK thous.): 6 496

Total project cost – TBU (CZK thous.): 5 756

Project cost of TBU in 2020 (CZK thous.): 2 908

TJ02000269 Nanostructured filtration materials for elimination of arsenic in water

Project investigator on behalf of TBU: Eva Domincová Bergerová

Implementation period: 2019 - 2021

Total project cost (CZK thous.): 2 297

Total project cost – TBU (CZK thous.): 1 624

Project cost of TBU in 2020 (CZK thous.): 836

5.7 Projects financed by the Ministry of Culture

In 2020, 1 project financed by the Ministry of Culture was implemented at the TBU in Zlín. Total eligible costs amounted CZK 3,718 thousand for TBU in Zlín in 2020.

5.7.1 Faculty of Multimedia Communications

NAKI II Programme

Projects where TBU acts as a co-investigator

DG18P02OVV059 Designers in the Czech Lands and the Czechoslovak Machinery Industry

Principal investigator: National Technical Museum

Project investigator on behalf of TBU: Zdeno Kolesár

Implementation period: 2018 - 2022

Total project cost (CZK thous.):	23 206
Total project cost – TBU (CZK thous.):	11 080
Project cost of TBU in 2020 (CZK thous.):	1 199

5.8 PROJECTS – SUMMARY

Number of projects implemented in 2020

Component part / Provider	European Commission	Czech Science Foundation	Ministry of Culture	Ministry of Industry and trade of the Czech Republic		Ministry of Education, Youth and Sports of the Czech Republic	Ministry of the Interior of the Czech Republic	Ministry of Agriculture of the Czech Republic	Technology Agency of the Czech Republic	Total
				MIT total	Operational Programme projects					
Faculty of Technology	1	1	0	1	1	0	0	2	3	8
Faculty of Management and Economics	0	2	0	1	1	2	0	0	5	10
Faculty of Multimedia Communications	0	0	1	0	0	0	0	0	2	3
Faculty of Applied Informatics	0	1	0	11	9	2	3	0	3	20
Faculty of Humanities	0	2	0	0	0	0	0	0	2	4
Faculty of Logistics and Crisis Management	0	0	0	1	0	1	0	0	1	3
TBU Library	0	0	0	0	0	0	0	0	0	0
University Institute	0	7	0	4	1	8	0	1	12	32
Rectorate	0	0	0	0	0	0	0	0	0	0
TBU total	1	13	1	18	12	13	3	3	28	80

Total costs acknowledged for TBU in Zlín in 2020 (in CZK thousands)

Component part / Provider	European Commission	Czech Science Foundation	Ministry of Culture	Ministry of Industry and trade of the Czech Republic		Ministry of Education, Youth and Sports of the Czech Republic	Ministry of the Interior of the Czech Republic	Ministry of Agriculture of the Czech Republic	Technology Agency of the Czech Republic	Total
				MIT total	Operational Programme projects					
Faculty of Technology	1 644	1 634	0	1 725	1 725	0	0	1 664	2 006	8 673
Faculty of Management and Economics	0	0	0	1 030	1 030	697	0	0	3 001	4 728
Faculty of Multimedia Communications	0	0	1 199	0	0	0	0	0	1 217	2 416
Faculty of Applied Informatics	0	1 071	0	17 585	15 866	550	4 077	0	7 236	30 519
Faculty of Humanities	0	1 317	0	0	0	0	0	0	1 934	3 251
Faculty of Logistics and Crisis Management	0	0	0	2 512	0	357	0	0	585	3 454
TBU Library	0	0	0	0	0	0	0	0	0	0
University Institute	0	7 616	0	2 247	629	37 586	0	1 485	14 582	63 516
Rectorate	0	0	0	0	0	0	0	0	0	0
TBU total	1 644	11 638	1 199	25 099	19 250	39 190	4 077	3 149	30 561	116 557

Total costs acknowledged for all investigators in 2020 (in CZK thousands)

Component part / Provider	European Commission	Czech Science Foundation	Ministry of Culture	Ministry of Industry and trade of the Czech Republic		Ministry of Education, Youth and Sports of the Czech Republic	Ministry of the Interior of the Czech Republic	Ministry of Agriculture of the Czech Republic	Technology Agency of the Czech Republic	Total
				MIT total	Operational Programme projects					
Faculty of Technology	56 422	1 634	0	6 988	6 988	0	0	6 157	7 615	78 816
Faculty of Management and Economics	0	0	0	8 523	8 523	697	0	0	7 387	16 607
Faculty of Multimedia Communications	0	0	4 556	0	0	0	0	0	3 130	7 686
Faculty of Applied Informatics	0	1 071	0	69 980	61 925	1 650	9 940	0	14 105	96 746
Faculty of Humanities	0	1 317	0	0	0	0	0	0	1 934	3 251
Faculty of Logistics and Crisis Management	0	0	0	4 952	0	820	0	0	2 185	7 957
TBU Library	0	0	0	0	0	0	0	0	0	0
University Institute	0	10 744	0	10 621	3 713	38 532	0	3 601	30 432	93 930
Rectorate	0	0	0	0	0	0	0	0	0	0
TBU total	56 422	14 766	4 556	101 064	81 149	41 699	9 940	9 758	66 788	304 993

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The publication was not checked for language or editorial