

Project Title	Excellence Centre for functionalised multiphase materials (FUN-MAT)
Coordinator	Prof. Ing. Jozef Janovec, DrSc.
Start Date	04/08/2011
End Date	31/12/2014
Programme	-- Other domestic --
Annotation	The aim of the project is to gain new physics knowledge in the field of multiphase complex alloys, ceramics, composites and catalytically active surfaces of metals, plasmonic effects, fotovoltaic and thermoelastic polymer structures, as well as from the field of biosensors. The acquired knowledge should enable targeted functionalisation of materials with the goal to achieve required specific properties such as mechanical toughness, chemical selectivity, increased quantum efficiency of light conversion and others. The final aim will be a marked added value in research, development and the implementation of unique high-tech solutions based on a multidisciplinary approach and the connection of research subjects with the expertise in the field of physics of solids, quantum optics, materials engineering, anorganic chemistry, chemistry of polymers and biology.
Project Title	Characterisation of special glasses via physical methods
Coordinator	Assoc.Prof. Ing. Marian Kubliha, PhD.
Start Date	01/01/2012
End Date	31/12/2013
Programme	APVV, SR - Czech Rep.
Annotation	The project is focused on the support of long-time co-operation between the Slovak and Czech partners in the field of study into special glasses, particularly in the case of special glasses on the basis of chalcogenides and oxides of heavy metals for optoelectronic applications requiring very low contents of impurities and defects (e.g. content of OH groups usually does not exceed 0.0001 mol%). To analyse glasses, highly sensitive measuring methods of selected physical quantities are used along with conventional ones. Partners from the Czech Republic will prepare special glasses and carry out analysis of their optical properties. Researchers from the Slovak Republic will conduct analysis of electrical and dielectric properties in order to determine the quality of the prepared glasses, their homogeneity, amount and type of defects. The examined glasses are determined for the fields of photonics in the form of fibres transmitting the energy of lasers and optical signals (passive and active applications) as well as for the generation of radiation. The 4f-4f shining transition is generally used after doping the glasses with rare earths serving also as active elements.
Project Title	Chemical sputtering: Computational modelling of interactions in carbon-containing films when exposed to molecular ions and hydrogen EURATOM CU
Coordinator at MTF	Prof. RNDr. Miroslav Urban, DrSc.
Start Date	01/01/2010
End Date	31/12/2012
Programme	Euratom
Annotation	The project focuses on the formation of small hydrocarbons, their chemistry and cracking pattern, upon the electron (e-) and the impact and/ or thermodynamics of the formation of saturated lower hydrocarbons. The project assessed the interaction energies of the hydrogen, nitrogen and molecular ions with compounds and the creation of a model for interactions with hydrogenated carbon films. The outcomes included calculations of the ionisation potentials of small hydrocarbons, C _x H _y

(C_xH_yD_z) and their ions, their properties and thermodynamic stability.

Project Title	Interactions in bio and nanosystems
Coordinator at MTF	Prof. RNDr. Miroslav Urban, DrSc.
Start Date	01/05/2011
End Date	31/10/2014
Programme	APVV, General Call
Annotation	The bonding characteristics, including chemical and hydrogen bonds to weak intermolecular interactions are essential in apparently remote areas like biophysics and material sciences. Recently, benchmarking data was obtained for properties of molecules and their interactions, using the Coupled Cluster CCSD(T) method capable of recovering a substantial part of the electron correlation. It provides reliable predictions of molecular properties. innovations developed within the project remit to allow CC molecular calculations with more than 80 correlated electrons and basis sets with up to 1500 functions. Real applications require properties of large molecules and clusters, inaccessible to rigorous methods. As a result computationally less demanding DFT and semiempirical methods will be used. The accuracy control of appropriate methods using relativistic CC data for smaller model systems is essential in this project. Intermolecular interactions will be exploited "in silico" drug design, "docking and scoring" analysis and the description of the ligand-active site of the protein. The activity of "Aurora" kinase inhibitions in tumor cells, molecules with angiostatic activity, blocking the vascular endothelial growth factor receptor-2 will be investigated. Reference data for metal ligand interactions related to the SAMS formation and catalysis on surfaces and cavities will be obtained. A model will be proposed as part of the research findings in order to summarise the application of Au-nanoparticles in relation to material sciences and drug design. Polymer interactions based on HCNB clusters will also be studied.

Project Title	Solidification and properties of novel peritectic TiAl-based alloys
Coordinator at MTF	Ing. Svetozár Demian
Start Date	01/05/2011
End Date	31/10/2014
Programme	APVV, General Call
Annotation	Peritectic alloys based on TiAl are excellent candidates for near net shape casting of light-weight structural components for aircraft and automotive engines, industrial gas turbines and new generation of nuclear reactors. To advance the knowledge in the emerging casting technology sector of TiAl-based alloys, the SOPERIT project aims to investigate microstructure formation and segregation during solidification and solid phase transformations of novel peritectic TiAl-based alloys. The attention is directed to understand the effect of solidification parameters and alloying on the primary solidification phase, solidification path, phase equilibria, the columnar-to-equiaxed transition (CET), texture formation and nucleation activity of peritectic phase which will open up new opportunities for alloy and process design. The novel peritectic alloys with a fine grain structure will be designed and their microstructure and properties (chemical, physical and mechanical) will be characterised. Fine grain structure will be achieved through appropriate alloying affecting nucleation of peritectic phase and solid phase transformations. Unique CET experiments will provide advanced knowledge about the mechanisms of nucleation of equiaxed grains, associated segregation and the necessary input data for CET modelling. Parallel to these research activities, laboratory near net shape casting techniques based on plasma melting in a water-cooled crystalliser and gravity casting into ceramic moulds will be developed.

Project Title Preparation and characterisation of composites with the polymer matrix – elastomer, reactoplast
Coordinator Mgr. Ondrej Bošák, PhD.
Start Date 01/01/2012
End Date 31/12/2013
Programme APVV, SR - Czech Rep.
Annotation The project is aimed at mutual co-operation in the field of preparation and study of newly developed materials on the base of rubber mixtures and composites based on polymer substances filled with non-oriented and oriented fibres and nanotubes. Partnering workplaces in the Czech Republic are able to prepare examined materials and diagnose common technical applications. The Slovak partner will focus on diagnostic methods either in the field of interaction of the electromagnetic field with material, or in the area of characterisation of the thermo-mechanical behaviour at elevated temperatures.

Project Title Research and development of advanced materials, processing and automation technologies for direct manufacturing and application
Coordinator Assoc.Prof. Ing. Martin Kusý, PhD.
Start Date 01/09/2011
End Date 31/08/2014
Programme Other international
Annotation The subject of the research is focused on advanced materials, processing and automation technologies for direct manufacturing and its application.

Project Title Structure, properties and processes at surfaces and interfaces of materials from first principles calculations.
Coordinator RNDr. Andrej Antušek, PhD.
Start Date 01/01/2012
End Date 31/12/2015
Program VEGA
Annotation The project is focused on density functional calculations of surface and interface structures relevant for materials science and chemistry. Through the application of methods of theoretical and computational chemistry the research will address the growth of a thin layer and the subsequent thermodynamic properties of such structures with possible applications in brazing and joining technology. Using our previous experience with intermolecular interactions, the research will model interactions of molecules with surfaces, with a focus on increasing the understanding of the bonding mechanism. For smaller model systems accurate relativistic CCSD(T) calculations will be used as benchmarks to verify DFT results. Wave function calculations may also be useful for the selection of a proper DFT functional.

Project Title Study of phase equilibria in advanced materials using aimed experiments and computational thermodynamics.
Coordinator Ing. Roman Čička, PhD.
Start Date 01/01/2011
End Date 31/12/2013
Program VEGA
Annotation The aim of the research project is to contribute to the thermodynamic description by creating and assessing the thermodynamic databases of selected materials systems for Pb-free solders, advanced steels and complex metallic alloys. In the experimental part of the study the chemical and phase compositions of samples in investigated systems will be determined, their thermodynamic properties will be measured and phase transitions will be characterised. This data will be analysed and compared to results of computations of phase equilibria, using the CALPHAD method and the Thermocalc software. Based on this procedure, the thermodynamic description of

phases in the investigated systems will be optimised and values of interaction parameters of components will be refined. These results should be useful for planning further research of new alloys in these systems, aimed to improve the properties of existing materials.

Project Title Study of crystal structure and thermodynamic properties of aluminium-base and zinc-base complex metallic alloys
Coordinator Prof. Ing. Jozef Janovec, DrSc.
Start Date 01/07/2012
End Date 31/12/2015
Programme APVV, General Call
Annotation The project is focused on the study of phases, their equilibria, and transformations due to changes in temperature and chemical composition in aluminium-base and zinc-base complex metallic alloys, as well as on the determination of their crystal structure. This study will be carried out using experimental (X-ray diffraction, DTA, DSC, TEM, electron diffraction, SEM, EDX, WDX, and EBSD) and theoretical (CALPHAD, DFT and empirical potentials) tools. Selection of alloys will be focused on systems where one component is either aluminium or zinc, and the remaining components are formed by transition metals. The project may significantly contribute to complementation and clarification of phase diagrams in areas that are less well-known and poorly studied. The emphasis will be placed on areas where structurally complex and quasicrystalline phases could be supposed. The contribution to finding of new quasicrystalline and structurally complex phases is anticipated. Theoretical study of these phases will lead to a more detailed description of their crystal structure, as well as to a deeper understanding of the relationship between the structure and physical properties.

Project Title Study into structural and mechanical stability of a new extremely hard coating for the construction and tool materials.
Coordinator Assoc.Prof. Ing. Ľubomír Čaplovič, PhD.
Start Date 01/01/2012
End Date 31/12/2014
Programme VEGA
Annotation The project is aimed at analysing the effect of structural, material and technological parameters of the current advanced coatings applied on the construction and tool materials in specific conditions of their application. The latest analytical techniques (HRSEM, HRTEM, EBSD, RTG diffraction) will be used to examine the mechanism of forming wear-resistant types of PVD coatings on selected types of materials. The following evaluation of mechanical and tribological characteristics will be used to describe the influence of dynamic and static load of the layers on their operational reliability. The goal is to find a correlation between the internal construction of coatings, their interphase interfaces with substrate, structural tension relations in the layers, way of heat treatment prior to and post the PVD application and their tribological properties.

Project Title Properties of lead-free solders and their liquid-state and solid-state interfacial reaction with substrates
Coordinator Prof. RNDr. Milan Ožvold, CSc.
Start Date 01/01/2009
End Date 31/12/2012
Program VEGA
Annotation The aim of this project was to increase the basic knowledge of the crucial properties of alloys that can be used as environmentally friendly alternatives to solders. The work covered the areas of physical, metallurgical and mechanical properties. The top properties were to measure the melting point temperature and surface tension. The surface tension of molten solder is a basic parameter affecting wettability together with flux. The wettability of the solder alloy and mechanical properties of joints are

influenced by the interface reaction and intermetallic growth between the solder and under bump metallisation. The objective was to establish a (micro)structure-property relationship and potential reliability issue of Pb-free solders.

Project Title	Effect of exposition conditions on the development of binary and ternary phases in complex metal aluminium-based alloys.
Coordinator	Prof. Ing. Jozef Janovec, DrSc.
Start Date	01/01/2012
End Date	31/12/2012
Program	VEGA
Annotation	The project focuses on the study of thermally activated development of binary and ternary phases in complex metal alloys based on aluminium with the aim of specifying related phase diagrams. Alloys of Al-TM-TM type (TM=transition metal) will be annealed at various temperatures and subsequently rapidly quenched in order to preserve the state corresponding to exposition temperature. Tm was substituted by Pd, Fe, Co, Cr, Cu, Mn or other transition elements. X- ray diffraction analysis, TEM, SEM, DTA, EDX, WDX and EBSD, as well as thermodynamic modelling used to analyse the phases. Attention was paid to the systems which have not been previously studied. Based on the experimental results and available theoretical knowledge, thermodynamic parameters of the identified phases and enhance related thermodynamic databases were examined. The application of progressive experimental methods were prepared prerequisites for innovations in the methodology. The solutions contribute to the knowledge pool with the aim of possibly discovering new phases of original properties.

Project Title	Effects of inhomogeneities on functional properties of high-temperature superconducting wires
Coordinator	Mgr. Michal Skarba, PhD.
Start Date	01/01/2011
End Date	31/12/2014
Program	VEGA
Annotation	Non-metallic superconductors based on a mixture of Y, Ba and Cu oxides (YBCO) are well known materials showing superconductive properties at relatively high temperatures. Structural analysis of micrometer superconductive layers on metallic substrate enables an understanding of the relationship between the parameters of preparation of layer and its properties. During deposition of layer on metallic substrate and during further processing, defects in the structure of thin layers of YBCO develop. These defects significantly affect the electromagnetic properties of superconductors, especially critical current and ac losses. Information about defects in layers of YBCO, inferred from structural analysis, are useful for decreased imperfections of production of superconductive layers. It is also necessary for the development of superconductive devices, because they can have a significant influence on their working characteristics. Evaluations of structure of thin superconductive layers will be performed mainly with (high-resolution) TEM.

Projects 2012 – Institute of Production Technologies

Project title	Centre of Excellence for Five-Axis Machining programs regarding quality in manufacturing engineering
Coordinator	Prof. Dr. Ing. Jozef Peterka
Start Date	2012/2013
End Date	2012/2013
Programme	Networking of university researchers
Annotation	OPV Five-axis machining is one of the main trends in cutting technology used for mould in production. The term five-axis machining means cutting machine tools through which the movement is carried out on five different axes simultaneously. The benefit of five-axis machining is the machine's ability to machine complex shapes in a single set-up and achieve a uniform surface with roughness being cultivated. The Centre will have the opportunity to realise the basic research on 5-axis machining of complex shape parts, including control and measurement and will also be able to monitor the quality of cutting fluids and cutting processes. It will be able to provide for all levels of learning in education together with establishing an experimental base for doctoral researchers from Slovak and foreign universities, and also practitioners. The ambition of the project is to help mould and die manufacturers (developers, designers, technologists, quality control persons, supervisors, young starting engineers and also skilled senior engineers) to find a theoretical and practical orientation (guidance) in this difficult cutting process of five-axis machining.
Project title	Design, implementation and use of joint programs regarding quality in manufacturing engineering
Coordinator	Ing. Ladislav Morovič, PhD.
Start Date	2012
End Date	2013
Programme	Networking of university researchers
Annotation	The aim of the project is to increase the level of students education and flexibility in the field of production engineering and production engineering quality in the central European region. The primary goal is to implement a common Masters and Doctoral study programmes and improve co-operation within the network.
Project title	Modern methods of the constitution and measurement of geometrical surface structure
Coordinator	Ing. Ladislav Morovič, PhD.
Start Date	01/09/2011
End Date	31/08/2012
Programme	Designing a network of university researchers
Annotation	The common aim of all the project participants is the study focused on modern methods of measuring the geometrical surfaces structures. Synergy of partnering institutions provides the possibility of achieving effective co-operation (utilising laboratories, student and teacher mobility etc.).
Project title	Investigation of dynamic characteristics of the cutting process in 5 - axis milling in context of 5 - axis machining at the Centre of Excellence.
Coordinator	Assoc. Prof. Ing. Peter Pokorný, PhD.
Start Date	01/01/2011
End Date	31/12/2013
Programme	VEGA

Annotation	The project aims to explore the characteristics of the dynamic cutting process. In this context, the project studies the distribution and effect of cutting forces in the 5-axis milling. The chatter as well as its origination, effect and ultimately the conditions for its elimination are important dynamic characteristics as well. The project therefore addresses the causes of the chatter in 5 - axis milling and deals with the solutions for milling without the chatter. The suitable choice of CAM milling strategies with regard to the desired shape and quality of a part is also an important parameter in the process of 5 - axis milling. The project will therefore also analyse the impact of various 5 - axis milling CAM strategies on dynamic characteristics of the cutting process.
Project title	Joining of surface treated thin steel sheets by modern joining methods
Coordinator	Prof. Ing. Milan Marônek, CSc.
Start Date	27/04/2011
End Date	31/12/2013
Programme	VEGA
Annotation	The scientific project deals with joining (welding and adhesive joining) of steel sheets with a different kind of surface treatment. The surface layer significantly influences arc stability of technological process and the subsequent quality of weld and adhesive joints. As the new joining technologies (laser beam welding, arc welding methods with controlled metal transfer, hybrid welding methods, MIG brazing and adhesive bonding) are gradually being applied in practice, there is the necessity to know the suitability of these joining methods to the defined surface treatment or to specify the range of process parameters leading to quality joint formation.
Project title	Technological heritability of laser micromachining process and its influence on technological and exploitation properties of material.
Coordinator	Prof. Ing. Peter Šugár, CSc.
Start Date	01/01/2011
End Date	31/12/2014
Programme	VEGA
Annotation	The goal of the project is to research of the laser micromachining process (laser micromilling and so called laser microstructuring) during machining of metals by solid-state Nd: YAG laser. Two fields of interest are solved in this project. The first is the assignment of laser-induced surface degradation relevancy on changes in corrosion resistance of corrosion-resistant steels and Ti-alloys with the different degree of deformation strengthening (thin sheet plates made by technology of drawing and metal spinning). The second area of interest is to define optimal technological conditions of laser structuring in the processes of incremental forming tools and semifinished products surfaces modifications.
Project title	Effect of the 5-axis grinding parameters on the geometrical precision of shank cutting tools
Coordinator	Assoc.Prof. Ing. Štefan Václav, PhD.
Start Date	01/01/2012
End Date	31/12/2013
Programme	VEGA
Annotation	The project will deal with the grinding precision and geometry of shank cutting tools in dependence of the cutting tool and using a newly designed methodology. The theory of cutting forces in grinding has not been processed properly. Researchers in this project will use a new method of experiment planning, where acquired relations will be dimensionally homogeneous and indicators of equations (dimension constants) will gain a physical sense. The project output will be dissemination of the theory of highly-parametrical grinding, a shift from 3-axis to 5-axis grinding. A unique contribution will be also the determination of life-cycle by means of specific cutting entrophy. The goal will be the verification of the originally manufactured tools for 5-axis milling machines and their subsequent measurement of geometry prior to and

post machining on both the Zoller 5-axis measuring machine and optical scanner.

Project title Implementation of an online classroom for the dynamic education of secondary technical school and university students focused on design and manufacturing of freeform surfaces

Coordinator Prof. Dr. Ing. Jozef Peterka

Start Date 01/01/2012

End Date 31/12/2013

Programme KEGA

Annotation The project aim is to develop an online classroom for the dynamic training of secondary school and university students and the pilot implementation of the online classroom for training the wider public in the field of CNC machines and CAD/CAM systems programming as well as for accredited study programmes of Computer-Aided Production Technologies (Bc.) and Computer-Aided Design and Production (Master) at STU MTF. The project will comprise the elaboration of complex materials (texts, presentations, multimedia videos, sample tasks) placed on the designed internet website available for all potential interested parties. Results will be applicable to the whole Slovak Republic as well as abroad.

Project title Research into the metallurgical joining and other technological processes of processing the magnesium and other light alloys by progressive and suitable environment-friendly technologies

Coordinator Prof. Ing. Milan Turňa, PhD.

Start Date 01/01/2012

End Date 31/12/2013

Programme VEGA

Annotation The project will focus on the design, experimental verification and scientific justification of technological processing of Mg alloys. Selection of progressive and environment-friendly technologies of metallurgical joining and forming. Welding and soldering/brazing the Mg alloys with other metals (Al, Ti, steels). Design and quality control of joints by using advanced non-destructive and destructive methods. A detailed study will be conducted of the interface of combined joints with the AZ91 and AZ31 alloys, thus contributing to the research into the mechanisms and their origin and participation into the development of a new Mg alloy of ML5 type. The investigation of heat distribution by concentrated energy sources and comparison with AWJC. Verification for the possible use of microplasma polishing of surfaces of the Mg and Al alloys will be made. The study will focus on the strain/stress-deformation states of materials in processing the Mg and Al alloys (ISF, MS, Thixoforming) in order to optimise the parameters of forming processes and predict utility properties of products. The justification of the economic and environmental priorities of the individual technologies will also be given.

Project title Research into the effect of parameters of selected technological processes on the integrity of surface layers

Coordinator Assoc.Prof. Ing. Jozef Bílik, PhD.

Start Date 01/01/2012

End Date 31/12/2014

Programme VEGA

Annotation The project is aimed at examining the effect of selected technological parameters and technological impact on the properties and integrity of surface layers in order to predict the utility and life-cycle of products. The goal is to determine the effect of speed and transformation size on the integrity of surface layers made by ramming, charging, spinning, rolling, shooting or cold-drawing of pipes and wires. To assess integrity, the research will use conventional methods of qualitative analysis as well as the results attained by the application of stereological materialography, Abbott-Fireston curves and evaluation of tribological properties. The attained results

will be applied in the prediction of utility properties of formings and parts in practice.

Project title Research into the weldability of duplex and superduplex stainless steels by concentrated energy sources
Coordinator Prof. Ing. Koloman Ulrich, PhD.
Start Date 01/01/2011
End Date 31/12/2013
Program VEGA
Annotation The aim of the scientific project is the investigation and proposed solutions to problems regarding the weldability of duplex steels with laser and electron beam. The welding of duplex steels with arc processes has been solved and is currently used in practice. Welding with laser and electron beams, generally presents a problem with attaining a suitable proportion of the structural components austenite/ferrite (around 50/50 %) and results in poor corrosion resistance. The balance of phases ferrite-austenite is important primarily from the aspect of corrosion, which is the main of priority of duplex steels.

Project title Development of a lead-free solder for the application at higher temperatures and research of material solderability of metallic and ceramic materials.
Coordinator Assoc. Prof. Ing. Roman Koleňák, PhD.
Start Date 01/01/2011
End Date 31/12/2013
Program VEGA
Annotation The project is aimed at the development of a lead-free solder for the application at higher temperatures. The developed solder is designed for environmentally friendly soldering of metallic and ceramic materials. The developed solder will be used for solderability tests of ceramic and metallic materials with the application of flux and without flux through the use of ultrasound power. The structural character of the solder under diverse soldering conditions will be studied, including the interactions on the soldered metal - solder boundary. The qualitative solderability criteria of wettability, spreadability, capillarity, diffusion and erosion at normal and extreme soldering conditions will be determined. The shear strength of joints fabricated with the developed solder in metallic and ceramic materials will also be determined. The ageing tests and thermal cycling tests of soldered joints will be also performed.

Projects 2012 – Institute of Production systems and Applied Mechanics

Project title Analysis of qualitative parameters of a machined surface in the 5-axis ultrasonic machining
Coordinator Assoc.Prof. Ing. František Pecháček, PhD.
Date from 01/01/2012
Date to 31/12/2014
Programme VEGA
Annotation The project is a base research focused on the machining of selected hard-to-machine materials by milling. The emphasis is on monitoring the desired and achieved quality parameters of machined surfaces of hard-to-machine materials by the technology of milling and ultrasonic assisted milling. The solution is focused on the typical quality parameters of machined surfaces: surface roughness represented by the mean arithmetic deviation Ra, height of roughness Rz, dimensional precision of machined surfaces, type and size of residual stresses, the size of the components of cutting forces, technological parameters of milling technology, type and shape of tool etc. When analyzing the results obtained by machining, i.e. milling and ultrasonic assisted milling of selected hard-to-machine materials, findings will be compared were the

values of quality parameters achieved under the same technological conditions.

Project title Analysis of non-equilibrium thermal, metallurgical and stress-strain processes in production technologies involving rapid cooling and solidification of metallic materials.

Coordinator Assoc. Prof. RNDr. Mária Behúlová, CSc.

Date from 01.01.2011

Date to 31.12.2014

Programme VEGA

Annotation Rapid cooling and solidification of materials in non-equilibrium conditions is used in several advanced technologies of production and the processing of metallic materials. The research in the framework of the submitted project will be focused on experimental investigation, numerical simulation and analysis of non-equilibrium thermal, metallurgical and stress-strain processes in technologies of preparation of rapidly solidified powders using inert gas atomisation of melt, material forming in semi-solid state and also the laser welding and surface heat treatment. The main aim of the project is the identification of common characteristics, phenomena and non-equilibrium processes leading to the development of refined microstructures in the conditions of rapid cooling and solidification of materials. In the theoretical field, the project should contribute to the explanation of physical and metallurgical reasons and mechanisms of metastable structures development in the high-alloyed materials on the base of iron and aluminum.

Project title Application of innovative layers and coatings for reconstruction of tribologically loaded surfaces.

Coordinator Ing. Eva Labašová, PhD.

Date from 01.01.2011

Date to 31.12.2013

Programme VEGA

Annotation The operation of technical systems results for interacting elements to the surface changes of elements. These changes are caused by the surface wearing and in many cases, the degradation of a tribological surface is caused as the consequence of unstable operational processes. Geometric changes of tribological surfaces (TS) generate improper transfers of power effects, causing further degradation of the TS element. Which often leads to element damage. Early diagnostics of incorrect functionality of TS and its subsequent reconstruction by innovative layers leads to regeneration of the correct tribological functionality of surface, prolongation of element life -time and renewal of the correct operational state of the technical system. The objective of the project is to analyse tribological layers properties in terms of material and geometrical parameters. Using numerical analysis will examine the stress-strain states of loaded TS with innovative layers. The results of computational analysis, wear and life will be verified experimentally.

Project title Intelligent assembly cell

Coordinator prof. Ing. Karol Velíšek, CSc.

Date from 01/01/2009

Date to 31.12.2012

Programme VEGA

Annotation The flexible and intelligent assembly cell conception includes new types of solutions to create structures of the assembly system. A none external industrial robot is used for the manipulation and also for assembly. Intelligent behaviour of the system will repose on the monitoring of important parameters of the system and also will monitor information about system interaction with its surroundings. Surround interaction information provide many advantages such as, the cell will bring flexible reactions of the system to the manufacturing changes, build up area saving, lower building costs and higher usage effects of the whole device.

Project Title Numerical, symbolic and experimental analysis of nonconservative mechanical systems

Coordinator Ing. Tibor Nánási, CSc.

Date from 01.01.2011

Date to 31.12.2013

Programme VEGA

Annotation Undesired vibration and excessive noise is persistently accompanying even the operation of the most advanced technological systems. The proposed project focuses on the development of analytical, numerical and experimental methods of analysis of complex mechanical systems with non-conservative couplings. Such an approach may be found in contradiction with common practice when the non-conservative problems are using artificial assumptions, transformed to a form which can be approached by conservative methods. The project involves also design and building of equipment for the measurement of damping as a function of frequency and temperature as well as equipment allowing for the non-conservative loading of the structure under consideration.

Project Title Research into the possibilities of "intelligence" implementation in the assembly process.

Coordinator Assoc. Prof. Ing. Peter Košťál, PhD.

Date from 01/01/2012

Date to 31.12.2014

Program VEGA

Annotation The intelligent assembly paradigm includes a new approach to assembly system structure design. For the manipulation and assembly the industrial robot is used and equipped with the industrial vision system. Intelligent behaviours are based on the monitoring of important parameters of the system and its environment and the flexible reaction to changes. Tealisation and utilisation of this design paradigm as an "intelligent assembly system" enables the flexible system to react to the production requirements as soon as environmental changes. Results of these flexible reactions are a smaller layout space through decreasing the production and investment costs and by increasing productivity.

Projects 2012 - Institute of Applied Informatics, Automation and Mathematics

Name of the project	Research into the monitoring and assessing the non-standard states in the vicinity of a nuclear power plant
ITMS of project	26220220159
Duration of project	04/2012- 09/2014
Workplace	Institute of Applied Informatics, Automation and Mathematics + Qintec, s.r.o. Trnava
Operational programme	OPVaV - 2011/2.2/07-SORO

Annotation

The project aim is to support research and development in the field of ICT. It will support the economic growth via technological improvement of the system of monitoring and assessing/evaluating of non-standard states in the vicinity of a nuclear power plant. The intention is that the results will markedly influence the environment. The project also supports co-operation between enterprises and universities and sustainable development in three fields: economic (increasing innovativeness, competitiveness and added value of research into small and medium-sized companies; social (life quality, safety and health protection); environmental (power security and environmental protection).

Name of the project	Implementation of the internal system of quality assurance in education
ITMS of project	26110230042
Duration of project	01/2012 - 12/2013
Operational programme	OPV - 2010/1.2/02-SORO

Annotation

The aim of the project is to design and verify the system of objective quality assessment and effective and purposeful education in order to achieve continual adaptation of tertiary education institutions to current and future needs of knowledge society. It will enable the introduction of the system of direct quality measurement of tertiary education, while improving the outputs and approximating the educational system to the society needs. The project objectives are:

- to design and verify the system of objective quality assessment of education in the Bachelor's study programmes in STU MTF;
- to design and verify the measures aimed at eliminating the information disproportion in the bachelor study programmes in STU MTF;
- to design and verify the measures for increasing the education quality in the Bachelor's study programmes in STU MTF;
- to design and verify the evaluation of measures in the Bachelor's study programmes in STU MTF.

Project title	Identification and evaluation of shapes and surfaces of materials scanned by laser confocal microscope
Coordinator	Ing. Tomáš Bezák, PhD.
Start Date	01/01/2012
Programme	KEGA
Annotation	Laser confocal microscopy (LCM) is gradually being applied in many workplaces in Slovakia despite its undisputed financial costliness. Scientific disciplines of biology seem to be the core area where the application of LCM is growing at a particularly high speed, while LCM with an episcopic illumination system typical for metallurgical applications systems is limited. Currently, there are two devices in Slovakia and they may still be considered as unique. When compared to conventional light microscopy, the advantage of laser confocal microscopy is in markedly increased depth of sharpness, reaching a value up to 10 mm at the magnification of 100-times. However, this benefit is achieved with a substantial time-consumption of scanning and subsequent need for the robust image-processing software tools. Complexity, robustness and effort for universality of commercial tools results in difficulties with satisfying specific application requirements.
Project title	Model of teaching Mathematics by using new technologies
Coordinator	Assoc.Prof. RNDr. Mária Mišútová, PhD.
Start Date	10/06/2011
Programme	KEGA
Annotation	The project deals with the teaching of Mathematics using new technologies in the full-time and part-time study forms in technical universities. In the first stage of the project, designed was the proposal of a teaching model with the use of open sourced mathematical software with the application of the methods supporting creative thinking. In the second stage, multimedia programs as well as e-materials for students will be developed. In the final stage, didactic effectivity will be verified by means of pedagogical experiment. The final stage will be the implementation of the model into teaching.
Project title	Elaboration of interactive multimedia textbook "Mechatronics" for secondary vocational schools
Coordinator	Assoc.Prof. Ing. Pavol Božek, CSc.
Start Date	01/01/2012
Programme	KEGA
Annotation	Various multimedia techniques allow for better, more intensive and efficient perception of information (texts, drawings, pictures, speech, music, animations and videos) in specific subjects. Students are not able to remember the enormous amount of information in the current teaching/learning practice. It is therefore crucial to be able to organise the information, grasp the aim and fundamentals of the subject studied. Multimedia and hypertext are the right tools for supporting the work with information in the related study material, it is easy to search and focus on it. The project is centred on the preparation and elaboration of a new educational application for engineering secondary schools in the Slovak Republic with the aim of increasing quality of teaching within the subject of "Mechatronics".
Project title	The data mining usage in manufacturing systems control
Coordinator	Assoc.Prof. Ing. Pavel Važan, PhD.
Start Date	01/01/2011
End Date	31/12/2013
Programme	VEGA
Annotation	The project is focused on the use of data mining techniques for gaining knowledge of manufacturing systems. The knowledge will be used in the management of these systems. The simulation models of manufacturing systems will be developed in order to obtain the necessary data about controlled production systems. Various control

strategies will be implemented in these simulation models. The researchers will develop a way of storing the data obtained from the simulation models in the data warehouse (it will include thousands of records) and create a data mining model using specific methods and selected techniques for specific problems of production system management. The collected knowledge about production management system and designed parameters of a particular management strategy will be tested on a simulation model of the production system. Proposal of the data-mining methodology for storing operation data of the production process will be an important benefit of the project.

Projects 2012 - Institute of Industrial Engineering, Management and Quality

Project Title	Rationalisation and improvement of the “Industrial Management” study programme with the aim to support career consultancy
Coordinator	Assoc.Prof. Ing. Jana Šujanová, CSc.
Start Date	01/01/2012
End Date	31/12/2013
Programme	ESF
Annotation	<p>The project is aimed at improving the Industrial Management study programme by using ICT and other modern methods of education in terms of career consultancy. Based on the “Principles of education quality management in STU Bratislava” as well as the practice requirements for graduates of the Industrial Management study programme, the project will introduce the changes with the aim to:</p> <ul style="list-style-type: none"> - improve the graduates’ employability in the labour market, - train graduates for the development and implementation of innovations of work procedures, products and services, - enable the checking of the study achievements, - respond to the requirement regarding the implementation of the European Qualifications Framework, - provide prerequisites for the continual monitoring of the study achievements and thus enabling flexible innovation of the study programme contents and methods.
Project Title	Identification of key parameters of sustainable performance of industrial companies under the conditions of a multicultural environment
Coordinator	Assoc.Prof. Ing. Miloš Čambál, CSc.
Start Date	01/01/2012
End Date	31/12/2014
Programme	VEGA
Annotation	<p>This project investigates the approaches to organisation performance management in terms of performance sustainability. The emphasis is on “sustainability”, since currently used models of performance management have a detrimental impact on the decisive groups of employees (long-time over-loading, burn-out syndrome, health troubles of various character), decreased their performance and thus also</p>

performance of the whole organisation and its competitiveness. The project is aimed at solving the subject under the specific conditions of multicultural organisations (with orientation on industrial companies), requiring the approaches different from those applied in monocultural organisations.

Project Title Concept of the HCS model 3E vs. concept of the Corporate Social Responsibility (CSR)
Coordinator Prof. Ing. Peter Sakál, CSc.
Start Date 03/09/2009
End Date 31/08/2012
Programme LPP Programme
Annotation This project is aimed at disseminating the results of research projects No. 019/2001: "Transforming Industry in Slovakia Through Participatory Ergonomic" (financially supported by a joint Slovak-American fund for scientific and technical co-operation) and KEGA project of Ministry of Education of SR No. 3-3111-05. Currently, the research continues in co-operation with CHIRANA PROGRESS, s.r.o. Piešťany in the field of sustainable development and Corporate Social Responsibility (CSR). The aim of the research is to contribute to the implementation of Agenda 21 and Lisbon strategy in individual pillars of sustainable development strategy in terms of research and development activity and teaching process in the workplaces of STU MTF Trnava.

Project Title Information Quality Management in project management of industrial companies in SR
Coordinator Assoc.Prof. Ing. Jana Šujanová, CSc.
Start Date 01/01/2012
End Date 31/12/2014
Programme VEGA
Annotation The project focuses on the results of the projects worked on in the Institute of Industrial Engineering, Management and Quality of STU MTF in Trnava:
- VEGA 1/2578/05: Analysis of current world-wide trends of project management, research of current state of the subject in Slovakia and a proposal of its implementation in the conditions of Slovakia;
- ESF 11230220391: Modular system of distant education in project management with e-learning and information technologies support;
- VEGA 1/0491/09: Maturity inspection of project management processes as a tool of increasing competitiveness of industrial companies. Partial outcome of the above-mentioned projects was the identification of shortcomings in the field of information and information management quality, negatively influencing the projects' impact. The project aim is to design a methodology of information quality management in project management of industrial companies in SR.

Project Title Research into the factors influencing the selection and implementation of the tools of integrated marketing communication with regard to the information security and customer protection
Coordinator Prof. Ing. Jarmila Šalgovičová, CSc.
Start Date 01/01/2012
End date 31/12/2014
Programme VEGA
Annotation The project is aimed at investigating and evaluating the factors influencing selection and subsequent implementation of the tools of integrated marketing communication in the conditions of various types of organisations. The application of tools should represent an optimum model corresponding with various aspects of information security management in compliance with the EU rules on one hand, and security and safety requirements on the other hand. Project output will be a proposal of the

methodology procedure of practical application of evaluation, verification, selection and following implementation of the integrated marketing communication tools in various types of organisations via utilising optimum software with the aim to improve the level of integrated marketing communication in the organisations oriented on customer, product quality and information security.

Project Title	Implementation of the subject " Corporate Social Responsibility Entrepreneurship" into the study programme Industrial Management in the second degree at MTF STU Trnava
Coordinator	prof. Ing. Peter Sakál, CSc.
Start Date	01.01.2012
End Date	31.12.2014
Programme	KEGA
Annotation	The content of the project concerns the implementation of the subject " Corporate Social Responsibility Entrepreneurship" into the study programme Industrial Management in context of the strategy of corporate social sustainable development of the EU. Firstly accepted in Gothenburg in 2001 and consequently revised in 2006 and 2009. The strategies include, Europe 2020 for Employment and Growth, Enterprise 2020, key findings from the council meeting on 19th November, 2010 about education for sustainable development (2010/C 327/05), and also from the Organisation of United Nations (OSN) summit from 20th-22nd September, 2010 regarding the millenium development aims and the present accepted norms. The project also considers ISO 26000 relating to corporate social responsible entrepreneurship

Project title	Utilisation of laboratory methods for the quantification and flammability of wood, wooden composites and plastering materials
Coordinator	Danica Kačíková (Zvolen)
Start Date	01/1/2012
End Date	31/12/2014
Programme	VEGA
Annotation	The research focuses on the quantification of flammability by determining fire, technical and safety characteristics of selected types of wood, wooden composites and plastering materials. The selection of materials will correspond with the materials of products used for internal equipment of buildings. Selection of the determined characteristics will correspond with the key properties important for evaluation of their influence on the origin and development of fires. Results of standardised methods will be compared with the results of laboratory methods. A new method will be designed for the exact evaluation of a cigarette test of plastering materials. The equipment will be constructed for evaluating flammability by using emanating heat source. Determined will be the dangerous components of products of thermodegradation and burning in relation to the physical and chemical properties of materials. Assessed will be the formation of dangerous explosive concentrations during thermodegradation of materials. The complex fire-protection of selected materials will be evaluated.

Title of the project: **Hybrid power supply for technical consultancy laboratory for the use and promotion of renewable sources and energy**

Type of the project: OPVaV

Number of the project: ITMS 26220220056

Main Investigator: Assoc. Prof. Ing. Bohunil Taraba, PhD.

Time period of the project: 2009-2012

Annotation of the project: Prototype of a hybrid source-based RES construction (hydro-potential, solar, biogas and bioethanol) for the long term testing and promotion. Through the proposed interventions the prestige of research will be increased, which will also lead to increased interest in the search for talent and higher employment in this field. The benefits will be new creative ideas and flexible responses to the needs of small enterprises and their closer cooperation. The resulting effect will be more competitive research teams within national research, greater interest from small and medium enterprises to conduct research focused on innovation in public research institutions, universities and other research centres. Slovak research teams will also compete at the international level, bringing the Slovak research development greater cooperation with the international environment and higher success of Slovak applicants in the 7th Framework Program of EU and other EU initiatives.