Questionnaire
Summary of the main activities of a research institute of the Slovak Academy of Sciences

Period: January 1, 2012 - December 31, 2015

1. Basic information on the institute:

1.1. Legal name and address

Institute of Informatics of Slovak Academy of Sciences (II SAS)
Dúbravská cesta 9
845 07 Bratislava
Slovak Republic

1.2. URL of the institute web site

http://www.ui.sav.sk

1.3. Executive body of the institute and its composition

Directoriat	Name	Age	Years in the position
Director	Ing. Ivana Budinská, PhD.	51	2015 -
Deputy director	Doc. Ing. Ladislav Hluchý, CSc.	63	2015 -
Scientific secretary	Mgr. Róbert Sabo, PhD.	34	2015 -

Changes during the assessment period:

Director:	Doc. Ing. Ladislav Hluchý, CSc.	– until 04/2015
Nominee director:	Ing. Ivana Budinská, PhD.	– 04/2015 – 06/2015
Deputy Director:	Ing. Ivana Budinská, PhD.	– until 04/2015
Scientific secretary:	Ing. Ladislav Matay, CSc.	– 02/2012 – 02/2015
	RNDr. Ján Glasa, PhD.	– until 02/2012

1.4. Head of the Scientific Board

RNDr. Ján Glasa, CSc.	02/2014 -
Doc. RNDr. Michal Laclavík, PhD.	03/2013 – 01/2014
Ing. Pavol Hrkút, CSc.	04/2011 – 02/2013

1.5. Basic information on the research personnel

1.5.1. Number of employees with university degrees (PhD students included) engaged in research projects, their full time equivalent work capacity (FTE) in 2012, 2013, 2014, 2015, and average number of employees in the assessment period

	2012		2013		2014		2015		total		
	number	FTE	number	FTE	number	FTE	number	FTE	number	averaged number per year	averaged FTE
Number of employees with university degrees	66,0	58,650	64,0	56,760	60,0	53,810	62,0	54,070	**252,0**	**63,0**	**55,823**
Number of PhD students	4,0	3,660	5,0	4,330	5,0	3,000	5,0	4,660	**19,0**	**4,8**	**3,913**
Total number	70,0	62,310	69,0	61,090	65,0	56,810	67,0	58,730	**271,0**	**67,8**	**59,735**

1.5.2. Institute units/departments and their FTE employees with university degrees engaged in research and development

Research staff	2012		2013		2014		2015		average	
	No.	FTE	No.	FTE	No.	FTE	No.	FTE	No.	FTE
Organisation in whole	66,0	58,650	64,0	56,760	60,0	53,810	62,0	54,070	**63,0**	**55,823**
1.1 Parallel and distributed computing	25,0	21,150	24,0	20,900	24,0	20,150	22,0	20,380	**23,8**	**20,645**
1.2 Design and diagnostics of digital systems	7,0	5,900	7,0	5,360	5,0	4,360	5,0	4,500	**6,0**	**5,030**
1.3 Numerical methods and algorithms	5,0	4,300	5,0	4,200	4,0	4,000	5,0	3,300	**4,8**	**3,950**
1.4 Speech analysis and synthesis	7,0	6,000	7,0	6,500	7,0	6,500	8,0	6,640	**7,3**	**6,410**
1.5 Electron beam lithography	13,0	11,400	12,0	10,800	11,0	9,800	12,0	9,350	**12,0**	**10,338**
1.6 Discrete processes modelling and control	5,0	5,900	5,0	5,000	5,0	5,000	6,0	5,900	**5,3**	**5,450**
1.7 Sensor systems	4,0	4,000	4,0	4,000	4,0	4,000	4,0	4,000	**4,0**	**4,000**

1.6. Basic information on the funding of the institute

Institutional salary budget and others salary budget

Salary budget	2012	2013	2014	2015	average
Institutional Salary budget *[thousands of EUR]*	859,000	859,000	848,000	861,000	**856,750**
Other Salary budget *[thousands of EUR]*	574,000	585,000	502,000	534,000	**548,750**

1.7. Mission Statement of the Institute as presented in the Foundation Charter

The basic mission and scope of activities of the Institute cover basic and oriented research in the following fields of science (Foundation Charter valid since July 1, 2008):

- Informatics, information and communication technologies.
- Electrical engineering, automation and control systems.

The scientific and research activity of the Institute is focused into the following basic directions:

- applied informatics, cybernetics, microelectronics
- parallel and distributed information processing, knowledge technologies
- design of information system components, microelectronic structures and nano-structures and their technological realisation, design and testability of digital systems
- numerical mathematics and scientific and technical calculations, mathematical modelling and computer simulation of complex natural phenomena
- processing and coding of digital signals in multimedia systems
- reaserch of speech communication, automatic processing of speech, processing of natural language and computer linguistics
- modelling, simulation and control of discrete and hybrid systems
- animation and control of mechatronic systems and sensor systems.

The aim of the research is in new scientific knowledge in the fields of science covering the Institute's scope of activities, in design and implementation of models, methods, algorithms, simulations, program tools, effective program systems, architectures, diagnostics and testing, as well as in research of parameters and behaviour of micro-electronic structures and methods of developing them.

The Institute performs scientific education within generally valid legal regulations.

The Institute´s activities include development and realisation of information system components, including micro/nano-electronic structures and development of laboratory and experimental equipment for research applications.

The Institute ensures publicity of the scientific and research work results through periodical and non-periodical publications. Publication of periodicals and non-periodicals is subject to SAS Presidium resolutions.

1.8. Summary of R&D activity pursued by the institute during the assessment period in both national and international contexts, (recommended 5 pages, max. 10 pages)

II SAS has a rich international cooperation within the European research area focused mainly on, but not limited to, service-oriented distributed computing, knowledge-oriented technologies and spoken language processing technology for a long period of EC 5^{th}-7^{th} Framework Programmes and HORIZON 2020. The Institute has successfully completed a number of projects within the framework programmes during the period 2008-2011: 4 projects of FP7, 5 projects of FP6. The Institute successfully continued to gain fundings for the projects within FP7 and HORIZON 2020. For the years 2012-2015 a total number of project solutions is as follows: 1 project of H2020, 3 projects of FP7 and 1 project of EDA (European Defence Agency).

R&D activities in the field of ***parallel and distributed computing, software engineering and complex applications***

The Institute has had a long term participation in building European grids and cloud infrastructures since 2004. In the period of 2012-2015 the Institute has participated in the project **EGI-InSPIRE** - Integrated Sustainable Pan-European Infrastructure for Researchers in Europe, FP7-261323 [RI call 7 - FP7-Infrastructures-2010-2]. The project aims at delivery of a sustainable high-quality infrastructure for the European Research Area (ERA) along with support services necessary for its exploitation by the European research and scientific community: the provision of high capability computing and/or high throughput computing capacity; networking and grid architectures and middleware, as well as other ways of interconnecting computing platforms; software for performing the computation; data management and curation methods for handling vast masses of data. II SAS has participated in infrastructure operational support ("first line support", providing grid services for national grid initiative NGI_SK, support for users for multicore parallel applications MPI and OpenMP), in adapting a task management system (DIANE) for user applications as workflows, in establishing a blueprint for federating institutional private clouds, in operating a reliable federated institutional IaaS Cloud service, and in distributed competence center for nano-applications. During this project valuable application focused papers were also published. The continuation of the project EGI-InSPIRE is an **EGI-Engage** EU H2020 project: **Engaging the Research Community**

towards an Open Science Commons, H2020-654142. The EGI-Engage project (Engaging the Research Community towards an Open Science Commons) started in March 2015, co-funded by the European Commission for 30 months, as a collaborative effort involving more than 70 institutions in over 30 countries. It aims to accelerate the implementation of the Open Science Commons by expanding the capabilities of a European backbone of federated services for compute, storage, data, communication, knowledge and expertise, complementing community-specific capabilities. In the project, II SAS is implementing the support of accelerated computing in EGI Federated cloud at all levels. At the site level, II SAS creates cloud sites supporting accelerated computing, provides configuration manuals for installation and configuration for different cloud frameworks. At EGI federation level, II SAS is developing extension of OGF GLUE standard for publishing information related to accelerated computing as well as extension of accounting records for accelerators.
National project **SIVVP (Slovak infrastructure for high performance computing)** created a computing infrastructure for Slovak research with one supercomputer "Aurel", more SMP computers and computing clusters. II SAS is providing one computing cluster with the power of 28.5 TFlops (8.8 TFlops by 776 Intel cores and 19.7 TFlops by 40'832 CUDA cores) and 144TB disk storage, which is connected to the EGI infrastructure (grid and cloud) and II SAS supports the participation of other SIVVP clusters to the EGI grid.

R&D activities in the field of ***knowledge and semantics technologies***

II SAS took part in the project **VENIS - Virtual Enterprises by Networked Interoperability Services, FP7-284984**, where R&D focused on Lightweight Interoperability assessment, Virtual Common Repository, Distributed Data Sharing, Recommendation Engine, prototypes and demonstration. Researchers published valuable publications within dissemination and exploitation activity, publications were highly evaluated by the Panel of reviewers. Enterprise interoperability is the emerging need in Europe for joint projects and business facing new marketing challenges.
A Lightweight Semantics concept was introduces by II SAS.

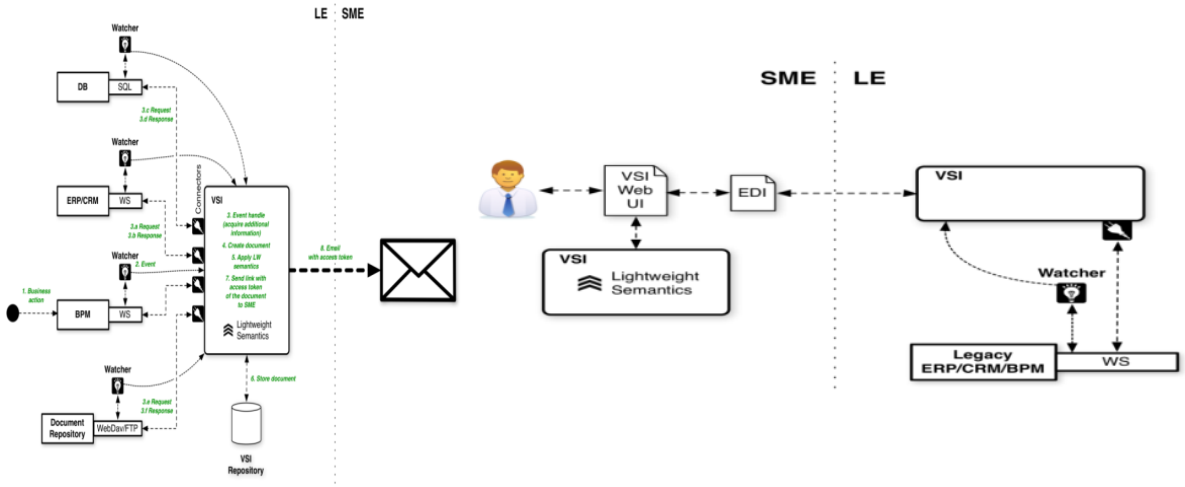

Fig.1 VENIS – II SAS solution for interoperability Large enterprise (LE) to Small and medium enterprise (SME) and vice versa.

Another project was **SECRICOM - Secure Communication for Crisis Management, FP7-218123**. Main R&D task for II SAS was the Secure Agent Infrastructure (SAI) with focus on theoretical background of SAI and privacy of data and security of information processed by agents using advance protection mechanisms including a trusted code execution in a Secure Docking Module and a Secure Attested Software Base. Main aim of the project was to create Seamless Communication for Crisis Management for EU safety. SECRICOM was awarded as the best project within the FP7 Programme Secure societies. Continuation of the project SECRICOM is the project **REDIRNET - Emergency Responder Data Interoperability Network, FP7-607768**. A main task of the Institute in the project was to implement and adapt a Secure Agent Infrastructure (SAI). We introduced a novel concept of Polls to manage information in the REDIRNET SAI architecture. The Poll is a process of smartly collecting and aggregating information using a pre-prepared configuration setup from a specific group of users, devices or services subscribed to various communication channels. Project REDIRNET provides a decentralized framework for interoperability for first responders' systems based on a public meta-data gateway controlled by the agencies themselves via REDIRNET socio-professional web. Publications within SECRICOM and REDIRNET projects were highly evaluated by international Panel of reviewers.

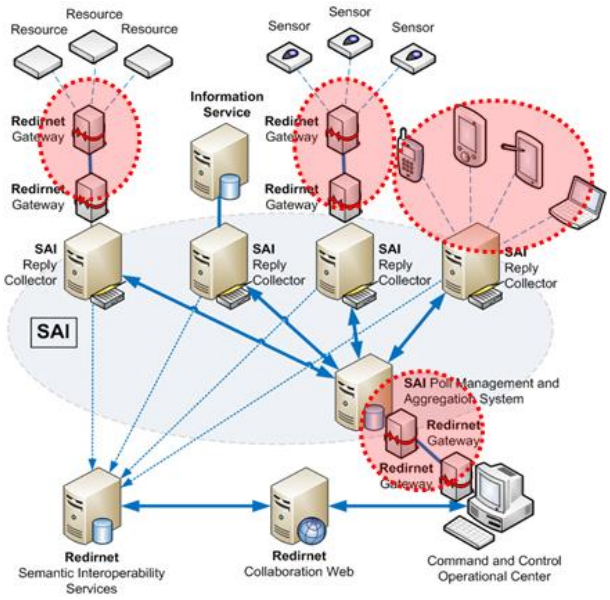

Fig.2 Redirnet- a basic architecture (The II SAS contribution is marked by red circles)

In the project **EUSAS** - **European Urban Simulation for Asymmetric Scenarios (2010-2012) A-0938-RT-GC** (EDA) the Institute embarked on the latest trends in agent-based modeling and simulation. The project dealt with asymmetric security threats in urban environment and aimed at improving and combining mission analysis capabilities with virtual training of security forces in a highly realistic 3-D cyber environment. The Institute took care of the intermediation infrastructure underlying the system, designed and implemented the project's core component -- Agent-Based Simulator (ABS) -- and participated in the design and implementation of the interfaces between ABS and other system components (Virtual Training and Data Farming). We also designed and implemented the Agent Definition, Scenario Definition and two Data Analysis tools. The resulting EUSAS system was accepted by the European Defense Agency as meeting the contractual requirements. Its overall technology readiness level was estimated at TRL 4-5 (technology validated/demonstrated in relevant environment). Our main achievement was the creation of a generic and modular agent architecture representing the simulated people. These agent models included various motivations, behavior patterns (forms of aggression and retreat to safety, etc.), and of perception and behavior moderators (e.g. fatigue). This architecture was implemented in a JAVA-based open-source simulation framework MASON. Based on these results our Institute has been invited to join project consortia for new project proposals in various EU FP7 and H2020 project calls.

Fig.3 EUSAS – simulation environment for training of professionals

II SAS has had also successful story during period 2012-2015 within domestic projects. In the project **CLAN - Cloud Computing for Big Data Analytics (2012-2015), APVV-0809-11,** addresses a set of fundamental research challenges posed by the concepts of the cloud computing and the big data analytics and their symbiosis. Project **Riot (Virtual and constructive modeling, training and simulation of crowd behavior in urban environment, 2011-2014, APVV)** developed an open, modular and universal multiagent

platform for simulations of human behavior and group dynamics. It is a generalization of the Agent-Based Simulator (ABS) in a JAVA-based open-source simulation framework MASON, which enables the creation of new models as well as the adaptation of existing models from scientific literature. Another important achievement of the Institute was the development of a new method of data analysis - causal partitioning through which emergent phenomena in complex systems can be studied. Causal partitioning is based on the theory of nonlinear structural causality and adapts its principles for use in models with real-valued variables.
In the project **TRA-DICE – Cognitive traveling in digital space of the Web and digital libraries supported by personalized services and social networks, APVV-0208-10** coordinated by FIIT STU, the research was performed in the area of large-scale data processing with a focus on text and web (unstructured) processing. In addition to standard methods of gathering and indexing textual content, II SAS has developed a simple (lightweight) semantic extraction tool of the text (named entity extraction) based on simple semantic trees and graphs. The project was rated as an excellent project.
II SAS also participated in solving of various projects under the Operational Program of Research and Development supported by Structural Funds.
The project - **Centre of Research of Risks of Water Distribution in a Large City** coordinated by Bratislava Water Management Enterprise, aimed to perform an excellent research in the field of water distribution in large urban areas – the pilot site was Bratislava, Slovakia. The research dealt with issues of information management, customer data processing, simulation of hydraulic parameters of the distribution network, data transfers to and from the SCADA system controlling the active components of the network, and other issues, which could create critical situations and lead to water distribution failures. II SAS was active in information and knowledge management where we have analyzed the data structure of current information system used by BVS, a.s. and created tools for export of data into other systems. The project - **Competence Center for SMART Technologies for Electronics and Informatics Systems and Services** aimed at strengthening the cooperation between academia and industry in Slovakia, and creation of a Competence Center for the research of intelligent technologies and industrial research in sensors, robotics and electronic services. II SAS was engaged in the cooperation mainly with MicroStep-MIS, ltd. and has created a series of electronic services (web services, data processing systems, knowledge management tools, knowledge extraction tools) used (also) for processing of environmental data. In the project **RECLER (2010-2012, ITMS=26240220029**), Industrial research in the area of effective technology for large scale data for user applications, the research focused on the interaction between humans and computers (HCI - Human Computer Interaction) with aim to achieve a responsive PC real-time multimodal user input and multimodal access to stored data. Another objective was to design of concept solutions for the efficient access to data for selected types of storage, presented in the form of models, algorithms, charts, methodologies, etc. The project also analyzed the existing situation and methodologies in the design of applications within the European Union.
Specifically important for the Institute is the project **CRISIS** – ERDF project (2011-2013, ITMS=26240220060) **Research and development of new information technologies for forecasting and solving crisis situations and for the security of population**. More than 45 researchers from all scientific departments of the Institute cooperate on this project. The project goals were to enhance security of population by advanced IT solutions. Specific results of different groups are described in other parts of this document.
We have solved also domestic scientific projects within VEGA Agency. The project **New methods and approaches on information processing and knowledge bases, VEGA 2/0185/13** was aimed on the research and development of innovative methods for analyzing and processing of structured data (LinkedData, transaction data, events, interactions) and unstructured data (text, web, documents, communications), for the purpose of knowledge base creation, which will enable modeling, management, searching and visualization of information and real world entities as well as user interaction with such data and knowledge base search. The project **Selected methods, approaches and tools for distributed computing (2012-2015), VEGA 2/0054/12** aimed at distributed processing of information, which so far represents an important part of European Research Area. Research and development were focused on the research of methods, approaches and algorithms for distributed information and data mining in multidimensional data, on innovative architectures and approaches for coordinated information gathering from heterogeneous sources and management of distributed resources using agents, on new methods and methodologies for management of distributed data and metadata in state-of-the-art of service-oriented environments and on research of parallel and distributed computing, with the emphasis on porting applications to the Cloud environment, as well as solving interoperability between different Clouds.
The dynamic development of IT has been enormous, which is why research must reflect this reality. II SAS may declare that in the years 2012-2015 IT industry was interesting in the research results, which can be to some extent the valuation of II SAS results. The detailed information on cooperation with industry is in Chapter 2.6.3.

R&D activities in the field of ***speech analysis and synthesis*** have been focused on

Speech synthesis. In the area of speech synthesis we focused on creating expressive speech databases, improving existing algorithms as well as designing new methods for the development of

expressive speech synthesizers. Highly natural voices with high intelligibility were created based on Statistical-parametric synthesis and on Unit selection, as well as their combination. An automatic dramatic piece reader for the blind and visually impaired was developed and presented at international conferences.
In the area of expressive synthesis (project CRISIS) we aimed at the development of speech synthesizer with variable emotional arousal level. This newly developed expressive-speech synthesizer is capable of generating warning messages with various levels of insistence and urgency.
The results were presented at the invited lecture “Milan Rusko: Expressive Speech Synthesis for Critical Situations”, at Columbia University NY, USA (for Spoken Language Processing Group of the Computer Science Department).
The research and development in speech synthesis was done mainly on the Slovak language, but we also developed a bi-lingual expressive speech synthesizer in Slovak and Serviko Romani (language of the Slovak Roma minority) languages.

Speech recognition. In the frame of the **RPKOM** project (ERDF project (2011-2014, ITMS=26240220064) **Research of technology for business processes control in heterogenous distributed systems in real time and with support of multi-modal communication)** experimental tools were developed and tests were carried out of speech recognition in noisy and reverberant environments to analyze possible deployment of Automated Speech Recognition (ASR) in trucks and other challenging acoustical settings.
According to the bi-lateral contract, our new dictation system specialized for the legal domain was finished (2012) and gradually handed over to judges and other employees of the Ministry of Justice of the Slovak Republic to use in their daily practice. 2200 licenses were activated until the end of 2015.
A specialized version of the dictation software and a voice interface to the information system of the General Attorney’s Office (GAO) was designed in the frame of the “Electronic services of the General Attorney’s Office” project in 2014-2015. 900 licences were purchased by the customer (GAO).

Speaker identification. Voice identification of pilots and air traffic controllers was one part of the FP7 project GAMMA - Global ATM Security Management. The idea was to introduce a new add-on security feature - speaker verification - in the Air Traffic Management (ATM). The research and development of the speaker verification methodology and algorithms was done, the speaker verification module was designed, and in the following step (2016) it will be integrated in the ATM simulation in the GAMMA Prototype to undergo validation and testing.

Stress detection from speech. The influence of stress on the voice of speakers was studied. Statistical analysis of various acoustic features of speech under stress was carried out. Existing approaches in stress recognition methodology were studied and new procedures were designed and tested. Experiments were made with various representative acoustic features and several architectures of stress detector. A first version of the stress detection module was created to be used for on-line monitoring the VoIP communication channel between pseudo-pilots and air-traffic controllers checking in the GAMMA prototype.

Speech databases development. A novel method for creation of the database of speech under acted stress was proposed. The database was recorded and used in the experiments with training and testing statistical models for the detection of stress in speech.

Basic research in phonetics. Cross-linguistic study of prosodic cues in English, Spanish, and Slovak was done. (In co-operation with Columbia University NY and the University of Buenos Aires).
Articulation analysis of Slovak phonemes and syllables, comparison of intonation in Slovak to that in Hungarian was carried out. (In co-operation with the Hungarian Academy of Sciences and the University of Helsinki).
Analysis of the formation of speech (intonation and articulation characteristics) under the so-called "Lombard speech" (cooperation with Columbia University New York, USA, measurements were realized on the Articulograph of Munich University, DE).
The relationship between pragmatics and prosody in dialogues (with the University of Buenos Aires and the University of Munich).

Fig.4 Analysis of the formation of speech - measurements were realized on the Articulograph of Munich University, DE

R&D activities in the field of ***numerical mathematics and scientific calculations, and mathematical modelling and computer simulation of complex nature phenomena***

The research has been focused on **mathematical modelling and computer simulation of fires: mathematical foundations of fire models, their implementation, applicability of advanced fire simulators for fires in selected environments and verification and validation of simulations by fire experiments**. Objectives of the research are very topical and in accordance with the world research trend (to apply knowledge and innovative approaches of ICT (Information and Communication Technologies) in the field of safety, protection of citizens, communities and environment from natural disasters and disasters caused by man). The experimental data obtained during series of full-scale fire experiments with automobiles carried out in Slovakia and the Czech Republic within the APVV-0532-07 project coordinated by II SAS were used to verify computer simulations of tested fire scenarios. The development of fires in automobile engine compartment, passenger compartment and luggage compartment, as well as of a single car fire in open air and spread of the fire to adjacent vehicles, and fires in road tunnels and car parks were studied using Fire Dynamics Simulator (FDS). The considered fire scenarios and environments were selected in cooperation with the Presidium of Fire Fighting and Rescuing Corps of the Ministry of Interior of the SR (HaZZ MV SR) and the Fire Fighting Technical and Expertise Institute of the MI SR (PTEÚ). The impact of parallelization on accuracy and efficiency of fire simulation realized on multi-core computers and computer clusters were investigated using high-performance computational infrastructure available at II SAS. People evacuation during a road tunnel fire was simulated by FDS+Evac; new knowledge about proper representation of exits considering limitations of the system was published. Research in the field of forest fire simulation was carried on studying the elliptical forest fire spread model implemented in the FARSITE simulator. The former research brought important scientific results related to development of a new method of the model derivation and original mathematical and physical interpretations of key model's assumptions, which allowed us to generalize the model for several non-elliptical types of local fire spread observed during fire experiments. For homogeneous case, we have been able to demonstrate the model for four types of local fire spread using universal explicit formulae developed. The fire research was conducted within 2 scientific projects funded by VEGA (2010-2013 and 2014-2016, the first one evaluated as a project with excellent scientific results), 1 applied research project CRISIS (2011-2013) funded by ASFEU and the VT project (2011-2012) solved within the FP7 EGEE project. The fire research group submitted numerous research project proposals (1 to VEGA, 6 to APVV and 2 to ASFEU) and was requested to carry out fire simulations by contracts about contract**:** fire in a nuclear power station in SR (1 contract); fire in two road tunnels in SR (3 contracts) and visualization of smoke stratification in a virtual road tunnel tube in the Traffic&Operation Simulator in Zilina (2 contracts) (see Chapter 2.6.3). The team was invited to carry out simulations of fires in several forested areas in Slovakia within the national project of MI SR funded by ERDF EU SF (in review). The outstanding credit of the research group, in the national and international level, can be documented also by numerous publications (14 journals and 12 proceedings) and citations (150 WoS citations); including 2 and 7 papers in periodicals indexed in the CCC and WoS/SCOPUS databases, respectively, invited chapter in scientific monograph entitled "Advances in Modelling of Fluid Dynamics" edited by Prof. Chaoqun Liu (University of Texas at Arlington, USA) and invited series of articles in the "Civil protection: revue for civil protection of population" journal published by MI SR.

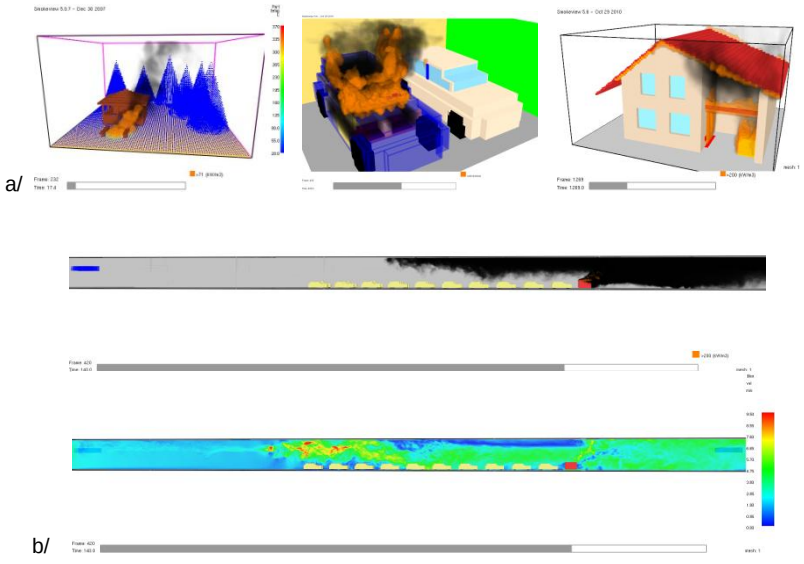

Fig.5 Fire simulations in different environments (a), smoke spreading simulation in tunnels (b)

R&D activities in the field of ***modelling, simulation and control of discrete and hybrid systems***

Timed Petri nets (TPN) and hybrid Petri nets (HPN), more precisely first-order HPN (FOHPN) were used to model, analyse and control discrete-event systems (DES) and hybrid systems (HS) of different kinds consisting of cooperating subsystems (moduls, agents). New methods of supervision were developed and the results were applied in a few case studies, namely the throughput of transport systems (rail and road), flexible manufacturing systems and workflow of the evacuation process from an endangered area. These results were achieved as part of projects "**Cooperation of Discrete-Event and Hybrid Subsystems in Intelligent Control of Complex Systems**"(2013-2016), "**Methods and algorithms of the cooperative interaction of intelligent decentralized control subsystems based on DES**"(2009-2010) granted by VEGA agency and "**Modern Paradigms in the Field of Intelligent Systems**" (2015-2017), "**Agent Oriented Diagnostics of Complex Systems**" (2012-2014) – a bi-lateral project with Bulgarian Academy of Sciences. Results were published in about 20 publications including 13 publications indexed in WOS/SCOPUS.

A new concept in the modelling and control of mobile robots - swarm robotics was studied and researched in projects "**BioMRCS** - **Bioinspired multirobot coordination**" (2011-2014) – APVV/SRDA 0261-10, coordinated by II SAS, and "**Cooperation and coordination of mobile agents**" (2013-2015) - VEGA. The concept is based on decentralized mechanisms that underlie natural systems and communities such as ant colonies, swarms of bees, flocks of birds, etc. Several methods and algorithms based on the principles of swarm robotics and swarm intelligence have been proposed for coordination and cooperation of agents in achieving a global goal. The proposed methods are characterized by several features that significantly affect their possibility of application; the foremost among these are platform independence, flexibility, scalability, adaptivity, robustness, and parallelism. The proposed methods and algorithms have been implemented and tested by computer simulation, with the help of mini-robots using Lego Mindstorm set in our laboratory, and outdoors using quadrocopters. While testing and evaluating the proposed methods and algorithms, we have focused on the efficiency of achieving the global objective in comparison with other methods and on possible solutions in the case of loss of connection among individual agents. The task of area monitoring and space exploration was also researched in these projects. The results were achieved in cooperation with a company VÝVOJ Martin, a.s., as a partner of the project. They suppose to use a group of Unmanned Aerial Vehicles (UAVs) as a tool for increasing the safety of crews of armoured vehicles.
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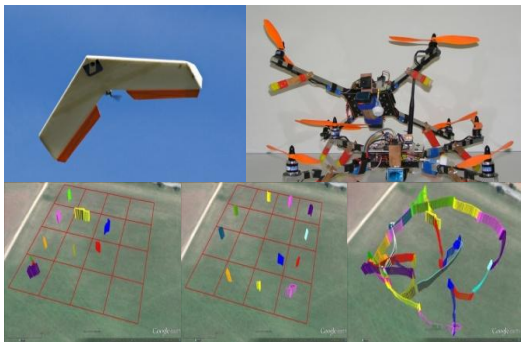

Fig.6 Cooperation of autonomous mobile agents – outdoor testing and results

The project "**Advanced methods and methodologies for integrated intelligent control systems**" (2010-2012, APVV/SRDA) was focussed on research and development of advanced methods and methodologies for intelligent integrated control of production systems and business enterprises. Among the most significant results are the creation of a framework for application of Discrete Events Dynamic Systems for production systems with continuous production (e.g. FPDE plastic foils recycling), design and development of modified artificial intelligence methods (Particle Swarm Optimisation – PSO, Artificial Immune Systems – AIS), and design and development of a multiagent system to support job-shop scheduling in manufacturing systems. The methods were modified in order to accelerate schedule computing and improve the schedule. The methods enable dynamic rescheduling, e.g. when a new order arrives. A modified PSO method was optimised for parallel computing and tested on MATLAB distributed computing server. All methods were tested for a real production line – in a company MAT obaly, s.r.o..

New methods for logistics and business processes were developed in project **RPKOM - ERDF (2011-2014, ITMS=26240220064) Research of technology for business process control in heterogenous distributed systems in real time and with support of multi-modal communication.** The project integrated research from three research groups in the Institute. Discrete systems modelling and control group worked on new intelligent methods for modelling and control of enterprise processes, specifically for logistics processes. The problem of ATM machine management was studied as well.

Results were published in 10 papers in proceedings indexed in WOS/SCOPUS, 1 chapter in a book published by Springer, 2 papers in journal with Impact Factor (IF).

R&D activities in the field of ***mechatronic and visual systems***

Mechatronic Visual System (2010-2012) supported by the national scientific grant agency VEGA. The system has been designed for automatic monitoring and tracking of moving objects. The system consists of several relatively independent subsystems cooperating to achieve a common objective to recognize the existence and the motion of relatively small objects from the background, to report their position, speed and acceleration, to predict the movement and to support tracking of the selected object. The combination of an automatic recognition with an automatic prediction of movement and camera orientation supports the ability of the system to operate autonomously in real time. The system is modular in design to allow for easy adaptation to a number of static and mobile cameras mechanically oriented in space with two degrees of freedom. The open architecture of the system allows for the further development of new problem-oriented applications.

The research activities continued in the years 2012-2013 within the project funded by ERDF: "Research and Development of New Information Technologies for Prediction and Management of Crisis Situations and Population Security" (CRISIS), ITMS 26240110060, 03/01/2011- 31/12/2013 in cooperation with the Slovak Technical University in Bratislava. Within the activity 1.4 'Smart mechatronic systems' **a concept of the distributed static and mobile cameras** has been introduced. The common world model of the recognized objects of interest in the form of **the simplified 3D model of virtual reality** was developed. The cooperation goal of the automatically oriented cameras is to monitor the restricted area and to reveal extraordinary situations. The world model based on the relative and central positions of the recognized objects supports the ability of the system to work autonomously. A company, EVPU, s.r.o. Nová Dubnica, is interested in results of the group.

R&D activities in the field of ***design, analysis and simulation of micro-robotic devices*** have been realized within two projects solutions in cooperation with the Faculty of Electrical Engineering, Department of Measurements.

Project **"(Micro) Electro-mechanisms for robotics and extreme work spaces environments"** (2012-2015) was supported by the national scientific grant agency VEGA. The project elaborates methods and brings solution tools for designing, modeling and simulation of (micro) electro-mechanical devices, mainly sensors of mechanical quantities and actuators for specific applications in robotics, and in extreme working conditions. The solution is based on synergy of mechanical parts–characteristics of flexural elements, electronics for signal processing and transmission, EMG sensing and methods for data processing/ evaluation.

The general goal of the project is the theoretical study and methodical/experimental evaluation of a concept for designing and building electro-mechanical devices, sensors of mechanical quantities and actuators used in harsh environments. The main achieved results are:

- Methods for design and solution for special electro-mechanical devices, sensors of mechanical quantities (force, position) and actuators.
- Modeling and simulation of performance characteristics of (micro) electro-mechanical devices. Analysis of complex small and micro electro-mechanical structures, functional models (compliance, frequency, stiffness, transmissions, etc.) and the Model-Based-Design (MBD) method were worked out in detail. For the purpose of experimentation the specific test bed was elaborated (see Fig.6).
    - Research of robust methods and possibility of wire-less signal transmissions from sensors and to actuator as well as calibration methods and linearization of output characteristics as for instance characteristic given by combination of non-linear characteristics of mechanical and electronic parts. Evaluation of these problems includes processing of knowledge and own – mechatronic approach to analysis, modeling and design.

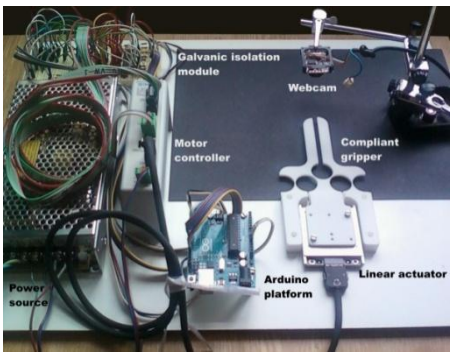

Fig. 7 Laboratory test bed for measurements on compliant mechanisms / devices

Results from this research were published in 19 international conference papers and 3 international journal papers. Investigation concerning new EMG sensors was the subject for PhD thesis defended at STU (2013).

R&D of **advanced micro- and nanotechnological processes using electron-beam lithography**

a/ **Advanced micro- and nanotechnological processes using electron-beam lithography**
R&D in the field of micro- and nano-technological processes has been realised within the following projects:

- The grants **VEGA 2/0021/12** Advanced micro- and nano-technological processes using electron-beam lithography, (2012/2014) and **VEGA 2/0134/15** Development of advanced patterning processes for nanoscale devices, (2015/2017).

These grants were devoted to advanced patterning processes that can extend capabilities of the electron beam lithography into the deep nanoscale regime. New approaches to resist design, exposure strategies, development techniques, and correlation with subsequent dry etching were investigated.

The main results: Estimation of exposure parameters of selected e-beam resists (SML300, CSAR62, HSQ XR 1541, SU-8, AZ 5214E) using variable shaped e-beam pattern generator and their applications as RIE etch-masks in etching of various thin layers. Development of a method for nanostructuring of surfaces of metal oxides for gas sensors.

- The project **APVV SK-GR-047-11** Molecular-friendly processes for fabrication of molecular electronic devices – MOLFAB (2013/2014). The aim of this proposal was the development of a viable production process for molecular logic devices based on self-assembled monolayers and the subsequent characterization of the produced devices.

The main results: A molecular switch was proposed, designed and produced. Technological process was optimised for the production of the gate metal and dielectric electrodes without either a high thermal budget or wet conditions after the application of the molecular layer, i.e. a process that has low risk of damaging the molecular layer.

- The project **APVV SK-BG-0037-10** Robust Lithography of Submicron nad Nano-dimensional Structures – RoNaLit, (2012/2013) and the project **MAD SK-BUL** Study of electron beam resists and patterning of nano-structures by electron beam lithography for gas sensor applications (2015/2017). The goal of these projects was to experiment with and improve the models and computer simulation tools at nanometer dimensions. The final aim was to use the research results for exposures of patterns smaller than 100 nm.

The main results: Experimental investigation and simulation of resist characteristics of negative e-beam resist HSQ XR-1541 and positive e-beam resists PMMA and AR-P 6200/2 for electron energy 20, 30 and 40 keV. Optimisations of lithographic parameters of negative e-beam resist SU-8 for the production of gratings on a large area on Si and GaAs substrates.

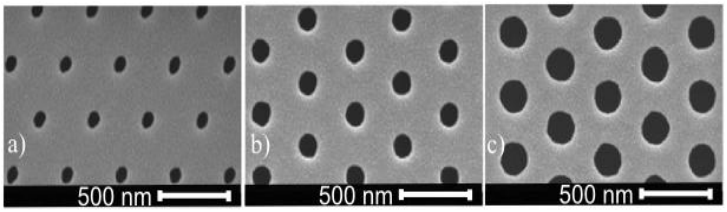

Fig.8 Application: Fotonic structures for integrated optoelectronics

b/ **The application of research results in projects devoted to the R&D of sensors based on technology of micro-electro-mechanical systems (MEMS)**.
Contribution of II SAS in the following projects was concentrated on the development of production processes for the newly designed sensor devices:

- The project APVV SK-FR-2013-0032 Electron Spin PolaRImeTer based on thin ferromagnetic membranes, (2014/2015). The aim of the project was the development of a new type of electron spin polarimeter based on spin-filtering effects in ferromagnetic thin films.

The main results: A series of special membranes Si3N4 on Si substrates were etched using reactive ion etching (RIE) and prepared for the French partner for further investigation and measurements.

- The project APVV-14-0613 Broadband MEMS detector of terahertz radiation, (2015/2018). The project is aimed at research and development of new types of broadband detectors for terahertz frequency range.

The main results in the year 2015: Optimisation of micro-electro-mechanical technological processes for the production of a broadband MEMS detector of terahertz radiation. Production of a set of photomasks for that purpose.

• II SAS was the partner in other project OPVaV-2009/4.2/03-SORO ITMS-26240220037 Resistant sensoric system for extreme environments with high pressures, temperatures and high level of electromagnetic perturbation - EkoWatt, (2011/2013). The aim of the project was to create a sensoric system for extreme environments resistant to high temperatures up to 400ºC, high pressures up to 1000 bar and for environments with electromagnetic perturbation.

The main results: Analysis of a position detector for extreme conditions with high temperature, pressure and surrounding noise. Design and realisation of the module controlled by microcomputer suitable for extreme environments.

R&D activities in the field of ***design and diagnostics of digital systems*** have been aimed at development of new methods of the design of built-in self-repair architectures for SoC digital logic cores and the design of specialized hardware cores for different algorithm effective calculation.

The important research outcomes are:

A new method for identifying functional blocks for built-in self-repair (BISR) that automatically generates BISR architectures for random logic SoC (Systems-on-Chips) cores. It is based on the genetic algorithm, and the generated architectures are guided by the two key BISR characteristics, namely the mean time to failure (MTTF) and the area overhead. The generated BISR architectures are modified in that direction in which the characteristics are improved. The priority between them can be set by an external parameter, which will guide the generation procedure. The proposed method was implemented and evaluated over benchmark circuits, and the experiments confirmed that BISR architectures can be successfully generated for random logic cores at the cost of relatively low area overhead, mostly by 20% – 70%, while the area overhead remained below 150%.

A new effective method that was developed for the generation of compressed skewed-load test for transition delay faults (TDFs) for wrapper-based logic cores of SOCs. The generated test application requires only one storage element per cell in the scan chain and wrapper boundary register (WBR). The added test area is therefore low, which is a prerequisite for use in the self-repair. The test generator based on the developed genetic algorithm generates a vector that detects as many faults as possible (test vectors contain already overlapped test vector pairs) for the given input signal sequence. Consequently, less vectors are necessary (by approximately 25 %) to achieve the same TDF coverage as other methods, and the test application will be shorter. The proposed generator guarantees the highest achievable TDF coverage for the given WBR and the scan cell order. The assembled circuit model for the given fault allows to identify undetectable faults by classifying the problem as unsatisfactory. The method is scalable – it enables to generate test for the biggest available benchmark circuits.

Design of a new generic backup architecture (BISR) and backup methods with minimal area overhead implementable for any logic core whose development is guided by four defined basic requirements. The architecture can include one of four algorithms to handle the fault detection and localization procedure. Each algorithm (parallel, serial, parallel then serial, partitioning) aims to fulfil different goals. Therefore the area overhead, reconfiguration speed and the number of repaired faults may differ. The repair capability is limited only by the number of reconfigurable logic blocks inside the core. The BISR parameters are improved also by the on-line fault detection of the core functional part and a new fault diagnosis and repair procedure proposal (the repair is performed during the off-line mode). The system is thus able to repair more permanent faults at the same time and can recover from transient faults as well. The experimental results showed that the additional area needed is in the range of 100-200 % of the original core area, which is a considerable savings compared to previously published results (250-300%) and well below the additional area of the triple modular redundancy solution; thus increasing the theoretical lifetime of the cores, too.

A generic BISR architecture was experimentally implemented into LEON3 processor environment. The overhead area is less than 90%, and this contributed to the increase of reliability parameters - probability of fault-free operation and MTTF. The implementation also benefited from a processor core usage itself due to software built-in self-testing multiplier (the test algorithm necessarily required in self-repair procedure was also proposed and implemented) that enabled creating a functioning architecture of reconfigurable logic blocks with the minimum area added.

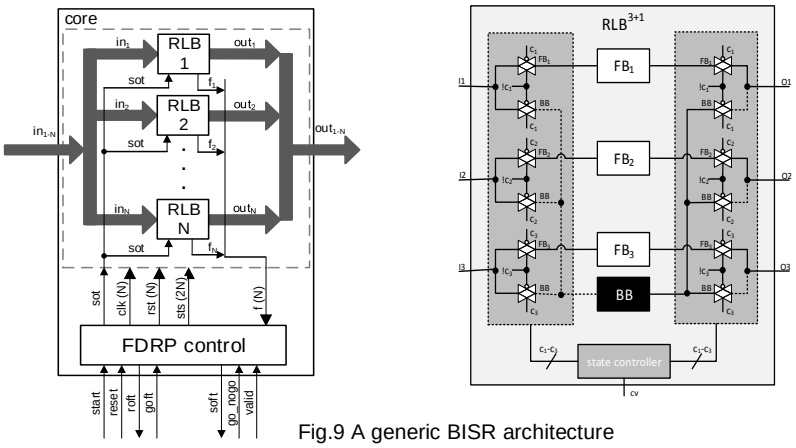

Fig.9 A generic BISR architecture

Design of dedicated hardware IP core for a fast and efficient image pre-processing oriented for the autonomous tracking objects in video recording, which was implemented in FPGA technology (Xilinx SX35 Virtex4). The IP core filters incoming video data, calculates background images and the map of all moving objects in the video stream, renders the output communication of displaying results and controls access to the memory. It is independent of the number of frames and input resolution. The optimized computational algorithm reduces the number of mathematical operations (eliminates multiplications completely), minimizes the total area and reduces energy consumption.

Design of two new hardware architectures for accelerating the floating-point calculation of the division and exponential functions which are intended for computationally demanding applications. The both hardware architectures are oriented to algorithms with a high number of iterations and for processing the large amounts of data from sensors (e.g. in spectroscopy). Computational time reduction in comparison to other solutions is 27 %.

The achieved scientific results were published in 2 CCC journals and 11 papers were accepted in the proceeding of international conferences indexed in WOS database.

R&D activities in the field of ***processing and coding of digital signals in multimedia systems***

The basic research has been focused on the **perfect reconstruction cosine/sine-modulated filter banks: general properties, fast algorithms and integer approximations**. Perfect reconstruction cosine- and sine-modulated filter banks such as the modified discrete cosine and sine transforms (MDCT and MDST), the modulated lapped transform (MLT), and the modulated complex lapped transform (MCLT) have played an important role in the transform/sub-band coding systems and the international audio/speech coding standards. These systems are currently modern information technologies for the high-quality compression and decompression of digital audio/speech signals in consumer electronics. The computation of complete filter banks is the most time-consuming operation in an audio/speech encoder/decoder. Therefore, the existence of fast algorithms with a simple and regular structure is very important for their efficient implementation. The research has been focused on algorithmic problems of the MDCT, MDST (MLT) and MCLT, i.e., the investigation and definition of sparse matrix factorizations of their transform matrices, and design and implementation of fast algorithms. The main goal of the research was to contribute to the knowledge about basic mathematical properties, sparse matrix factorizations of the transform matrices and essentially on the fast computational structures for their efficient implementation, and methods for their integer approximations. During the assessed period 2012-2015, the following main original scientific results were achieved in the framework of the national scientific VEGA projects No. 2/4149/24 (2010-2012), No. 2/0216/10 (2013), and No. 2/0184/14 (2014-2016):

- Based on a new alternative recursive sparse matrix factorization for the MDCT matrix and a relation between the MDCT and the MDST, a new recursive fast radix-2 algorithm for the efficient computation of the MCLT was proposed.
- The Dolby Digital (AC-3) and the Dolby Digital Plus or Enhanced AC-3 (E-AC-3) systems are currently the key enabling technologies for high-quality compression of digital audio signals. Based on the block sparse matrix factorization of a conversion matrix, a new fast conversion algorithm has been derived to convert the frequency coefficients of the long (MDCT) transform to those of short transforms, and vice versa. (see Chapter 2.1.5.).
- A new generalized conversion method of the MDCT to MDST coefficients directly in the frequency domain has been proposed for arbitrary symmetric windowing function. Based on the compact block matrix representation of the MDCT and MDST filter banks, on their properties and on relations among transform sub-matrices, a relation in the matrix-vector form between the MDCT and MDST coefficients in the frequency domain has been derived. Given MDCT coefficients of three consecutive data blocks at a decoder, the MDST coefficients of the current data block can be obtained by combining the MDCT coefficients of the previous, current and next blocks via conversion matrices.

- New fast algorithms for the low-delay MDCT computation in the MPEG-4 AAC-ELD audio coding standard have been proposed. (see Chapter 2.1.5.)
- The complete unified efficient implementations of complex exponential-modulated and real-valued cosine-modulated QMF banks used in the Spectral Band Replication (SBR) technology (standard and low delay) have been proposed. (see Chapter 2.1.5.)

These original scientific results in five papers have been published in the outstanding U. S. and European scientific journals (indexed in the CCC database) such as *IEEE Transactions on Signal Processing, IEEE Signal Processing Letters, Digital Signal Processing and Signal Processing (Elsevier Science)*. Moreover, numerous invitations have been received to review papers in journals such as *IEEE Transactions on Signal Processing, IEEE Signal Processing Letters, IEEE Transactions on Circuits and Systems for Video Technology, IEEE Transactions on Circuits and Systems II: Analog and Digital Signal Processing, IEEE Transactions on Multimedia, IEEE Transactions on Circuits and Systems for Video Technology, IEEE Transactions on Image Processing, IET Signal Processing, IET Circuits, Devices & Systems* and *Signal Processing*.

In March 2013, RNDr. V. Britaňák, DrSc. defended his doctoral dissertation (Doctor of Science - DrSc.) entitled "Fast Computational Structures for the Discrete Sinusoidal Transforms and Perfect Reconstruction Cosine/Sine-modulated Filter Banks" to the Commission in *Computer and Information Sciences (No. 010200).* It is important to note that the referee reports have been written by famous international researchers on these topics, namely, Dr. Henrique S. Malvar (Microsoft Research Corporation, Redmont, WA, USA) and Prof. Markus Pueschel (Swiss Federal Institute of Technology, Zurich, Switzerland).

The long-term collaboration with Prof. K. R. Rao (University of Texas at Arlington, Arlington, TX, USA) led to the preparation of the book entitled "*Cosine and Sine Modulated Filter Banks: General Properties, Fast Algorithms and Integer Aproximations*". Based on the contract No. 28141 with the publisher *Springer Science+Bussiness Media*, New York, USA, the assumed deadline is to be March 31, 2017. Currently, the preparation of the book is in its final stage.

2. Partial indicators of main activities:

2.1. Research output

2.1.1. Principal types of research output of the institute: basic research/applied research, international/regional (ratios in percentage)

Basic research/applied research 50:50 %

International/National 80:20 %

Comments: all our basic research activities are intended for applications in the medium time horizon (5-10 years). Basic research, with no direct outputs for practise, covers 50% of our research activities.

Our research is considered as international, it is not locally constrained and its results have an international impact. We provide research on unstructured text and speech that is intended also for Slovak language. In this term, the research oriented on Slovak language can be considered as national/regional. The other way, how to distinguish between the international and national research is involvement of researchers in the assessment of international cooperation. More than 80% of researchers are involved in various types of international projects and some other kinds of informal international co-operations – members of program committees of international conferences, editorial board of international journals, etc.

2.1.2 List of selected publications documenting the most important results of basic research. The total number of publications listed for the assessment period should not exceed the average number of employees with university degrees engaged in research projects. The principal research outputs (max. 5, including Digital Object Identifier - DOI) should be underlined

Comments: a number of citations listed bellow is restricted to the period 2011-2014. Actual number of citations including 2015 and 2016 can be seen at our website.

AAA Scientific monographs published abroad

AAA01 ŠIMKOVÁ, Mária - GARABÍK, Radovan - GAJDOŠOVÁ, Katarína - LACLAVÍK, Michal - ONDREJOVIČ, Slavomír - JUHÁR, Jozef - GENČI, Ján - FURDÍK, Karol - IVORÍKOVÁ,

Helena - IVANECKÝ, Jozef. *The Slovak language in the digital age* = Slovenský jazyk v digitálnom veku. Ed. G. Rehm, H. Uszkoreit. Berlin ; New York : Springer, 2012. 85 p. White paper series. ISBN 978-3-642-30369-2.
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ABC02 HALADA, Ladislav - WEISENPACHER, Peter - GLASA, Ján. Computer modeling of automobile fires : chapter 9. In *Advances in modeling of fluid dynamics*. - InTech, 2012, p. 203-228. ISBN 978-953-51-0834-4.
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ABC06 MASÁR, Marek - BUDINSKÁ, Ivana. Swarm-based heuristics for an area exploration. In *Advances in Soft Computing, Intelligent Robotics and Control : Topics in Intelligent Engineering and Informatics*. - Budapest : Springer, 2014, vol. 8, part II., p. 219-238. ISBN 978-3-319-05944-0. ISSN 2193-9411.

ABC07 MOJŽIŠ, Ján, info - LACLAVÍK, Michal. Relationship discovery and navigation in big graphs. In *Studies in Computational Intelligence : Extended and Selected Results from the Science and Information Conference 2014*. - Switzerland : Springer International Publishing, 2015, 2015, vol. 591, p. 109-123. ISBN 978-3-319-14653-9. ISSN 1860-949X.

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DOI: 10.1007/s12559-014-9261-4
1 citation

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ADCB Scientific papers in foreign journals registered in Current Contents Connect without IF (non-impacted)

ADCB01 BUDINSKÁ, Ivana - KASANICKÝ, Tomáš - ZELENKA, Ján. Production planning and scheduling by means of artificial immune systems and particle swarm optimisation algorithms. In International Journal of Bio-Inspired Computation, 2012, vol. 4, no. 4, p. 237-248. (2012 - Current Contents). ISSN 1758-0366.
DOI: 10.1504/12.48064
8 citations

ADDA Scientific papers in domestic journals registered in Current Contents Connect with IF (impacted)

ADDA01 BALOGH, Zoltán - GATIAL, Emil - HLUCHÝ, Ladislav - TOEGL, Roland - PIRKER, Martin - HEIN, Daniel M. Agent-based cloud resource management for secure cloud infrastructures. In *Computing and Informatics*, 2014, vol. 33, no. 6, p. 1333-1355. (0.319 - IF2013). (2014 - Current Contents). ISSN 1335-9150.

ADDA02 BARTOK, Juraj - BABIČ, František - BEDNÁR, Peter - PARALIČ, Ján - KOVÁČ, Jozef - BARTOKOVÁ, Ivana - HLUCHÝ, Ladislav - GERA, Martin. Data mining for fog prediction and low clouds detection. In *Computing and informatics*, 2012, vol. 30, no. 6+, p. 1441-1464. (0.239 - IF2011). (2012 - Current Contents). ISSN 1335-9150.
1 citation

ADDA03 BUNDZEL, Marek - KASANICKÝ, Tomáš - PINČÁK, Richard. Experimental analysis of the prediction model based on string invariants. In *Computing and informatics*, 2013, vol. 32, no. 6, p. 1131-1146. (0.254 - IF2012). (2013 - Current Contents, WOS). ISSN 1335-9150.
1 citation

ADDA04 ČAPKOVIČ, František. Timed and hybrid Petri nets at solving problems of computational intelligence. In *Computing and Informatics*, 2015, vol. 34, no. 4, p. 746-778. (0.504 - IF2014). (2015 - Current Contents). ISSN 1335-9150.

ADDA05 DOBAI, Roland - BALÁŽ, Marcel. Compressed skewed-load delay test generation based on evolution and deterministic initialization of populations. In *Computing and*

informatics, 2013, vol. 32, no. 2, p. 251-272. (0.254 - IF2012). (2013 - Current Contents, WOS). ISSN 1335-9150.

2 citations

ADDA06 DOBROVODSKÝ, Karol - ANDRIS, Pavel. Real-time recognition and tracking of moving objects. In *Computing and Informatics*, 2014, vol. 33, no. 6, p. 1213-1236. (0.319 - IF2013). (2014 - Current Contents). ISSN 1335-9150.

ADDA07 KASANICKÝ, Tomáš - ZELENKA, Ján. Optimal pedestrian path planning in evacuation scenario. In *Computing and Informatics*, 2014, vol. 33, no. 6, p. 1269-1287. (0.319 - IF2013). (2014 - Current Contents). ISSN 1335-9150.

ADDA08 KVASSAY, Marcel - HLUCHÝ, Ladislav - DLUGOLINSKÝ, Štefan - SCHNEIDER, Bernhard - BRACKER, H. - TAVČAR, A. - GAMS, M. - CONTAT, Marc - DUTKA, Łukasz - KRÓL, D. - WRZESZCZ, M. - KITOWSKI, Jacek. A novel way of using simulations to support urban security operations. In *Computing and Informatics*, 2015, vol. 34, no. 6, p. 1201-1233. (0.504 - IF2014). (2015 - Current Contents). ISSN 1335-9150.

ADDA09 LACLAVÍK, Michal - DLUGOLINSKÝ, Štefan - CIGLAN, Marek. Discovering relations by entity search in lightweight semantic text graphs. In *Computing and Informatics*, 2014, vol. 33, no. 4, pp. 877-906. (0.319 - IF2013). (2014 - Current Contents). ISSN 1335-9150.

ADDA10 NGUYEN, Binh Minh - TRAN, Dinh Viet - HLUCHÝ, Ladislav. A generic development and deployment framework for cloud computing and distributed applications. In *Computing and informatics*, 2013, vol. 32, no. 3, p. 461-485. (0.254 - IF2012). (2013 - Current Contents, WOS). ISSN 1335-9150.

1 citation

ADDA11 NGUYEN, Giang - ŠIPKOVÁ, Viera - KRAMMER, Peter - HLUCHÝ, Ladislav - DOBRUCKÝ, Miroslav - TRAN, Dinh Viet - HABALA, Ondrej. Integrated system for hydraulic simulations. In *Computing and Informatics*, 2015, vol. 34, no. 5, pp. 1065-1088. (0.504 - IF2014). (2015 - Current Contents). ISSN 1335-9150.

ADDA12 RUSKO, Milan - DARJAA, Sakhia - TRNKA, Marián - SABO, Róbert - RITOMSKÝ, Marian. Expressive speech synthesis for critical situations. In *Computing and Informatics*, 2014, vol. 33, no. 6, p. 1312-1332. (0.319 - IF2013). (2014 - Current Contents). ISSN 1335-9150.

ADDA13 WEISENPACHER, Peter - GLASA, Ján - HALADA, Ladislav - VALÁŠEK, Lukáš - ŠIPKOVÁ, Viera. Parallel computer simulation of fire in road tunnel and people evacuation. In *Computing and Informatics*, 2014, vol. 33, no. 6, p. 1237-1268. (0.319 - IF2013). (2014 - Current Contents). ISSN 1335-9150.

ADMA Scientific papers in foreign impacted journals registered in Web of Sciences or Scopus

ADMA01 KVASSAY, Marcel - HLUCHÝ, Ladislav - KRAMMER, Peter - SCHNEIDER, Bernhard. Causal analysis of the emergent behavior of a hybrid dynamical system. In *Acta polytechnica Hungarica : journal of applied sciences at Budapest Tech Hungary*, 2014, vol. 11, no. 4, p. 21-40. (0.471 - IF2013). ISSN 1785-8860.

ADNA Scientific papers in domestic impacted journals registered in Web of Sciences or Scopus

ADNA01 ANDOK, Róbert - BENČUROVÁ, Anna - HRKÚT, Pavol - KONEČNÍKOVÁ, Anna - MATAY, Ladislav - NEMEC, Pavol - ŠKRINIAROVÁ, J. The AZ 5214E resist in EBDW lithography and its use as a RIE etch-mask in etching thin Ag layers an N2 plasma. In *Journal of Electrical Engineering*, 2013, vol. 64, no. 6, p. 371-375. (0.546 - IF2012). (2013 - WOS, SCOPUS, INSPEC). ISSN 1335-3632.

ADNA02 HRONEC, P. - ŠKRINIAROVÁ, J. - BENČUROVÁ, Anna - NEMEC, Pavol - PUDIŠ, D. - KOVÁČ, Jaroslav. Far field measurements of PhC led prepared by e-beam lithography. In *Journal of Electrical Engineering*, 2014, vol. 65, no. 5, p. 309-312. (0.420 - IF2013). (2014 - INSPEC, WOS, SCOPUS). ISSN 1335-3632.

ADNA03 MIKOLÁŠEK, M. - JAKABOVIČ, J. - ŘEHÁČEK, V. - HARMATHA, L. - ANDOK, Róbert. Capacitance analysis of the structures with the a-Si: H(i)/c-Si(p) heterojunction

for solar-cell applications. In *Journal of Electrical Engineering*, 2014, vol. 65, no. 4, p. 254-258. (0.420 - IF2013). (2014 - INSPEC, WOS, SCOPUS). ISSN 1335-3632.

ADMB22 CIGLAN, Marek - AVERBUCH, Alex - HLUCHÝ, Ladislav. Benchmarking traversal operations over graph databases. In *2012 IEEE 28th International Conference on Data Engineering Workshops : proceedings*. - Los Alamitos : IEEE Computer Society, 2012, p. 186-189. ISBN 978-1-4673-1640-8.
DOI: 10.1109/ICDEW.2012.47
17 citations

AEC Scientific papers in foreign peer-reviewed proceedings, monographs

AEC03 CIGLAN, Marek - LACLAVÍK, Michal - NØRVÅG, K.: On Community Detection in Real-WorldNetworks and the Importance of Degree Assortativity, 19th ACM SIGKDD Conference on Knowledge Discovery and Data Mining, KDD 2013. Eds. Grossman, R.L., Uthurusamy, R., Dhillon, I., Koren, Y. - New York : ACM, 2013, p. 1007-1015. ISBN 978-1-4503-2174-7.

DOI=10.1145/2487575.2487666

Paper Acceptance Rate 125 of 726 submissions, **17.2% acceptance ratio**.

3 citations

ADMB Scientific papers in foreign non-impacted journals registered in Web of Sciences or Scopus

ADMB23 CIGLAN, Marek - NØRVÅG, Kjetil - HLUCHÝ, Ladislav. The SemSets model for ad-hoc semantic list search. In WWW´12 Proceedings of the 21st International Conference on World Wide Web. - New York : ACM, 2012, p. 131-140. ISBN 978-1-4503-1229-5

Paper Acceptance Rate 108 of 885 submissions, **12% acceptance ratio.**
14 citations

2.1.3 List of monographs/books published abroad

AAA01 ŠIMKOVÁ, Mária - GARABÍK, Radovan - GAJDOŠOVÁ, Katarína - LACLAVÍK, Michal - ONDREJOVIČ, Slavomír - JUHÁR, Jozef - GENČI, Ján - FURDÍK, Karol - IVORÍKOVÁ, Helena - IVANECKÝ, Jozef. The Slovak language in the digital age = Slovenský jazyk v digitálnom veku. Ed. G. Rehm, H. Uszkoreit. Berlin ; New York : Springer, 2012. 85 p. White paper series. ISBN 978-3-642-30369-2.

2.1.4. List of monographs/books published in Slovakia

2.1.5. List of other scientific outputs specifically important for the institute, max. 10 items

- **The award of the Minister of Education, Science, Research and Sport** in the category of Scientific and Technical Research Team of the Year 2012. A team of Department of speech analysis and synthesis of the Institute of Informatics, Slovak Academy of Sciences and Department of electronics and multimedia telecommunication, Faculty of electrical engineering and informatics, Technical University in Košice, for a distinquished research of speech technology for Slovak language and for a unique system of automated transcription of dictate with a broad implementation in justice in Slovakia.

- **Spectral band replication (SBR) compression technology: Survey of unified efficient low-cost implementations of complex exponential- and cosine-modulated QMF banks**

Author: RNDr. Vladimír Britaňák, DrSc.

Spectral Band Replication (SBR) is an enhancement compression technology, a bandwidth extension method which significantly improves the compression efficiency of perceptual audio and speech coding schemes. There are two versions of the SBR technology: Standard SBR and low delay SBR (LD-SBR). Central to the operation of standard and LD-SBR are dedicated complex exponential-modulated and real-valued cosine-modulated quadrature mirror filter (QMF) banks as the basic mathematical tools to analyze and synthesize audio signals. The tutorial paper presents the complete unified efficient implementations of complex exponential-modulated and real-valued cosine-modulated QMF banks used both in the standard SBR and LD-SBR encoder and decoder. In general, for each QMF bank is presented: Definition of its equivalent block transform with a common parameter M representing the number of sub-bands, its general symmetry property in the frequency or time domain, and the derivation of a fast algorithm for its efficient implementation. All fast algorithms are analyzed in detail in terms of the arithmetic complexity, regularity and structural simplicity for a potential real-time low-cost implementation in hardware or software.

Publication:

V. Britanak, Spectral band replication (SBR) compression technology: Survey of unified efficient low-cost implementations of complex exponential- and cosine-modulated QMF banks“, Signal Processing, Vol. 115, October 2015, pp. 49-65.

- **Fast conversion algorithm for the Dolby Digital (Plus) audio coding standards**

Author: RNDr. Vladimír Britaňák, DrSc.

The Dolby Digital (AC-3) and the Dolby Digital Plus or Enhanced AC-3 (E-AC-3) systems are currently the key enabling technologies for high-quality compression of digital audio signals. For the time-to-frequency transformation of an audio data block and vice versa, both systems have adopted a long transform being the MDCT. The AC-3 additionally defines two variants of cosine-modulated filter banks called the first and second short transforms. A fast conversion algorithm has been derived to convert the frequency coefficients of the long (MDCT) transform to those of two short transform and vice versa, directly in the frequency domain. It is based on a block sparse matrix factorization of a conversion matrix. The fast conversion algorithm is efficient in terms of the structural simplicity, arithmetic complexity and memory requirements compared to the obvious conversion methods. Moreover, the existing AC-3 fast computational modules may be simply re-used in the conversion procedures. Consequently, the E-AC-3 to AC-3 bit stream conversion and the AC-3 to E-AC-3 bit stream transcoding can be realized in a simplified and efficient way, thus minimizing the amount of partial decoding/encoding and memory requirements during the conversion and transcoding processes.

Publications:

V. Britanak, Fast conversion algorithm for the Dolby Digital (Plus) audio coding standards, *IEEE Signal Processing Letters,* Vol. 19, No. 12 , 2012 (issued in January 2013), pp. 910-913. (1.388 - IF2011), ISSN 1070-9908. and presented on *International Conference on Acoustics, Speech and Signal Processing (ICASSP'2013)*, Vancouver, Canada, May 2013.

V. Britanak, Fast computational structures for the discrete sinusoidal transforms and perfect reconstruction cosine-sine-modulated filter banks, Doctoral dissertation, Bratislava, defended in March 2013.

- **Relationship between phonetic forms and meaning functions of speech**

Author: Doc. Mgr. Štefan Beňuš, Ph.D

This research focuses on two main areas. The first one is the effort at better understanding of the relationship between the phonological (i.e. functional, discrete, meaningful) differences and their phonetic (continuous, measurable) acoustic and articulatory realizations. Specifically, we look at so the phonetic characteristics of called yer and non-yer vowels in Slovak and test the implicit assumption of all phonological

analyses of this phonological contrast is phonetically neutralized; that is, that the yer vowels are not phonetically distinct from the non-yer vowels. In a novel and unique way we analyzed the duration and quality of these vowels as well as their co-articulatory properties using both acoustic and articulatory data. The published results provide a weak support for the hypothesis that yer vowels are phonetically weaker than their non-yer counterpart vowels.

In the second area of research we focus on the form-function relationship in short words with positive polarity such as *mhm*, *okay*, and others. The phonetic form is represented by acoustic and prosodic features. The function relates to their pragmatic meaning in conversations and represents a challenging problem for automatic dialogue systems due to the functional overload of these words as they commonly convey multiple such meanings. In the second paper we describe some of the acoustic-prosodic differences among the words conveying different pragmatic functions based on the analysis of a corpus of conversational dyadic task-oriented conversations in American English. These results are important as they contribute to improvements in both automatic recognizing of meanings based on phonetic features as well as in synthesizing the form of these words that corresponds to a given meaning. Finally, we also assess the predictive power of various methods for automatic clustering of the form-function pairs among these words.

Publications:
BEŇUŠ, Štefan. Phonetic variation in Slovak yer and non-yer vowels. In Journal of Phonetics, 2012, vol. 40, p. 535-549. (1.410 - IF2011). (2012 - Current Contents). ISSN 0095-4470.

GRAVANO, Agustin - HIRSCHBERG, Julia - BEŇUŠ, Štefan. Affirmative cue words in task-oriented dialogue. In Computational Linguistics, 2012, vol. 38, no. 1, p. 1-39. (0.721 - IF2011). (2012 - Current Contents). ISSN 0891-2017.

- **Effects of network assortativity on results of community detection methods on real world networks.**

Author: RNDr. Marek Ciglan, PhD.

Graph clustering, often addressed as the community detection, is a prominent task in the domain of graph data mining with dozens of algorithms proposed in recent years. In the paper we focus on several popular community detection algorithms with low computational complexity and with decent performance on the artificial benchmarks, and we study their behaviour on real-world networks. Motivated by the observation that there is a class of networks for which the community detection methods fail to deliver good community structure, we examine the assortativity coefficient of ground-truth communities and show that assortativity of a community structure can be very different from the assortativity of the original network. We then examine the possibility of exploiting the latter by weighting edges of a network with the aim to improve the community detection outputs for networks with assortative community structure. The evaluation shows that the proposed weighting can significantly improve the results of community detection methods on networks with assortative community structure.

Publication:
CIGLAN, M. - LACLAVÍK, M. - NØRVÅG, K.: On Community Detection in Real-World Networks and the Importance of Degree Assortativity, 19th ACM SIGKDD Conference on Knowledge Discovery and Data Mining, KDD 2013, Eds. Grossman, R.L., Uthurusamy, R., Dhillon, I., Koren, Y. - New York : ACM, 2013, p. 1007-1015. ISBN 978-1-4503-2174-7, DOI=10.1145/2487575.2487666

- **New fast algorithms for the low delay MDCT computation in the MPEG-4 AAC Enhanced Low Delay audio coding standard**

Author: RNDr. Vladimír Britaňák, DrSc.

Recently, the MPEG committee has completed development of a new audio coding standard, the MPEG-4 Advanced Audio Coding - Enhanced Low Delay (AAC-ELD). State-

of-the-art MPEG audio coding standards, such as MPEG-4 AAC Low Complexity (AAC-LC), High Efficiency AAC (HE-AAC) and AAC Low Delay (AAC-LD), utilize for the time-to-frequency transformation of an audio block and vice versa, the well known time domain aliasing cancellation modified discrete cosine transform (TDAC-MDCT). In order to achieve low algorithmic delay, the AAC-ELD has adopted a perfect reconstruction low delay filter bank, called the low delay MDCT (LD-MDCT). New fast algorithms for the LD-MDCT computation in the AAC-ELD have been proposed. Further, a simple relation between the LD-MDCT and TDAC-MDCT has been derived. Exploiting this relation, as an alternative, the improved fast LD-MDCT algorithms based on the TDAC-MDCT have been presented. They do not require reverse operations and sign changes with respect to both the time and frequency indices compared to existing TDAC-MDCT-based fast algorithms. Since the AAC-LC, HE-AAC and AAC-LD audio codecs use the TDAC-MDCT, the new proposed and improved TDAC-MDCT-based fast LD-MDCT algorithms provide the unified efficient implementation of LD-MDCT and TDAC-MDCT filter banks in all four codecs: AAC-ELD, AAC-LD, HE-AAC and AAC-LC.

Publication:

V. Britanak, „New fast algorithms for the low delay MDCT computation in the MPEG-4 AAC Enhanced Low Delay audio coding standard“, Signal Processing, Vol. 105, No. 12, December 2014, pp. 410-418.

- **Entrainment, Dominance and Alliance in Supreme Court Hearings**

Authors: Doc. Mgr. Štefan Beňuš, PhD

This work addresses the role of entrainment – the propensity of conversational partners to behave like one another – in (1) the production of conversational fillers (CFs) and acoustic intensity; (2) patterns of turn-taking; and (3) Linguistic Style markers and how all of these relate to power relations, conflict, and voting behavior in a corpus of speech produced by justices and lawyers during oral arguments of the U.S. Supreme Court in the 2001 term. We examine several different measures of entrainment in justice–lawyer pairs to see whether or not they are related to justices' favorable or unfavorable votes for the lawyer's side. While two measures (a naive measure of similarity in CF rates and global similarity in CF phonetic realizations for the entire session) show no relationship, a third, which measures local entrainment in CFs in lawyer-justice pairs, does in fact identify a significant positive relationship between entrainment and justice votes. With respect to local entrainment in intensity, we found that lawyers do entrain more to justices than justices to lawyers, although there is no greater entrainment of female lawyers than of male lawyers. When we examine the relationship between entrainment in intensity and judicial voting, we find that, when justices voted for the petitioners, there is significant evidence of entrainment by both petitioners and respondents to justices. Finally, we find that there are lexical cues to divisiveness within the Court itself that can distinguish cases with close verdicts from cases with unanimous verdicts.

Publication:

BEŇUŠ, Štefan - GRAVANO, Agustin - LEVITAN, Rivka - LEVITAN, Sarah Ita - WILLSON, Laura - HIRSCHBERG, Julia. Entrainment, dominance and alliance in supreme court hearings. In Knowledge-Based Systems, 2014, vol. 71, p. 3-14. (3.058 - IF2013). (2014 - Current Contents). ISBN 0950-7051.

- **Compressed skewed-load transition delay test generation**

Authors: Ing. Marcel Baláž,PhD., Prom. Fyz. Mária Fischerová, Ing. Jana Bečková, Ing. Peter Malík,PhD., Ing. Andrej Kincel, RNDr.Michal Mojžiš

To generate compressed skew-load tests for time delayed failures (TDFs), two new effective methods - SKEWSAT and SKEWGEN have been developed for the logical cores with the wrapper test boundary in systems-on-chips (SoCs). The generated test can be applied to the logic cores comprising only one memory element in the outer edge cell of the wrapper boundary register (WBR) and in the inner scan chain. The added test area is therefore low. The proposed test generator SKEWSAT represents a powerful new

approach based on the Boolean satisfiability method (SAT), because the test is generated gradually bit by bit without having a pre-established set of test pairs - initialization vectors and excitation vectors. Test generator SKEWGEN uses a newly developed genetic algorithm which is intended to generate a vector that detects not just one, but always as many failures as possible (test vectors comprise of overlapping vector pairs), resulting in the decreased number of vectors and 25 % shorter test time for achieving the same test coverage.

Publications:

DOBAI, Roland - BALÁŽ, Marcel. SAT-based generation of compressed skewed-load tests for transition delay faults. In Microprocessors and Microsystems, 2013, vol. 37, p. 196-205. ISSN 0141-9331.

DOBAI, Roland - BALÁŽ, Marcel. Compressed skewed-load delay test generation based on evolution and deterministic initialization of populations. In Computing and Informatics, 2013, vol. 32, no. 2, p. 251-272. (0.254 - IF2012). ISSN 1335-9150.

- **Control and Coordination System of Heterogeneous Robotic Swarm Supported by Biologically Inspired Method**

Authors: Ing. Ján Zelenka,PhD., Ing.Tomáš Kasanický

This scientific result presents a new approach to control and coordination of the heterogeneous robotic swarm communicating solely via the environment through the artificial pheromone trail (volatile substances). Proposed algorithms are inspired by the process from the observed behavior of social insects. The main idea was to develop a robust coordination method to ensure achieving the desired objective in case of the failure of individual members of the swarm. The proposed method is fault-tolerant and achieving the global objective is not threatened if the swarm is reduced to one individual. “Emergent” behavior of the swarm is ensured by simple rules for individuals in the swarm. Proposed approach is robust, flexible a scalable. Methods were tested by simulations and on real robotic platforms. Simulation results of the rules for the reduction of conflicts, which arising between robots and the intensity of the pheromone trial in specific narrow spaces were presented in the following publications:

ZELENKA, Ján - KASANICKÝ, Tomáš. Control and coordination system supported by biologically inspired method for 3D space "proof of concept". In The 24th international conference on robotics in Alpe-Adria-Danuberegion : RAAD 2015. - Bucharest, Romania, 2015, proceedings, 8 p. ISBN 978-973-720-568-1. WOS, SCOPUS

ZELENKA, Ján - KASANICKÝ, Tomáš. Control and CoordinationSystemSupported by BiologicallyInspiredMethodfor 3D Space "Performanceimprovements". In INES 2015 : 19th IEEE InternationalConference on IntelligentEngineeringSystems. - Bratislava : Slovak UniversityofTechnology in Bratislava, 2015, p. 265-269. ISBN 978-1-4673-7938-0. SCOPUS

- **Reliability increase of digital computational cores**

Authors: Ing. Marcel Baláž, Prom. Fyz. Mária Fischerová, Ing. Jana Bečková, Ing. Peter Malík,PhD., Ing. Andrej Kincel,PhD., RNDr. Michal Mojžiš

The research goal was to contribute to the increased reliability and life expectancy of digital cores used in SoCs. The research was focused on standard cores (processors, control and other computational cores), and also on the special computational-intensive cores for which there is currently no method to increase reliability. In the first area, we focused on the parameters' improvements of our proposed reliability increased architecture. We have introduced the on-line testing principle for the main functional area of the core [1]. We proposed a new procedure to control test and self-repair procedures which are executed in the event of failure detection [2]. The new system is able to repair multiple detected failures and it can recover from transient faults. The added area of the resulting architecture is significantly smaller compared to the TMR on-chip solution. In the second area, we have designed two new hardware architectures to accelerate the

floating-point calculation of division [3] and exponential function [4] which are oriented for computationally demanding applications. Computational time reduction in comparison to other solutions is 27 %. The both hardware architecture are oriented for algorithms with a high number of iterations and for processing the large amounts of data from sensors (e.g. in spectroscopy). The increased reliability of these architectures will provide the designed self-repairing architectures.

Selected publications:

[1] DOBAI, Roland - BALÁŽ, Marcel. SAT-based generation of compressed skewed-load tests for transition delay faults. In Microprocessors and Microsystems, 2013, vol. 37, p. 196-205. ISSN 0141-9331.

[2] DOBAI, Roland - BALÁŽ, Marcel. Compressed skewed-load delay test generation based on evolution and deterministic initialization of populations. In Computing and and informatics, 2013, vol. 32, no. 2, p. 251-272. (0.254 - IF2012). ISSN 1335-9150.

[3] MALÍK, Peter. High throughput floating-point dividers implemented in FPGA. In 2015 IEEE 18th DDECS 2015. – Belgrade, Serbia: IEEE CPS, 2015, proceedings, p. 291-294. ISBN 978-1-4799-6780-3.

[4] MALÍK, Peter. High Throughput floating point exponential function implemented in FPGA. In 2015 IEEE ISVLSI. - Montpellier, France: IEEE CPS, 2015, proceedings, p. 97-100. ISBN 978-1-4799-8718-4.

2.1.6. List of patents, patent applications, and other intellectual property rights registered abroad, incl. revenues

2.1.7. List of patents, patent applications, and other intellectual property rights registered in Slovakia, incl. revenues

2.1.8. Table of research outputs (as in annual reports).

Papers from international collaborations in large-scale scientific projects (Dwarf team, ALICE Collaboration, ATLAS collaboration, CD Collaboration, H1 Collaboration, HADES Collaboration, and STAR Collaboration) have to be listed separately.

Scientific publications	2012			2013			2014			2015			total			
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	averaged number per year	av. No. / FTE	av. No. / salary budget
Scientific monographs and monographic studies in journals and proceedings published abroad *(AAA, ABA)*	1,0	0,016	0,001	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	**1,0**	**0,3**	**0,004**	**0,000**
Scientific monographs and monographic studies in journals and proceedings published in Slovakia *(AAB, ABB)*	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	**0,0**	**0,0**	**0,000**	**0,000**
Chapters in scientific monographs published abroad *(ABC)*	4,0	0,064	0,005	2,0	0,033	0,002	1,0	0,018	0,001	2,0	0,034	0,002	**9,0**	**2,3**	**0,038**	**0,003**
Chapters in scientific monographs published in Slovakia *(ABD)*	0,0	0,000	0,000	0,0	0,000	0,000	1,0	0,018	0,001	0,0	0,000	0,000	**1,0**	**0,3**	**0,004**	**0,000**
Scientific papers published in journals registered in Current Contents Connect *(ADCA, ADCB, ADDA, ADDB)*	9,0	0,144	0,010	7,0	0,115	0,008	12,0	0,211	0,014	7,0	0,119	0,008	**35,0**	**8,8**	**0,146**	**0,010**
Scientific papers published in journals registered in Web of Science Core Collection and SCOPUS *(ADMA, ADMB, ADNA, ADNB)*	33,0	0,530	0,038	39,0	0,638	0,045	55,0	0,968	0,065	40,0	0,681	0,046	**167,0**	**41,8**	**0,699**	**0,049**
Scientific papers published in other foreign journals (not listed above) *(ADEA, ADEB)*	9,0	0,144	0,010	2,0	0,033	0,002	5,0	0,088	0,006	2,0	0,034	0,002	**18,0**	**4,5**	**0,075**	**0,005**
Scientific papers published in other domestic journals (not listed above) *(ADFA, ADFB)*	2,0	0,032	0,002	8,0	0,131	0,009	1,0	0,018	0,001	1,0	0,017	0,001	**12,0**	**3,0**	**0,050**	**0,004**
Scientific papers published in foreign peer-reviewed proceedings *(AEC, AECA)*	15,0	0,241	0,017	9,0	0,147	0,010	4,0	0,070	0,005	0,0	0,000	0,000	**28,0**	**7,0**	**0,117**	**0,008**
Scientific papers published in domestic peer-reviewed proceedings *(AED, AEDA)*	0,0	0,000	0,000	9,0	0,147	0,010	6,0	0,106	0,007	3,0	0,051	0,003	**18,0**	**4,5**	**0,075**	**0,005**
Published papers (full text) from foreign and international scientific conferences *(AFA, AFC, AFBA, AFDA)*	13,0	0,209	0,015	6,0	0,098	0,007	6,0	0,106	0,007	7,0	0,119	0,008	**32,0**	**8,0**	**0,134**	**0,009**
Published papers (full text) from domestic scientific conferences *(AFB, AFD, AFBB, AFDB)*	12,0	0,193	0,014	7,0	0,115	0,008	7,0	0,123	0,008	5,0	0,085	0,006	**31,0**	**7,8**	**0,130**	**0,009**

- **Supplementary information and/or comments on the scientific outputs of the institute.**

The Institute's researchers present latest research results during significant conferences under the auspices of significant international organisations (IEEE, IFAC, IFIP, etc.), and their contributions are published in proceedings, in book series (LNCS, LNAI) by renowned publishing houses (Springer Verlag, Elsevier, etc.). With respect to rapid changes in the trends of contemporary informatics, the usage is to publish results in peer-reviewed conferences sooner than in journals, where theoretical aspects of informatics are emphasized. Several examples of such fields can be given, such as cluster computing, grid computing, peta-computing, ambient and pervasive information processing and cloud computing, where enormous effort is recently given to research and results, are published primarily during conferences.

Among Chapters in scientific monographs published abroud there are 2 publications edited by Spriger, which is listed in the „SENSE RANKING OF ACADEMIC PUBLISHERS“ in a group B -Refereed book publications published by the world's semi-top of publishers.

Among the scientific results the significant importance is given to technical reports and deliverables. Some of the most important deliverables, where II SAS was the leader or considerable contributor, are as follows:

- Fire and Smoke Simulation virtual team project report", 2012, leader, https://documents.egi.eu/document/1341, projekt EGI-InSPIRE
- "SPEEch on the griD (SPEED) virtual team project report", 2013, leader, https://documents.egi.eu/document/1777, projekt EGI-InSPIRE
- "Periodic Report - PY5", 2014, contributor, https://documents.egi.eu/document/2406, projekt EGI-InSPIRE
- D4.4.2: Intermediation Infrastructure and Tools, Industrial Confidential, leader, project EUSAS
- D4.5.2: Data Analysis Tools, Industrial Confidential, co-leader, project EUSAS
- D5.5: EUSAS V2 integration and demonstration, Industrial Confidential, contributor, project EUSAS
- D8.1 Secure cross-network integration test with follow up report, contributor, unpublished, project SECRICOM
- D7.4 Report from testing 2, contributor, unpublished, project SECRICOM
- 10.1 Final demonstration report, contributor, unpublished,p SECRICOM
- D1.4 Final Report, contributor, unpublished, project SECRICOM
- D1.1 Project quality handbook (periodic), contributor, http://www.redirnet.eu/deliverables/D1%201_ProjectQualityHandbook%20final_update.pdf
- D3.2 The Interface Control Document, contributor, project REDIRNET
  http://www.redirnet.eu/deliverables/ReDIRNET_D3.2_InterfaceControlDocument_v1.0_final.pdf
- D3.3 The system architecture document, contributor, unpublished, project REDIRNET
- D3.5 The Interface Control Document v2, contributor, unpublished, project REDIRNET
- D3.6 The system architecture document v2, contributor, unpublished, project REDIRNET
- D4.1 REDIRNET technology framework accessible via Internet, contributor, unpublished
- D4.2 Semantic interoperability services prototype, agent infrastructure and C&C component extensions, contributor, Project REDIRNET http://www.redirnet.eu/deliverables/D4%202%20Semantic%20interoperability%20services%20prototype%20updated_v2.pdf

- D4.3 The open source gateway software prototype and implementation handbook, contributor, project REDIRNET http://www.redirnet.eu/deliverables/D4.3_The%20open%20source%20gateway%20software%20prototype%20and%20implementation%20handbook%20-%20updated%20final.pdf
- D5.1 End-user system integration status report, contributor, unpublished, project REDIRNET
- D6.1 REDIRNET proof of concept test report, contributor, http://www.redirnet.eu/deliverables/D6.1_REDIRNET_proof_of_concept_test_report.pdf

2.2. Responses to the research outputs (citations, etc.)

2.2.1. Table with citations per annum.

Citations of papers from international collaborations in large-scale scientific projects (Dwarf team, ALICE Collaboration, ATLAS collaboration, CD Collaboration, H1 Collaboration, HADES Collaboration, and STAR Collaboration) have to be listed separately.

Citations, reviews	2011		2012		2013		2014		total		
	number	No. / FTE	number	No. / FTE	number	No. / FTE	number	No. / FTE	number	averaged number per year	av. No. / FTE
Citations in Web of Science Core Collection (1.1, 2.1)	150,0	2,407	191,0	3,127	204,0	3,591	255,0	4,342	**800,0**	**200,0**	**3,348**
Citations in SCOPUS (1.2, 2.2) if not listed above	89,0	1,428	73,0	1,195	87,0	1,531	101,0	1,720	**350,0**	**87,5**	**1,465**
Citations in other citation indexes and databases (not listed above) (3.2,4.2,9,10)	146,0	2,343	147,0	2,406	173,0	3,045	148,0	2,520	**614,0**	**153,5**	**2,570**
Other citations (not listed above) (3, 4, 3.1, 4.1)	13,0	0,209	10,0	0,164	10,0	0,176	12,0	0,204	**45,0**	**11,3**	**0,188**
Reviews (5,6)	1,0	0,016	0,0	0,000	1,0	0,018	0,0	0,000	**2,0**	**0,5**	**0,008**

2.2.2. List of 10 most-cited publications, with number of citations, in the assessment period (2011 – 2014).

ABC BRITAŇÁK, Vladimír - YIP, Patrick C. - RAO, K.R. Discrete cosine and sine transforms : general properties, fast algorithms and integer approximations. 1st ed. San Diego, USA : Academic Press, 2007. xiv, 349 s. ISBN 978-0-12-373624-6.

Citations: 124 including 62 WOS, 30SCOPUS

ADCA MOCZO, Peter - KRISTEK, Jozef - VAVRYČUK, Václav - ARCHULETA, Ralph J. - HALADA, Ladislav. 3D heterogeneous staggered-grid finite-difference modeling of seismic motion with volume harmonic and arithmetic averaging of elastic moduli and densities. In Bulletin of the Seismological Society of Amerika, 2002, vol. 92, no. 8, s. 3042-3066. ISSN 0037-1106.

Citations: 88 including 60 WOS, 7 SCOPUS

ADCA MOCZO, Peter - KRISTEK, Jozef - HALADA, Ladislav. 3D fourth-order staggered-grid finite-difference schemes: Stability and grid dispersion. In Bulletin of the Seismological Society of America, 2000, vol. 90, no. 3, p. 587-603. (2000 - Current Contents).

Citations: 57 including 45 WOS, 2 SCOPUS

ADCA SCHWIEGELSHOHN, Uwe - BADIA, Rosa M. - BUBAK, Marian - DANELUTTO, Marco - DUSTDAR, Schahram - GAGLIARDI, Fabrizio - GEIGER, Alfred - HLUCHÝ, Ladislav - KRANZLMÜLLER, Dieter - LAURE, Erwin - PRIOL, Thierry - REINEFELD, Alexander - RESCH, Michael - REUTER, Andreas - RIENHOFF, Otto - RÜTER, Thomas - SLOOT, Peter M. A. - TALIA, Domenico - ULLMANN, Klaus - YAHYAPOUR, Ramin. Perspectives on grid computing. In Future Generation Computer Systems : The International Journal of Grid Computing - Theory Methods and Application, 2010, vol. 26, iss. 8, p.1104-1115. (2.229 - IF2009). (2010 - Current Contents). ISSN 0167-739X.

Citations: 62 including 36 WOS, 8 SCOPUS

ADE JANGLOVÁ, Danica. Neural networks in mobile robot motion. In International Journal of Advanced Robotic Systems, vol.1, No.1, s. 15-22, 2004. ISSN 1729-8806.

Citations: 47 including 17 WOS, 7 SCOPUS

ADD LACLAVÍK, Michal - BALOGH, Zoltán - BABÍK, Marian - HLUCHÝ, Ladislav. AgentOWL: Semantic knowledge model and agent architecture. In Computing and Informatics. - Bratislava : Institute of Informatics, Slovak Academy of Sciences, 2006, vol. 25, no. 5, p. 419-439. ISSN 1335-9150.

Citations: 40 including 7 WOS, 16 SCOPUS

ADCA BEŇUŠ, Štefan - GRAVANO, Agustin - HIRSCHBERG, Julia. Pragmatic aspects of temporal accommodation in turn-taking. In Journal of Pragmatics, 2011, vol. 43, p. 3001-3027. (0.856 - IF2010). (2011 - Current Contents). ISSN 0378-2166.

Citations: 24 including 10 WOS, 8 SCOPUS

AEC FORGÁČ, Radoslav - MOKRIŠ, Igor. Feature generation improving by optimized PCNN. In SAMI 2008 : 6th International Symposium on Applied Machine

Intelligence and Informatics. Editor I. Rudas, P. Sinčák. - IEEE Communications Society, 2008, p. 203-207. ISBN 978-1-4244-2106-0.

Citations: 14 including 10 WOS, 3 SCOPUS

AEC DARJAA, Sakhia - CERŇAK, Miloš - TRNKA, Marián - RUSKO, Milan - SABO, Róbert. Effective triphone mapping for acoustic modeling in speech recognition. In INTERSPEECH 2011 : Speech Science and Technology for Real Life. - 2011, p. 1717-1720. ISSN 1990-9772.

Citations: 22 including 6 WOS, 8 SCOPUS

ADDA LACLAVÍK, Michal - DLUGOLINSKÝ, Štefan - ŠELENG, Martin - KVASSAY, Marcel - GATIAL, Emil - BALOGH, Zoltán - HLUCHÝ, Ladislav. Email analysis and information extraction for enterprise benefit. In Computing and informatics, 2011, vol. 30, no. 1, p. 57-87. (0.356 - IF2010). (2011 - Current Contents). ISSN 1335-9150.

Citations: 17 including 8 WOS, 4 SCOPUS

2.2.3. List of most-cited authors from the Institute (at most 10 % of the research employees with university degree engaged in research projects) and their number of citations in the assessment period (2011– 2014).

	WOS	SCOPUS	Other DB	Total	WOS+SCOPUS
Hluchý	162	89	172	**423**	**251**
Halada	127	30	70	**227**	**157**
Britaňák	109	43	57	**209**	**152**
Kostič	118	15	26	**159**	**133**
Beňuš	55	47	88	**190**	**102**
Rusko	41	34	33	**108**	**75**
Balogh	40	33	57	**130**	**73**

- **Supplementary information and/or comments on responses to the scientific output of the institute.**

During assessment period 2011-2014, responses to the scientific output of the Institute have been significantly increased comparing to the period 2006-2010. The total number of citations during 2006-2010 was 820, while in the period 2011-2014 the number of citations only in WOS CC is 800. We have noticed continuously increasing number of citations on our conference papers.

2.3. Research status of the institute in international and national contexts

- **International/European position of the institute**

2.3.1. List of the most important research activities demonstrating the international relevance of the research performed by the institute, incl. major projects (details of projects should be supplied under Indicator 2.4). Max. 10 items.

- Engaging the EGI Community towards an Open Science Commons (EGI-Engage), **Horizon2020** - 654142, 03/2015 - 08/2017 - project
- EGI: Integrated Sustainable Pan-European Infrastructure for Researchers in Europe (EGI-InSPIRE)), **FP7**-261323, 05/2010 - 04/2014 - project
- Virtual Enterprises by Networked Interoperability Services (VENIS), **FP7–**284984, 09/2011 - 02/2014 - project
- Seamless Communication for Crisis Management (SeCriCom), **FP7**-218123, 09/2008-04/2012 - project

  A programm committee of Secure societies H2020 at its meeting on September 30, 2014 in Brussels, evaluated the SeCriCom project as one of 15 **"success stories"** of Security programm FP7 (out of 200 completed projects)
- European Urban Simulation for Asymmetric Scenarios (EUSAS), A-0938-RT-GC, 03/2010- 08/2012, **EDA** (**European Defence Agency**) - project
- Relationship between trust and entrainment in speech, **AFOSR** (**Air Force Office of Scientific Research**), USA, FA9550-15-1-0055, 06/2015-12/2017 - project
- Global ATM security management (GAMMA), **FP7**-SEC-2012-1, 6/2015 - 12/2017 - project
- Emergency Responder Data Interoperability Network (REDIRNET), **FP7** - 607768 03/2014-08/2016 - project
- Within the project "Cross-linguistic study of prosodic cues in English, Spanish, and Slovak" we have collaborated with the Argentinian academy of sciences and a mobility exchange took place as well (Dr. Agustin Gravano visited the Institute of Informatics SAS in SLovakia and Dr. Benus visited CONICET in Argentina). The results of this research are published in the proceedings of Interspeech 2016, a major international conference in the field. – **international cooperation in basic research**
- The long-term collaboration with Prof. K. R. Rao (University of Texas at Arlington, Arlington, TX, USA) led to the preparation of the book entitled "Cosine and Sine Modulated Filter Banks: General Properties, Fast Algorithms and Integer Aproximations". Based on the contract No. 28141 with the publisher Springer Science+Bussiness Media, New York, USA, the assumed deadline is to be March 31, 2017. Currently, the preparation of the book is in its final stage. – **international cooperation in basic research**

2.3.2. List of international conferences (co)organised by the institute.

- LINDI 2012 - The 4th IEEE International Symposium on Logistics and Industrial Informatics, September 5-7, 2012, Smolenice, Slovakia (coorganised)
- SAMI 2012 - IEEE 10th International Symposium on Applied Machine Intelligence and Informatics, January 26-28, 2012, Herl'any, Slovakia (coorganised)
- SAMI 2013 - IEEE 11th International Symposium on Applied Machine Intelligence and Informatics to be held on January 31 - February 2, 2013, Herl'any, Slovakia (coorganised)
- CSIT 2013 - The 15th International Workshop on Computer Science and Information Technologies, Budapest - Bratislava - Vienna, 15.09.-21.09.2013 (coorganised)
- The important scientific event, organized by the Institute, was the **23rd International Conference on Robotics in Alpe-Adria-Danube Region** (RAAD) in Smolenice Castle on September 3-5, 2014 under the IFToMM and IEEE sponsorships. 60 papers and 80 participants from 18 countries were presented at the conference. (Organizator)

  Avialable at http://raad2014.org/

Fig.10 RAAD 2014 conference in Smolenice castle

2.3.3. List of edited proceedings from international scientific conferences.

FAI01 RAAD 2014 : 23rd International Conference on Robotics in Alpe-Adria-Danube Region. Eds. Budinská, I., Cigánek, J., Havlík, Š., Hricko, J., Kozák, Š. Bratislava : Slovak University of Technology in Bratislava, 2014. CD. ISBN 978-1-4799-6798-8.

FAI04 IEEE 11th International Symposium an Applied Machine Intelligence and Informatics : proceedings. Piscataway : IEEE, 2013. ISBN 978-1-4673-5926-9.

2.3.4. List of journals edited/published by the institute:

2.3.4.1. WOS (IF of journals in each year of the assessment period)

COMPUTING AND INFORMATICS, ISSN 1335-9150 (CAI)

IF of the journal has been increasing:

IF 2012: 0.254, IF 2013: 0.319, IF 2014: 0.504, IF 2015: 0.524

The CAI journal is indexed in these databases:

- ISI Current Contents® - Engineering, Computing and Technology
- SciSearch®
- Research Alert®
- CompuMath Citation Index®
- INSPEC
- DBLP - Computer Science Bibliography
- Zentralblatt Math
- VINITI Abstracts Journal
- Elsevier's Bibliographic Databases
- EBSCO
- SCOPUS

2.3.4.2. SCOPUS

2.3.4.3. other databases

2.3.4.4. not included in databases

- **National position of the institute**

2.3.5. List of selected projects of national importance

- TraDiCe - Cognitive traveling in digital space of the Web and digital libraries supported by personalized services and social networks (SRDA - APVV), evaluated by The SRDA committee as a **project with excellent scientific results**). II SAS was investigator
- CRISIS - Research and development of new information technologies for forecasting and solving crisis situations and for the security of population (EU Structural Funds)- special importance for the institute – integration of research activities of all scientific depatments
- Virtual digital design laboratory for high schools - Coordinator (SRDA)
- Virtual and constructive modelling, training and simulaion of crowd behaviour in urban environment - Coordinator (SRDA)
- Bioinspired multirobot coordination - Coordinator (SRDA)
- SIVVP - Slovak infrastructure for high performance computing (EU Structural Funds, Nationwide project) – IISAS is responsible for Grid computing activities
- Mathematical modelling and simulation of fire spread (VEGA, evaluated as a **project with excellent scientific results**)

2.3.6. Projects of the Slovak Research and Development Agency (SRDA - APVV)

- Hybrid Medical Complex Systems
- Seamless Communication for Crisis Management
- Virtual digital design laboratory for high schools
- Robust Lithography of Submicron nad Nano-dimensional Structures
- Advanced piezoelectric PiezoMEMS pressure sensors
- Virtual and constructive modelling, training and simulaion of crowd behaviour in urban environment
- Cognitive traveling in digital space of the Web and digital libraries supported by personalized services and social networks
- Bioinspired multirobot coordination
- Virtual Enterprises by Networked Interoperability Services
- Molecular-friendly processes for fabrication of molecular electronic devices
- MEMS structures based on load cell
- Electron Spin PolaRImeTer based on thin ferromagnetic membranes
- Emergency Responder Data Interoperability Network
- Global ATM security management
- Cloud Computing for Big Data Analytics
- Broadband TARAMEMS detector of terahertz radiation

2.3.7. Projects of the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA)

- Cooperation of Discrete-Event and Hybrid Subsystems at Intelligent Contro of Complex Systems
- Methods and algorithms for the semantic processing of Big Data in distributed computing environment
- Modelling and computer simulation of fires and their consequencies

- New architectures for increasing the reliability of digital cores and systems
- Networked control of heterogenous multi-agent systems.
- Speaker verification as an add-on element of the Air Traffic Management security
- Investigation of structures preparation processes for nanometer scale devices
- Electro-mechnisms for robotics and extremely work spaces
- Automatic meeting speech recognition with application to courtroom recordings transcription.
- Bioinspired multirobot coordination
- Centre of Excelence for New Technologies in Electrical Engineering
- Intelligent methods for large scale information processing
- Cooperation and coordination of mobile agents
- Mathematical modelling and simulation of fire spread
- Mechatronic vision system
- Methods and algorithms of the cooperative interaction of intelligent decentralized control subsystems based on DES
- Advanced methods and methodologies for integrated intelligent control systems
- Modified discrete cosine and sine transforms (MDCT and MDST)
- New methods and approaches on information processing and knowledge bases
- Advanced micro- and nano-technological processes using electron-beam lithography
- Construction and control of micro-electro-mechanical elements and devices
- Built-in self-repair for logic cores embedded in system-on-chip
- Selected methods, approaches and tools for distributed computing

2.3.8. Projects of SAS Centres of Excellence

2.3.9. National projects supported by EU Structural Funds

- Centre of Excelence for New Technologies in Electrical Engineering II (CENTE II)
- Research and development of new information technologies for forecasting and solving crisis situations and for the security of population (CRISIS)
- Technology research for the management of business processes in heterogeneous distributed systems in real time with the support of multimodal communication (RPKOM)
- Slovak infrastructure for high performance computing (SIVVP)
- Center of Excellence for SMART Technologies, Systems and Services II (SMART II)
- Industry research in the area of effective work with large data in user oriented applications (RECLER)
- A resistive microcontroller module for harsh industrial environment with high pressure, temperature and high level of electromagnetic interference (EkoWatt)
- Competence Center for SMART Technologies for Electronics and Informatics Systems and Services (KC-INTELINSYS)
- Centre for the Research of Risks of Water Distribution in a Large City
- Electronic services of General prosecution of the SR

2.3.10. List of journals (published only in the Slovak language) edited/published by the institute:

2.3.10.1. WOS (IF of journals in each year of the assessment period)

2.3.10.2. SCOPUS

2.3.10.3. Other databases

2.3.10.4. Not included in databases

- **Position of individual researchers in an international context**

2.3.11. List of invited/keynote presentations at international conferences, as documented by programme or invitation letter

BEŇUŠ, Š. Aspects of entrainment in spoken interactions. Invited presentation at conference Linguistics Beyond And Within, Lublin, Poland, 14. 11.2013

ČAPKOVIČ, F. Cooperation of Agents in Complex Systems Based on Supervision. A plenary presentation on „International Conference Automatics and Informatics 2013“, October 3-7, 2013, Sofia, Bulgaria. 3. 10. 2013. Abstract in: Proceedings of the International Conference Automatics and Informatics 2013, October 3-7, 2013, Sofia, Bulgaria, ISSN 1313-1850.

HLUCHÝ, L. The place of casual analysis in the analysis of simulation data. In Knowledge and systems engineering : proceedings of the Fifth International Conference KSE 2013. Vol. 2, p. 3. Eds. Huynh, V.-N., Denœux, Th., Tran, D.H., Le, A.C., Pham, S.B. - Switzerland : Springer, 2014. ISBN 978-3-319-02820-0. ISSN 2194-5357.

NGUYEN, T.G. - HLUCHÝ, L. - TÓBIK, J. - ŠIPKOVÁ, V. - DOBRUCKÝ, M. - ASTALOŠ, J. - TRAN, D.V. - ANDOK, R. Unified nanoscale gateway to HPC and Grid environments. In The 5th Symposium on Information and Communication Technology : SOICT 2014. - Hanoi : ACM, 2014, pp. 85-91, doi 10.1145/2676585.2676591. ISBN 978-1-4503-2930-9.

Invited/keynote presentations at research institutes abroad, as documented by programme or invitation letter

ČAPKOVIČ, F. Modelling, analyzing and Petri net-based supervision of complex hybrid systems. Institute of Information and Communication Technologies Bulgarian Academy of Sciences, 11. 9. 2012.

ČAPKOVIČ, F. Multi-agent systems. Silesian University in Opava, School of Business Administration in Karvina, Czech Republic, 21. 3. 2013.

GRAMATOVÁ, E. - FISCHEROVÁ, M. - KRIŠTOFÍK, Š. Testing, Testability and Self-repair of Memories. International Graduate School Tutorial, Brandenburg University of Technology in Cottbus, Technical University of Liberec, 160 slides, 21. 9. 2012.

HLUCHÝ, L. Cluster and grid computing, Research projects at II SAS. Fakulta informatiky a managementu, Univerzita Hradec Králové, Czech Republic 5. 12. 2012.

HLUCHÝ, L. Pan-European grid infrastructure. Faculty of Informatics and Management, University of Hradec Králové, Faculty of Informatics and Management, University of Hradec Králové, Czech Republic, 5. 12. 2012.

KOSTIČ, I. Robust lithography of submicrometer and nanometer structures. Institute of Electronics, Bulgarian Academy of Sciences, Sofia, Bulgaria, 6. 3. 2013.

RUSKO, M. Expressive speech synthesis for ciritical situations. Columbia University in the City of New York. Target group: Spoken Language Processing Group of the Computer Science Department at Columbia Univesity, 17. 7. 2015

2.3.12. List of researchers who served as members of the organising and/or programme committees

Type of commitee	Programme	Organizing	Programme and organizing
Number of memberships	58	11	5

Ing. Baláž Marcel, PhD.

IEEE Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS), Tallinn, Estonia, 2012 (Programme commitee)

Počítačové architektúry & diagnostika – Computer architectures & diagnostics , Mílovy, Czech Republic, 2012 (Programme committee)

IEEE International Symposium DDECS, Warsaw, Poland, 2014 (Programme and organizing commitee)

IEEE International Symposium DDECS, Belgrade, Serbia, 2015 (Programme and organizing committee)

Ing. Ivana Budinská, PhD.

Symposium on Emergent Trends on Artificial Intelligence and Robotics, Košice, Slovakia, 2013 (Programme committee)

Symposium on Emergent Trends on Artificial Intelligence and Robotics, Košice, Slovakia, 2015 (Programme committee)

The 15th International Workshop on Computer Science and information Technologies, Bratislava, Slovakia, 2013 (Programme and organizing committee)

23rd International Conference on Robotics in Alpe-Adria-Danube Region (RAAD 2014), Smolenice, Slovakia, 2014 (Programme committee and Organizing committee)

doc. Ing. František Čapkovič, CSc.

4th Asian Conference on Intelligent Information and Database Systems - ACIIDS 2012, Kaohsiung, Taiwan, 2012 (Programme committee)

4th International Conference on Computational Collective Intelligence - Technologies and Applications, Ho Chi Minh City, Vietnam, 2012 (Programme committee)

6th International KES Conference on Agents and Multi-agent Systems – Technologies and Applications - KES AMSTA 2012, Dubrovnik, Croatia, 2012 (Programme committee)

IEEE Conference on Intelligent Systems - IS'12, Methodology, Models, Applications in Emerging Technologies, Sofia, Bulgaria, 2012 (Programme committee)

Industrial Simulation Conference - ISC 2012. Track: Complex Systems Modelling, Brno, Czech Republic, 2012 (Programme committee)

2nd International Conference on New Paradigms in Electronics and Information Technologies - PEIT'013, Luxor, Egypt, 2013 (Programme committee)

3rd International Conference on Advanced Control Circuits and Systems - ACCS'013, Luxor, Egypt, 2013 (Programme committee)

7th International KES Conference on Agents and Multi-Agent Systems, Technologies and Applications – KES AMSTA 2013, Hue City, Vietnam, 2013 (Programme committee)

Industrial Simulation Conference - ISC 2013, Ghent University, Ghent, Belgium, 2013 (Programme committee)

International Conference on Computational Collective Intelligence, Technologies and Applications 2013, Craiova, Romania, 2013 (Programme committee)

International Scientific Conference on Informatics - Informatics 2013, Spišská Nová Ves, Slovakia, 2013 (Programme committee)

5th Asian Conference on Intelligent Information and Database Systems - ACIIDS 2013, Kuala Lumpur, Malaysia, 2013 (Programme committee)

10th IEEE International Conference on Artificial Intelligence Applications and Innovations Systems - AIAI'14, Island of Rhodes, Greece, 2014 (Programme committee)

12th Advanced Control and Optimization: Step Ahead - ACOSA 2014, Bankya, Bulgaria, 2014 (Programme committee)

12th Annual Industrial Simulation Conference - ISC 2014, Skövde - Sweden, 2014 (Programme committee)

18th Annual International Conference KES '14, Gdynia, Poland, 2014 (Programme committee)

6th Asian Conference on Intelligent Information and Database Systems - ACIIDS 2014, Bangkok, Thailand, 2014 (Programme committee)

6th International Conference on Computational Collective Intelligence Technologies and Applications - ICCCI 2014, Seoul, Korea, 2014 (Programme committee)

7th IEEE International Conference on Intelligent Systems - IS'14, Warsaw, Poland, 2014 (Programme committee)

8th International KES Conference on Agents and Multi-Agent Systems, Technologies and Applications – KES AMSTA 2014, Chania, Greece, 2014 (Programme committee)

Big Data, Knowledge and Control Systems Engineering - BdKCSE'2014, Sofia, Bulgaria, 2014 (Programme committee)

International Symposium on Control of Power Plants and Systems & International Conference on Robotics, Automation and Mechatronics, Sofia, Bulgaria, 2014 (Programme committee)

11th Artificial Intelligence Applications and Innovations Conference - AIAI 2015, Biarritz-Anglet-Bayonne (BAB), France, 2015 (Programme committee)

19th International Conference on Knowledge-Based and Intelligent Information & Engineering Systems - KES 2015, Singapore, 2015 (Programme committee)

2015 2nd National Foundation for Science and Technology Development (NAFOSTED) Conference on Information and Computer Science (NICS), Ho Chi Minh City, Vietnam, 2015 (Programme committee)

2nd IEEE International Conference on Cybernetics - CYBCONF 2015, Gdynia, Poland, 2015 (Programme committee)

2nd International Conference on Information Science and Security - ICISS 2015, Seoul, Korea, 2015 (Programme committee)

7th Asian Conference on Intelligent Information and Database Systems - ACIIDS 2015, Bali, Indonesia, 2015 (Programme committee)

7th International Conference on Computational Collective Intelligence Technologies and Applications - ICCCI 2015, Madrid, Spain, 2015 (Programme committee)

9th International KES Conference on AGENTS AND MULTI-AGENT SYSTEMS: TECHNOLOGIES AND APPLICATIONS - KES-AMSTA-15, Bay of Naples, Italy, 2015 (Programme committee)

Big Data, Knowledge and Control Systems Engineering - BdKCSE'2015, Sofia, Bulgaria, 2015 (Programme committee)

Complex Systems Modelling Track, 13th Annual Industrial Simulation Conference - ISC'2015, Valencia, Spain, 2015 (Programme committee)

Ing. Roland Dobai, PhD.

Special Session on Dependability and Testing of Digital Systems at the 15th EUROMICRO Conference on Digital System Design (DSD), Turkey, 2012 (Programme committee)

Mgr. Mária Fischerová

IEEE Symposium on Design and Diagnostics of Electronic Systems and Circuits, Tallinn, Estonia, 2012 (Programme committee)

Ing. Štefan Havlík, DrSc.

ROBTEP 2012, Štrbské Pleso - Vysoké Tatry, Slovakia, 2012 (Programme committee)

23rd International Conference on Robotics in Alpe-Adria-Danube Region (RAAD 2014), Smolenice, Slovakia, 2014 (Programme committee – chair, Organizing committee - member)

Doc. Ing. Ladislav Hluchý, CSc.

Symposium on Emergent Trends on Artificial Intelligence and Robotics, Košice, Slovakia, 2013 (Programme committee)

Symposium on Emergent Trends on Artificial Intelligence and Robotics, Košice, Slovakia, 2014 (Programme committee)

Symposium on Emergent Trends on Artificial Intelligence and Robotics, Košice, Slovakia, 2015 (Programme committee)

Ing. Jaroslav Hricko, PhD.

23rd International Conference on Robotics in Alpe-Adria-Danube Region (RAAD 2014), Smolenice, Slovakia, 2014 (Programme and organizing committee)

RNDr. Viera Jablonská

Advanced Study Institute NATO - ASI NATO: Nanomaterials and Nanoarchitectures, Cork, Ireland, 2013 (Organizing committee)

ECOF 13 - 13th European Conference on Organised Films, Cork, Ireland, 2013 (Organizing committee)

RNDr. Ivan Kostič

10 th Anniversary International Conference on Electron Beam Technologies EBT 2012, Varna, Bulgaria, 2012 (Organizing committee)

doc. RNDr. Michal Laclavík, PhD.

Email2012 Workshop - Messaging and Web of Data: Private meets Public, Lyon, France, 2012 (Programme and organizing committee)

International Workshop on Infrastructures and Tools for Multiagent Systems (ITMAS) held with AAMAS 2012 Conference, Valencia, Španielsko, 2012 (Programme committee)

SOFSEM - International Conference on Current Trends in Theory and Practice of Computer Science, Špindlerův Mlýn, Czech Republic, 2012 (Programme committee)

Workshop on Agent Based Computing: from Model to Implementation VII (ABC:Ml'12), Wrocław, Poland, 2012 (Programme committee)

SOFSEM - International Conference on Current Trends in Theory and Practice of Computer Science, Czech Republic, 2013 (Programme committee)

Ing. Nguyen Giang, PhD.

ICCSAMA'2015, International Conference on Computer Science, Applied Mathematics and Applications, Metz, France, 2015 (Programme committee - PC member)

ICCSAMA'2014, International Conference on Computer Science, Applied Mathematics and Applications, Metz, France, 2014 (Programme committee - PC member)

Ing. Milan Rusko, PhD.

Text Speech Dialogue, Plzeň, Czech Republic, 2013, 2014, 2015 (Programme committee)

Ing. Jolana Sebestyénová, PhD.

RAAD 2014, Smolenice, Slovak Republic, 2014 (Organizing committee)

Ing. Viet Tran, PhD.

ICCSAMA'2015, International Conference on Computer Science, Applied Mathematics and Applications, Metz, France, 2015 (Programme committee - PC member)

ICCSAMA'2014, International Conference on Computer Science, Applied Mathematics and Applications, Metz, France, 2014 (Programme committee - PC member)

- **Position of individual researchers in a national context**

2.3.13. List of invited/keynote presentations at national conferences, as documented by programme or invitation letter

KVASSAY, M. - KRAMMER, P. - HLUCHÝ, L. Validation of parameter importance in data mining a case study. In 8th Workshop on Intelligent and Knowledge Oriented Technologies : WIKT 2013 proceedings. Eds. Babič, F., Paralič, J. - Košice : Centre for Information Technologies, Technical University in Košice, 2013, pp. 115-120. ISBN 978-80-8143-128-9.

PAJOROVÁ, E. - KURDEL, P. - SLÍŽIK, P. Visualization of Results of Scientific Simulations Computed in the Environment of High-performance Computers and Algorithms. Conference 'Innovative Information and Communication Technologies in Water Management, Bratislava, May 3, 2013.

RUSKO, M. Acustica Ludus: Jet-driven pipes. Lecture and workshop, Kočovce, June 9, 2014.

Invited/keynote presentations at research institutes in Slovakia

HLUCHÝ, L. Generic and modular agent architecture for the simulation of human behaviour in multiagent systems.. Comenius University Faculty of Mathematics, Physics and Informatics of , 14. 5. 2012.

KOSTIČ, I. Electron beam lithography in nanotechnology. Faculty of Electrical Engineering and Information Technology of Slovak Technical University in Bratislava (FEI STU), Institute of Nuclear and Physical Engineering, Bratislava, November 5, 2013.

RUSKO, M. How computers talk and write dictate. Philosophical faculty Kommenius University, Bratislava, November 26, 2014.

RUSKO, M. Self-learning automated speech-processing systems. Workshop Millennials Technical Exchange - Bratislava 2015, IBM Slovensko, Apollo 2 Business Center, October 16, 2015.

2.3.14. List of researchers who served as members of organising and programme committees of national conferences

Ing. Štefan Dlugolinský

Workshop of Intelligent and Knowledge oriented Technology WIKT'2012 (Organizing committee)

Doc. Ing. Ladislav Hluchý, CSc.

Workshop of Intelligent and Knowledge oriented Technology WIKT'2012 (Programme committee)

Workshop of Intelligent and Knowledge oriented Technology WIKT'2013(Programme committee)

Workshop of Intelligent and Knowledge oriented Technology WIKT'2014 (Programme committee)

Workshop of Intelligent and Knowledge oriented Technology WIKT'2015 (Programme committee)

doc. RNDr. Michal Laclavík, PhD.

Workshop of Intelligent and Knowledge oriented Technology WIKT'2012 (Programme committee)

Workshop of Intelligent and Knowledge oriented Technology WIKT'2013(Programme committee)

Workshop of Intelligent and Knowledge oriented Technology WIKT'2014 (Programme committee)

Ing. Nguyen Giang, PhD.

Workshop of Intelligent and Knowledge oriented Technology WIKT'2012 (Organizing committee)

Ing. Milan Rusko, PhD.

Akustika a vibrácie, Kočovce, Slovakia, 2014 (Programme and organizing committee)

Akustika a vibrácie, Kočovce, Slovakia, 2015 (Programme and organizing committee)

3rd Workshop “Acoustics and Speech Processing (Programme and organizing committee)

- **Supplementary information and/or comments documenting the international and national status of the Institute**

Besides taking part in international projects and in bilateral contracts, the Institute received the visits of significant persons from abroad, with whom experience and results achieved within the Institute's fields of research have been interchanged.
Selected important visits from abroad received at Institute of Informatics between 2012 and 2015:

- Alex Dorman – Magnetc Media Online, Inc., CTO Magnetic, New York (4.7.2013, 25.9.-27.9.2013, 20.1.-21.1.2014)
- Oren Ben Tocim, Shlomo Mofaz – Knowledge management and Application requirements analysis professional, St. Modiin, Israel, Discovery project, 14.6.2012
- Robert Harakaly, Dimitar Shizachi – Dcore Systems, Suisse, Discovery project, 29.2.-1.3.2012, 14.6.2012
- Marc Contat, Jérémy Patrix – Cassidian France, EUSAS project, 18.1.-19.1.2012
- Bernhard Schneider - Cassidian Germany, EUSAS project, 18.1.-19.1.2012
- Ales Tavcar – JSI Slovenia, EUSAS project, 18.1.-19.1.2012
- Lukasz Dutka, Bartosy Krysza, Michal Wrzesz, Darius Król – Cyfronet Poland, EUSAS project, 18.1.-19.1.2012
- Agustin Gravano – National Scientific and Technical Research Council, Project Cross-linguistic study of prosodic cues in English, Spanish, and Slovak, 10.9. - 14.9. 2015

Researchers of the Institute cooperate on projects evaluation as experts in relevant areas.

Name	**Type of program/project/call**	**Number of evaluated projects**
Zoltán Balogh	VEGA	3
Beňuš Štefan	AFOSR- Air Force Office of Scientific Research	2
Budinská Ivana	APVV - SRDA VV 2014	4
Budinská Ivana	VEGA	1
Forgáč Radoslav	KEGA	2
Havlík Štefan	European Commission projects	12
Havlík Štefan	FP7 - SME	22
Havlík Štefan	Horizont 2020 (FET)	25
Ladislav Hluchý	FET-Proactive call FETHPC 2014	14
Ladislav Hluchý	VEGA/KEGA	8
Peter Malík	VEGA	1
Ladislav Matay	VEGA	1
Ladislav Matay	APVV - SRDA	1
Ján Zelenka	VEGA	1

Membership in editorial boards of journals

doc.Mgr. Štefan Beňuš, PhD.

Laboratory Phonology (associate editor), since 2013

IEEE Transactions on Audio, Speech and Language Processing (member of editorial board)

Journal of Phonetics (member of editorial board)

Phonology (member of editorial board)

Speech Communication (member of editorial board)

Topics in Linguistics (associate editor), since 2014

.Ing. Ivana Budinská, PhD.

Computing and Informatics (Guest editor of special issue, 2014)

Doc. Ing. František Čapkovič, CSc.

Advances in Applied Intelligence Technologies (AAIT) Book Series, IGI Global, USA (member of editorial board)

International Journal of Intelligent Information and Database Systems, Inder Science Publishers, USA (member of editorial board)

Journal Of Applied Systems Studies (JASS), Cambridge, UK (member of editorial board)

New Generation Computing, Ohmsha/Springer (member of editorial board), since 2014

doc. Ing. Ladislav Hluchý, CSc.

Acta Electrotechnica et Informatica (member of editorial board)

Computing and Informatics (editor in chief)

Computer Science, Elsevier (member of editorial board), since 2014

Journal of Applied Sciences (member of editorial board), since 2015

Acta Polytechnica Hungarica (member of editorial board), since 2015

Guest editor of special issue of the jounal Computational Intelligence and Neuroscience, 2015

doc. RNDr. Ladislav Halada, CSc.

Civilná ochrana, revue pre civilnú ochranu obyvateľstva (member of editorial board)

Journal of the Applied Mathematics, Statistics and Informatics (member of editorial board)

Ing. Ladislav Matay, PhD.

Sensors & Transducers (member of editorial board)

Ing. Milan Rusko, PhD.

Fyzikálne faktory prostredia (member of editorial board), since 2014

Ing. Štefan Havlík, DrSc.

Int. Journal of Advanced Robotics (member of editorial board), since 2015

Memberships in the international scientific societies, unions

doc. Mgr. Štefan Beňuš, PhD.

COST Action 2102 (member) 2012, 2013

EuCOG II (member) 2012, 2013

International Speech Communication Association (member) 2012

EuCOG (member) 2014, 2015

RNDr. Vladimír Britaňák, CSc.

IEEE Computer Society (Signal Processing Society) (member) 2012 - 2015

doc. Ing. František Čapkovič, CSc.

IEEE (member) 2012 - 2015

International Directory of Distinguished Leadership, American Biographical Institute (ABI), Inc. (member) 2012 - 2015

doc. RNDr. Elena Gramatová, CSc.

IEEE Computer Society (member) 2013, 2014

Ing. Štefan Havlík, DrSc.

IARP (International Advanced Robotic Program (permanent member) 2012 - 2014

Komitét IFToMM - Robotic and Mechatronics (Ing. Federation on the Theory of Machines and Mechanisms (permanent member) 2012 - 2015

Komitét IFToMM - History (Int. Federiaton on the Theory of Machines and Mechanisms) (permanent member) 2012 - 2015

RAAD- Robotics in Alpe-Adria-Danube Region (permanent member) 2012 - 2015

doc. Ing. Ladislav Hluchý, CSc.

EGI Council (member) 2012

e-IRG (funkcia: represenatative for Slovak republic in ESFRI for Information Technology) 2012

e-IRG (member) 2013

IEEE (member) 2012

IEEE Computer Society (member) 2013, 2015

ESFRI, member for Slovak republic for Information Technology for the year 2013

Mgr. Ján Mojžiš
IEEE Computer Society (member) 2015

Ing. Juraj Pálfy

ACM (Association for Computing Machinery) (member) 2012 - 2013

IEEE (Institute of Electrical and Electronics Engineers) (member) 2014

IET (Institution of Engineering and Technology) (member) 2012 - 2013

Ing. Milan Rusko, PhD.

European Acoustic Association - EAA (member) 2012, 2013

(member) 2012, 2013

Memberships in the Advisory Board of the Slovak Government

doc. Ing. Ladislav Hluchý, CSc.

RNDr. Ján Glasa, CSc.

Consultants at the working group on research and development in information and communication technology (Ministry of Education working groups in the areas of specialization RIS3 in terms of available scientific and research capacities SR)

Memberships in boards and committees of grant agencies SRDA, VEGA

Ing. Zoltán Balogh, PhD.

Ing. Ivana Budinská, PhD.

RNDr. Ján Glasa, CSc.

Members - VEGA agency, Committe No 5 – for electrotechnics, automation and control systems and related fields of information and communication technologies

Ing. Štefan Havlík, DrSc.

Member – SRDA – Council for Technical Sciences

Memberships in the national scientific societies, unions and Committees

Ing. Ivana Budinská, PhD.

Slovenská spoločnosť pre kybernetiku a informatiku (member of the main committee) 2012 - 2015

doc. Ing. František Čapkovič, CSc.

Slovenská spoločnosť pre kybernetiku a informatiku (member) 2012 - 2015

Ing. Sakhia Darjaa, PhD.

Slovenská akustická spoločnosť pri SAV (member) 2012 - 2015

Ing. Milan Rusko, PhD.

Slovenská akustická spoločnosť (vice-chairman) 2012

Slovenská akustická spoločnosť (member) 2013 - 2015

Ing. Marian Trnka

Slovenská akustická spoločnosť (member) 2012

Slovenská akustická spoločnosť (member) 2013 - 2015

Mgr. Róbert Sabo, PhD.

Slovenská jazykovedná spoločnosť pri Jazykovednom ústave Ľ. Štúra SAV (member) 2015

List of national conferences and workshops (co)organised by the institute

- WIKT 2012 – 7th Workshop on Intelligent and Knowledge Oriented Technologies, 22. – 23. november 2012, Smolenice, Slovakia
- WIKT 2013 – 8th Workshop on Intelligent and Knowledge Oriented Technologies, 24. – 25. novembra 2013, Herľany, Slovakia
- WIKT 2014 – 9th Workshop on Intelligent and Knowledge Oriented Technologies, 20. – 21. novembra 2014, Smolenice, Slovakia
- WIKT 2015 – 10th Workshop on Intelligent and Knowledge Oriented Technologies, 12. – 13. novembra 2015, Košice, Slovakia
- A workshop Acoustics and Speech Processing in Košice organized by the Department of Speech Analysis and Synthesis II SAS together with TU Košice and Slovak Acoustical Society organized, (2014), http://www.skakustika.sk/acoustics-and-speech-processing,-kosice-2014.html
- Viena-Bratislava-Brno-Prague Joint Research Seminar for PhD students, Bratislava, 23 participants, 30. 06. 2015. Wrkshop for PhD. students from Faculty of Informatics and Information Technologies in Brno (Czech republic), Viena (Austria), Prag (Czech republic) and Bratislava (Slovakia).
- International workshop CogniSys 2012 - International Workshop on Cognitive Hybrid Complex Systems, CogniSys 2012 (SK-RO) 20.11.-20.11.2012. 30 participants.
- VENIS Bratislava WP4 Technical Meeting, Bratislava, 16 April 2014 (13 people). Main objective of this developers meeting was about the integration of the WP3/WP4 components, following the end of the WP4 (Distributed Data Sharing) and the planning of the activities for the design of the WP5 (Business Process Handler) architecture and the WP5 components development. Moreover, the presentation of the status of the WP7 (Dissemination and Exploitation) was part of the agenda too.
- IKT 2013 - Conference on Innovative Information and Communication Technologies in Water Management, 2. - 3. May 2013, Bratislava, Slovakia
- IKT 2014 - Conference on Innovative Information and Communication Technologies in Water Management, 28. November 2014, Bratislava, Slovakia IKT 2015 - Conference on Innovative

Information and Communication Technologies in Water Management, 26 June 2015, Bratislava, Slovakia

- KC-Intelinsys conference - Activity 2.2 - Research in the field of management and robotic systems - 22. -23. october 2014, Smolenice, Slovakia

List of edited proceedings from national scientific conferences.

FAI02 Workshop RPKOM 2013 : Technológie pre riadenie podnikových procesov v heterogénnych distribuovaných systémoch v reálnom čase s podporou multimodálnej komunikácie. Eds. Budinská, I., Hluchý, L., Ványa, Š. Bratislava : Ústav informatiky SAV, 2013. CD. ISBN 978-80-970145-7-5.

FAI03 Innovative Information and Communication Technologies in Water Management. Eds. Dubová Vanda, Hluchý Ladislav. Liptovský Ján : PROHU s.r.o., 2013. 180 p. ISBN 978-80-89535-14-9.

FAI05 Information Technologies for Prediction and Management of Crisis Situations. Ladislav Hluchý , Štefan Kozák, Ivana Budinská. Bratislava : Ústav informatiky SAV, 2012. CD. ISBN 978-80-970745-6-8.

FAI06 WIKT 2014 : 9th Workshop on Intelligent and Knowledge Oriented Technologies. Eds. Hluchý, L., Bieliková, M., Paralič, J. Bratislava : Nakladateľstvo STU, 2014. 157 p. Proceedings in Informatics and Information Technologies. ISBN 978-80-227-4267-2.

2.4. Tables of project structure, research grants and other funding resources

- **International projects and funding**

2.4.1. Major projects within the European Research Area and other important project – Framework Programmes of the EU, ERA-NET, European Science Foundation, NATO, COST, INTAS, etc. (here and in items below please specify: type of project, title, grant number, duration, total funding and funding for the institute, responsible person in the institute and his/her status in the project, e.g. coordinator "C", work package leader "W", investigator "I")

	Project title	Typ / Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute / Responsible person
2012	Seamless Communication for Crisis Management (SeCriCom)	FP7-218123	09/2008-04/2012	35931	I / L. Hluchý
	Virtual Enterprises by Networked Interoperability Services (VENIS)	FP7-284984	09/2011-08/2015	54321	I / L. Hluchý
	EGI: Integrated Sustainable Pan-European Infrastructure for Researchers in Europe (EGI-InSPIRE)	FP7-261323	05/2010-12/2014	78805	I / L. Hluchý
	European Urban Simulation for Asymmetric Scenarios (EUSAS)	EDA (European Defense Agency)/ A-0938-RT-GC	03/2010-08/2012	100855	I / L. Hluchý
2013	EGI: Integrated Sustainable Pan-European Infrastructure for Researchers in Europe (EGI-InSPIRE)	FP7-261323	05/2010-12/2014	83408	I / L. Hluchý
	Virtual Enterprises by Networked Interoperability Services (VENIS)	FP7-284984	09/2011-08/2015	0	I / L. Hluchý

2014	EGI: Integrated Sustainable Pan-European Infrastructure for Researchers in Europe (EGI-InSPIRE)	FP7-261323	05/2010-12/2014	72199	I / L. Hluchý
	Global ATM security management (GAMMA)	FP7-SEC-2012-1	6/2015 - 12/2017	2566	I / M. Rusko
	Emergency Responder Data Interoperability Network (REDIRNET)	FP7 - 607768	03/2014-08/2016	53770	I / L. Hluchý
	Virtual Enterprises by Networked Interoperability Services (VENIS)	FP7-284984	09/2011-08/2015	66752	I / L. Hluchý
2015	Global ATM security management (GAMMA)	FP7-SEC-2012-1	6/2015 - 12/2017	43867	I / M. Rusko
	Virtual Enterprises by Networked Interoperability Services (VENIS)	FP7-284984	09/2011-08/2015	23944	I / L. Hluchý
	Emergency Responder Data Interoperability Network (REDIRNET)	FP7 - 607768	03/2014-08/2016	69544	I / L. Hluchý
	Engaging the EGI Community towards an Open Science Commons (EGI-Engage)	Horizon2020 - 654142	03/2015 - 08/2017	17550	I / L. Hluchý

2.4.2. Other international projects, incl. total funding and funding for the institute

- R&D project between SCS Group SA (Switzerland) and The Institute of Informatics of Slovak Academy of Sciences. Within the agreement II SAS conducted R&D: Discovery-Egene project designed to be a new generation job-search engine, allowing usage of semantic information in the collection and matching of job announces with applicant CVs. It should support as “job search” also “applicant search” as detailed below in the features list. Funding: 40 000€
- Magnetic Media Online, Inc, CONSULTING AGREEMENT. This Consulting Agreement is made and entered into as of _June 1st 2013 by and between Magnetic Media Online, Inc., a Delaware corporation and _Institute of Informatics SAS (2013-2015). Within this agreement II SAS conducted R&D: 1.Development of Keyword/Query Categorization Process based on category hierarchy provided by the Company. The Process should scale to 10 million keywords/queries categorized in under 30 minutes in batch mode. The process should be suitable to execution on Company’s Hadoop cluster.Each keyword/query should be mapped to up to 5 categories. The process should assign accuracy rank that reflects certainty this keyword/Query belongs to a category. 2. Provide recommendations on improvements to existing Keyword/Query Normalization process. The Company will provide existing source code. Funding: 14 329€
- Connectik Technologies SA, (Switzerland) and The Institute of Informatics of Slovak Academy of Sciences. Within the agreement (2014-2015) II SAS conducted R&D: Matching &Recommendation system with aim to introduce semantic analysis of dynamic data within the system, allowing more advanced discovery of relationships, interactions, and interconnections between different logical entities. Funding: 62 851€
- Relationship between trust and entrainment in speech, AFOSR (Project of Air Force Office of Scientific Research), USA, FA9550-15-1-0055, 06/2015-12/2017 8000€ in 2015, (total funding for II SAS untill 2017 – 24 000€)

2.4.3. Other important, international projects and collaborations without direct funding (max. 10 projects)

- Modern Paradigms in the Field of Intelligent Systems, MAD, 01/2015-12/2017, F. Čapkovič

- Agent Oriented Diagnostics of Complex Systems, MAD, 01/2012-12/2014, F. Čapkovič
- Molecular-friendly processes for fabrication of molecular electronic devices, MAD, SK-GR-047-11, 01/2013-12/2014, I. Kostič
- Study of electron beam resists and patterning of nano-structures by electron beam lithography for gas sensor applications, MAD, 01/2015-12/2017, I. Kostič
- Design and testability of low power processor and MDCT algorithm in 90 nm CMOS technology, MAD, 01/2010-12/2012, M. Fischerová
- Advanced methods for distributed intelligent and knowledge oriented control systems. MAD, 01/2010-12/2012, I. Budinská
- Programming environment for adaptive development of high performance parallel software on heterogeneous platforms. MAD, 01/2011-12/2013, L. Hluchý
- Robust Lithography of Submicron nad Nano-dimensional Structures, MAD, SK-BG-0037-10, 01/2012-12/2013, I. Kostič
- Cross-linguistic study of prosodic cues in English, Spanish, and Slovak, 01/2014-12/2015, SAS-CONICET, M. Rusko

- **National projects and their funding**

2.4.4. Projects supported by the Slovak Research and Development Agency (APVV) Role of the Institute e.g. coordinator "C", investigator "I".

	Project title	Typ / Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute / Responsible person
2012	Hybrid Medical Complex Systems	SK-RO-0014-10	01/2011-12/2012	5200	C / L. Hluchý
	Seamless Communication for Crisis Management	DO7RP-0007-08	09/2008-04/2012	103179	C / L. Hluchý
	Virtual digital design laboratory for high schools	LPP-0149-09	09/2009-08/2012	66356	C / P. Malík
2013	Robust Lithography of Submicron nad Nano-dimensional Structures	SK-BG-0037-10	01/2012-12/2013	5200	C / I. Kostič
2014	Advanced piezoelectric PiezoMEMS pressure sensors	APVV-0450-10	05/2011-10/2014	39984	I / L. Matay
	Virtual and constructive modelling, training and simulaion of crowd behaviour in urban environment (Riot)	APVV-0233-10	05/2011-10/2014	175000	C / L. Hluchý
	Cognitive traveling in digital space of the Web and digital libraries supported by personalized services and social networks (TraDiCe)	APVV-0208-10	05/2011-10/2014	34863	I / L. Hluchý
	Bioinspired multirobot coordination	APVV 0261-10	05/2011-10/2014	116547	C / I. Budinská
	Virtual Enterprises by Networked Interoperability Services (VENIS)	DO7RP-0020-11	09/2011-08/2015	43487	C / L. Hluchý
	Molecular-friendly processes for fabrication of molecular electronic devices	SK-GR-047-11	01/2013-12/2014	5200	C / I. Kostič
2015	MEMS structures based on load cell	APVV	07/2015-06/2019	82820	I / Š. Havlík
	Electron Spin PolaRImeTer based on thin ferromagnetic membranes	SK-FR-2013-0032	01/2014-12/2015	5300	C / R. Andok
	Emergency Responder Data Interoperability Network (REDIRNET)	DO7RP-0041-12	03/2014-08/2016	32589	C / L. Hluchý
	Global ATM security management (GAMMA)	DO7RP–0036–12	6/2015 - 12/2017	22293	C / M. Rusko
	Cloud Computing for Big Data Analytics (Clan)	APVV-0809-11	07/2012-12/2015	229463	C / L. Hluchý
	Broadband TARAMEMS detector of terahertz radiation	APVV	07/2015-06/2018	39999	I. / L. Matay

2.4.5. Projects supported by the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA) for each year, and their funding

VEGA	2012	2013	2014	2015
Number	11	9	8	9
Funding in the year (EUR)	115823	122657	106509	104231

[1]

- **Summary of funding from external resources**

2.4.6. List of projects supported by EU Structural Funds

- Centre of Excelence for New Technologies in Electrical Engineering
- Research and development of new information technologies for forecasting and solving crisis situations and for the security of population (CRISIS)
- Technology research for the management of business processes in heterogeneous distributed systems in real time with the support of multimodal communication
- Slovak infrastructure for high performance computing (SIVVP)
- Center of Excellence for SMART Technologies, Systems and Services II
- Industry research in the area of effective work with large data in user oriented applications (RECLER)
- A resistive microcontroller module for harsh industrial environment with
- high pressure, temperature and high level of electromagnetic interference
- Competence Center for SMART Technologies for Electronics and Informatics Systems and Services (KC-INTELINSYS)
- Centre for the Research of Risks of Water Distribution in a Large City
- Electronic services of General prosecution of the SR

[1] Excluding projects for the popularisation of science

2.4.7. Summary of external resources of the EU Structural Funds (ERDF/ESF)

Role of the Institute in the project, e.g. coordinator "C", work package leader "W", investigator "I".

Year	Project title	Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute
2012	Centre of Excelence for New Technologies in Electrical Engineering	ITMS 262 401 200 19	03/2010-02/2013	262251	I / I. Kostič
	Research and development of new information technologies for forecasting and solving crisis situations and for the security of population (CRISIS)	ITMS 26240220060	01/2011-12/2013	784485	C / L. Hluchý
	Technology research for the management of business processes in heterogeneous distributed systems in real time with the support of multimodal communication	ITMS 26240220064	01/2011-06/2014	803363	I / L. Hluchý
	Slovak infrastructure for high performance computing (SIVVP)	ITMS 26230120002	01/2010-09/2015	1257500	I. / L. Hluchý
	Center of Excellence for SMART Technologies, Systems and Services II	26240120029	01/2010-01/2014	265254	I / L. Hluchý
	Industry research in the area of effective work with large data in user oriented applications (RECLER)	ITMS 26240220029	05/2010-04/2012	148266	I / L. Hluchý
	A resistive microcontroller module for harsh industrial environment with high pressure, temperature and high level of electromagnetic interference	ITMS 26240220037	01/2011-10/2013	164215	I / R. Andok
	Competence Center for SMART Technologies for Electronics and Informatics Systems and Services (KC-INTELINSYS	ITMS 26240220072	09/2012-06/2015	272000	I. / L. Hluchý
	Centre for the Research of Risks of Water Distribution in a Large City	ITMS 26240220082	07/2012-06/2015	342644	C / L. Hluchý
2013	Electronic services of General prosecution of the SR	IMTS 21110120022	06/2013-06/2015	238115	I / M. Rusko

External resources	2012	2013	2014	2015	total	average
External resources (milions of EUR)	3,047	1,344	1,293	1,140	**6,824**	**1,706**
External resources transfered to coooperating research institute (milions of EUR)	0,180	0,065	0,034	0,008	**0,287**	**0,072**

- **Supplementary information and/or comments on research projects and funding sources**

More information about the projects is on

http://www.ui.sav.sk/w/index.php/en/research/projects/
http://ups.savba.sk/parcom/index.php?page=projlist.

International projects of highest priority were supported also by MVTS projects funded by SAS:

Seamless Communication for Crisis Management (SeCriCom), MVTS, 1333,-€

EGI: Integrated Sustainable Pan-European Infrastructure for Researchers in Europe, MVTS, 12631,-€

European Urban Simulation for Asymmetric Scenarios (EUSAS)EDA, MVTS, 2667,-€

Virtual Enterprises by Networked Interoperability Services, MVTS, 11667,-€

Emergency Responder Data Interoperability Network, MVTS, 7333,-€

Global ATM security management, MVTS, 7165,-€

Engaging the EGI Community towards an Open Science Commons, MVTS, 3333,-€

2.5. PhD studies and educational activities

2.5.1. List of accredited programmes of doctoral studies, period of validity

9.2.9. Applied informatics 2009-2013, 2013-2016

9.2.7. Cybernetics 2009-2013, 2013-2016

The Institute has gained the accreditation for both of the programmes for the next period in 2016.

2.5.2. Summary table on doctoral studies (number of internal/external PhD students; number of foreign PhD students, number of students who successfully completed their theses, number of PhD students who quit the programme*)*

PhD study	31.12.2012			31.12.2013			31.12.2014			31.12.2015		
Number of potential PhD supervisors	13			13			14			14		
PhD students	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted
Internal	5,0	1,0	0,0	5,0	1,0	0,0	5,0	0,0	3,0	5,0	0,0	0,0
External	6,0	0,0	0,0	5,0	1,0	0,0	6,0	0,0	0,0	6,0	1,0	0,0
Other supervised by the research employees of the institute					3,0			1,0			1,0	

3 research fellowships at FBI and II SAS were realized for PhD students: 2 Czech and 1 Slovak

- Ing. L. Valášek – a PhD student under supervision of RNDr. Ján Glasa, PhD. – has got a scholarship from The National Scholarship Programme of the Slovak Republic. The host institution – VŠB Technical University of Ostrava, Faculty of Safety Engineering - March 11, 2014, duration 1 month

2.5.3. Summary table on educational activities

Teaching	2012	2013	2014	2015
Lectures (hours/year)[2]	70	525	101	43
Practicum courses (hours/year)[2]	266	688	413	770
Supervised bachelor theses (in total)				
Supervised diploma theses (in total)	12	12	24	15
Supervised PhD theses (in total)	5	4	4	3
Members in PhD committees (in total)	5	5	5	5
Members in DrSc. committees (in total)	0	0	0	0
Members in university/faculty councils (in total)	1	1	2	2
Members in habilitation/inauguration committees (in total)	1	2	1	0

In our information system we do not distinguish between supervised bachelor and diploma theses. The summary is shown in the line named "Supervised diploma thesis"

2.5.4. List of published university textbooks

ACB01 LACLAVÍK, Michal - ŠELENG, Martin. Vyhľadávanie informácií [Information Discovery]. Bratislava : Nakladateľstvo STU, 2012. 141 p. Edícia učebných textov informatiky a informačných technológií. ISBN 978-80-227-3829-3.

2.5.5. Number of published academic course books

2.5.6. List of joint research laboratories/facilities with universities

- **Supplementary information and/or comments on doctoral studies and educational activities**

There is a specific situation in PhD study for informatics and computational science. The graduates from respective specialization are demanded and highly valuated by commercial branches. It is very difficult to obtain an excellent student, who prefers academic carrier to business. However, the Institute offers very attractive positions due to numerous international cooperations and projects. We have 100% of PhD students in the 2nd year of the study involved in at least one national project (VEGA). Besides the possibility to gain additional financial sources, the chance to work together with experienced researchers in large international consortia attracts students and young researchers as well.

The problem is, when PhDs involved in projects are external university students. The university charges for external form of PhD study. The fees are often very high and demotivating. The issue is negotiated with our university partners.

The Institute supports young researchers to gain higher qualifications in order to be able to supervise PhD students. For those, who are able to cooperate on supervising of PhD students but still are not eligible, we have a system of consultants for PhD thesis. Young researchers work together with an experienced PhD supervisor and with a student on thesis.

The problem with PhD study in SAS is that we completely depend on universities. It would be desirable to gain again autonomy and full right for PhD study implementation, as it was several years ago.

Members of SOK (Spoločná odborová komisia – Joint departmental committee for PhD study at universities)

Ing. I. Budinská, PhD.
- SOK 9-2-7 Cybernetics, STU - member
- SOK 5-2-4 Automation, STU - member

Doc.Ing. František Čapkovič, CSc.
- SOK 9-2-7 Cybernetics, STU - member

Doc.Ing.K.Dobrovodský,CSc.
- SOK 9-2-7 Cybernetics, STU - member

Ing. Havlík Štefan, DrSc.
- SOK 9-2-7 Cybernetics, STU - member

Ing. Ladislav Hluchý, CSc.
- SOK 9-2-9 Aplied informatics, STU - member

2.6. Social impact

2.6.1. List of the most important results of applied research projects. Max. 10 items

- Automated transcription of dictate (2008-2012) – a bilateral contract with Ministry of Justice of the Slovak Republic. Unlimited number of licenses, 2200 licenses activated until the end of 2015 (450 000€)
- Automated transcription of dictate and Voice input to the PATRICIA information system – OPIS structural funds project Electronic Services of the General Attorney's Office, 900 licenses (375 000€)
- IMS Nanofabrication AG, Schreygasse 3, A-1020 Vienna, Austria: On the base of the Purchase Order - Processing with e-beam resists - Spincoating of Si wafers with positive and negative electron beam resists. Fakturovana Suma 2013 -2015: 16,480.00 EUR
- The main results of the project VEGA Nr. 2/0145/10 "Mechatronic Visual System" have been subsequently realized in the form of a visual subsystem of the Fire Control System of an anti-aircraft gun. In collaboration with the Slovak company EVPU a.s. Nová Dubnica as our industrial partner, an upgrade of Indian Army's ZU-23 anti-aircraft gun has been proposed to convert the mechanical gun into the electronic one with laser optical fire control system. The collaboration has been realized within an agreement Nr. EOU-012-806/11 between EVPÚ a.s. Nová Dubnica and the Institute of Informatics SAS Bratislava in the year 2012. The system has been presented in international tender in India. Revenues: 40 000 EUR
- SCS Group SA, hereafter called SCS, a company incorporated under Swiss law and having its registered office at:Rue Cesar-Soulie 5, CH-1260, Nyon, Switzerland and The Institute of Informatics of Slovak Academy of Sciences, hereafter called IISAS, with its principal office at:Dubravska cesta, Bratislava, Slovak Republic, 2011-2013. Within this agreement II SAS conducted R&D: Discovery-Egene project designed to be a new generation job-search engine, allowing usage of semantic information in the collection and matching of job announces with applicant CVs. It should support as "job search" also "applicant search" as detailed below in the features list. Funding: 10 000 EUR
- EEA s.r.o., Hattalova 12/B, 831 03, Slovenská republika and Institute of Informatics SAS, Dúbravská cesta 9, 84507 Bratislava, Slovenská republika, 2015, innovation voucher within which was conducted R&D and main outcome was: A feasibility study for using semantic technologies in the product Feywa for JIRA with main focus on semantic search and recommendation system, annotation objects using semantics.
- DIMANO, a. s, Prievozská 14, 821 09 Bratislava, Slovenská republika and Ústav informatiky SAV, Dúbravská cesta 9, 84507 Bratislava, Slovenská republika, 2015, innovation voucher within which was conducted R&D and main outcome was: A feasibility study for the

possibilities to use and benefits of semantic search in documents without specifying domain knowledge.

- Subcontracting Agreement with AMG Technology Ltd., Microelectronica Industrial Zone, 2140, Botevgrad, Bulgaria. Leonardo da Vinci Development of Innovation project No. 510591-2010-LLP-FR-LMP "Training New Skills for the New Jobs in Nanotechnology " (NanoSkills), 07/06/2011-31/10/2013. Revenues: 2012: 3,030.00 EUR
- Magnetic Media Online, Inc, CONSULTING AGREEMENT. This Consulting Agreement is made and entered into as of June 1st 2013 by and between Magnetic Media Online, Inc., a Delaware corporation and Institute of Informatics SAS (2013-2015). Within this agreement II SAS conducted R&D: 1.Development of Keyword/Query Categorization Process based on category hierarchy provided by the Company. The Process should scale to 10 million keywords/queries categorized in under 30 minutes in batch mode. The process should be suitable to execution on Company's Hadoop cluster. Each keyword/query should be mapped to up to 5 categories. The process should assign accuracy rank that reflects certainty this keyword/Query belongs to a category. 2. Provide recommendations on improvements to existing Keyword/Query Normalization process. The Company will provide existing source code. Funding: 14 329€
- Connectik Technologies SA, (Switzerland) and The Institute of Informatics of Slovak Academy of Sciences. Within the agreement (2014-2015) II SAS conducted R&D: Matching &Recommendation system with aim to introduce semantic analysis of dynamic data within the system, allowing more advanced discovery of relationships, interactions, and interconnections between different logical entities. Funding: 62 851€

2.6.2. List of the most important studies commissioned for the decision-making authorities, the government and NGOs, international and foreign institutes

Feasibility analysis - The technical equipment of the courtrooms and related services for audio-recording of the court hearings., for: Ministry of Justice of the Slovak Republic, 28 pages. 2013, Responsible person: Ing. M. Rusko PhD.

2.6.3. List of contracts and research projects with industrial and other commercial partners, incl. revenues

- Ministry of Justice of the Slovak Republic. Project: Automated transcription of dictate (2008-2012). Revenues: 450 000€
- Datalan, a. s., Project: Electronic Services of the General Attorney's Office (2014-2015), Revenues: 375 000€
- TEMPEST, a.s. GBC IV, Galvaniho 17/B 821 04 Bratislava 2, Slovenská republika and Ústav informatiky SAV, 2015. Within the agreement II SAS conducted R&D providing the services of data processing and analysis necessary for carrying out research of Tempest in mobile and data security. The aim of cooperation is to create a joint team and use a novel methods of processing large volumes of data, machine learning and data mining(05-10/2015) Revenues: 121 800 EUR
- SCS Group SA (Switzerland), Project R&D: Discovery-Egene,(2014) Revenues: 36 051€
- AMG Technology Ltd., Microelectronica Industrial Zone, 2140, Botevgrad, Bulgaria. Project No. 6IF-02-13/15.12.2012, "HighTech Force / Displacement Gauges with Compliant Transmission Mechanisms and Extended Operational Range "(VISMEM), Bulgarian Innovation Fund– 6th Call Project, (15/03/2013 - 15/12/2015). Revenues: 4,400.00 EUR
- AMG Technology Ltd., Microelectronica Industrial Zone, 2140, Botevgrad, Bulgaria. Project No. 6IF-02-12/15.12.2012 "Development of Nanolaminated Conductive Structures for Advanced Applications" (NanoLAMS), Bulgarian Innovation Fund– 6th Call Project, (15/03/2013-15/12/2015). Revenues 2014-2015: 9,730.00 EUR
- Boeing (USA), AirBus (multinational group), Finmeccanica (Italy), Thales (Greece), Institut für Flugführung (Germany), CiaoTech (Italy), Lanchester Univeesity (UK), Isdefe, (Spain), RNC

Avionics (UK), Romatsa (Romania). Project GAMMA - Global ATM Security Management Project - 8 commercial partners

- CETIC (Belgium), Pramacom Prague s.r.o (Czech republic), Nextel Sa (Špain), Bapco Lbg (UK), Universite Du Luxembourg (Luxemburg), Verde Sro (Slovakia), Institut Jozef Stefant (Slovenia), Ardaco a. s. (Slovakia). Project: REDIRNET - Emergency Responder Data Interoperability Network – 6 commercial partners
- Engineering (Italy), Intersoft (Slovakia), ITLink (Italy), Link Technologies (Greece); Project: Virtual Enterprises by Networked Interoperability Services - 4 commercial partners
- Ardaco a. s. Project: Technology research for the management of business processes in heterogeneous distributed systems in real time with the support of multimodal communication, ITMS 26240220064
- Geotermal Anywhere, Project EKOWATT - A resistive microcontroller module for harsh industrial environment with high pressure, temperature and high level of electromagnetic interference, ITMS 26240220037
- BVS, a. s. (Slovakia), DHI, a.s. (Slovakia), Project: Research Center of the water supply risks of large cities, ITMS 26240220082 – 2 commercial partners
- Vyvoj Martin, a.s., Martin, Slovakia, cooperation on research and development of a system for coordination of a group of mobile robots as part of the project APVV – BioMRCS.

2.6.4. List of licences sold abroad and in Slovakia, incl. revenues

- Automated transcription of dictate - "Automatický prepis diktátu (APD)" (2008-2012) – a bilateral contract with Ministry of Justice of the Slovak Republic. Unlimited number of licenses, 2200 licenses activated until the end of 2015, (450 000€)
- Automated transcription of dictate and Voice input to the PATRICIA information system – OPIS structural funds project Electronic Services of the General Attorney's Office, 900 licenses (375 000€)

2.6.5. List of most important social discourses under the leadership or with significant participation of the institute (max. 10 items)

2.6.6. Summary of relevant activities, max. 300 words

The Institute research results are useful for real-world applications, for the commercial as well as non-commercial sectors. A strong focus on research topics related to the field of public safety and a synergistic effect, which is produced by integrating several research areas of the Institute, makes an excellent research organization with significant impact on society. Results in the field of security of population have been achieved by several research groups (secure communication, information acquisition, simulation of fire spreading, mechatronic and robotic systems for monitoring and tracking objects). Several companies are interested in these results (e.g., EVPU Nova Dubnica - Mechatronic visual system for tracking moving objects).

Among the most significant research topics that interest partners from practice (commercial and non-commercial) belongs processing of spoken language. Within a long-lasting co-operation with an Association of Blind and Visually Impaired, a product (a text-to-speech tool) is offered for distribution. The National Highway Company, the Presidium of Fire Fighting and Rescuing Corps of the Ministry of Interior of the SR (HaZZ MV SR) and the Fire Fighting Technical and Expertise Institute of the MI SR (PTEÚ) are interested in computer simulation of fire spreading in different environments.

Several results from the field of coding of audio signals have got positive responses from Dolby Stereo company. Design and implementation of IP cores by a group from our Institute was selected by the Presidium of SAS as one of most prospective implementation results. The problem with implementing such results is in inadequate protection of results since the patenting of results is in contrary to their publication in scientific journals.

Several commercial companies from Slovakia and from abroad were interested in our results in the field of knowledge management and knowledge technology.

2.7. Popularisation of Science (outreach activities)

2.7.1. List of the most important popularisation activities, max. 20 items

- doc.RNDr. Ladislav Halada, CSc., (RADIO SLOVENSKO) Rozhlasová relácia Vec verejná [Broadcast show matter of public], 29.11.2015, http://www.rtvs.sk/radio/archiv/1171/347806
- Ing. Milan Rusko, PhD. et al. (TV SME), Relácia o výsledkoch Oddelenia analýzy a syntézy reči UI SAV [The report on the results of the Department of Speech Analysis and Synthesis II SAS], Internet TV SME, 2.12.2013, http://tv.sme.sk/v/28787/apple-a-google-pouzivaju-dedicstvo-bratislavcana.html
- Ing. Ivana Budinská, PhD. et al. (TV TA3) Veda na dosah. [Science within reach] http://www.ta3.com/clanok/1063969/veda-na-dosah-zo-16-juna.html
- Ing. Ján Zelenka, PhD. et al. (SCIENTIFIC KIOSK) Veda netradične [Science unusually], 9.11.2015
- RNDr. Britaňák, Vladimír, DrSc. (RADIO SLOVENSKO), Rozhlasová relácia Vec verejná [Broadcast show matter of public], 8.2.2013
- Ing. Ján Zelenka, PhD. et al. (SCIENTIFIC KIOSK) Robotika hrou [Robotics game], Within the nationwide popularizing project "Noc výskuníkov" (Night of researchers), www.nocvyskumnikov.sk, 25.9.2015
- Ing. Ivana Budinská, PhD. (PUBLICATION) Obzory nových technológií - kapitola Roboty pracujú v zoskupeniach [Horizons of new technologies – Chapter: Robots work in swarms], Publisher: Vydateľstvo Matice slovenskej 2015
- RNDr. Ivan Kostič, Príspevok - fotografie do knihy Pohľady do nanosveta [post + photos into the book Looking into the nanoworld], Author Štefan Luby, 2015, ISBN 978-80-8115-207-8
- Ing. Ján Zelenka, PhD., et al. (SCIENTIFIC KIOSK) Ovládaj virtuálny svet gestami [Control the virtual world using gestures], Within the nationwide popularizing project "Noc výskuníkov" (Night of researchers), www.nocvyskumnikov.sk 26.9.2014
- Ing. Ivana Budinská, PhD. et al. (LECTURE) Swarm Robotics. Čo sa môžu roboty naučiť od mravcov. [What robots can learn from ants] Within the nationwide popularizing project CVTI Vedecká cukráreň (Scientific patisserie), 19.11.2013
- Ing. Ján Zelenka, PhD. Otestuj-zmysly-robota. [Test the senses of the robot] (SCIENTIFIC KIOSK) Within the nationwide popularizing project "Noc výskuníkov" (Night of researchers) 27.9.2013
- Ing. Marian Trnka et al. (SCIENTIFIC KIOSK) Stroje rozprávajú a počúvajú. [Machines talk and listen.] Within the nationwide popularizing project "Noc výskuníkov" (Night of researchers) 28.9.2012
- Ing. Mgr. Robert Andok, PhD. A. Ritomský (PUBLICATION) Snímače polohy do vyšších prevádzkových teplôt a tlakov [Detectors of the higher operating temperatures and pressures], ATP Journal 4 (2013)
- Ing. Mgr. Robert Andok, PhD. P. Andris (PUBLICATION) Návrh mikropočítačom riadeného modulu vhodného pre drsné priemyselné prostredia. [Proposal of microcomputer controlled module suitable for harsh industrial environments] Elektrotechnický časopis 19, (2013), 45, pp. 36-37,
- Ing. Peter Malík, PhD. (STUDENT COMPETITION) Môj prvý digitálny návrh - študenstká súťaž pre študetov stredných škôl [My first digital design - competition for high school students], Organizing of competitions for students from various high schools whitin 13 days.
- Ing. Pavol Nemec, R. Andok a kol. (EXCURSIONS/LECTURES) Chemický deň - pozorovania, rôzne aktivity, pokusy, experimenty, prezentácia UI SAV [Chemical day - observations, various activities, experiments, presentation of II SAS], Popularization of science for students from School for highly gifted children, Every year 2-4 lectures and excursions
- Organizing of Annual open day of Institute of Informatics SAS. (excursions and lectures for students and the public)

2.7.2. Table of outreach activities according to institute annual reports

Outreach activities	2012	2013	2014	2015	total
Articles in press media/internet popularising results of science, in particular those achieved by the Institute	0	3	0	2	5
Appearances in telecommunication media popularising results of science, in particular those achieved by the Institute	0	1	0	3	4
Public popularisation lectures	29	29	16	20	94

- **Supplementary information and/or comments on popularisation activities, max. 300 words**

II SAS is actively involved in events organized by organizations responsible for the popularization of science. The Institute regularly organizes open days and participates at Researchers' Night and Week of Science and Technology. In addition, we organize excursions and lectures on our premises for high school students upon their requests. We publish articles in journals and provide interviews on topical issues for the media. As the Institute does not have and not going to have their own PR department, we rely on a Department for Communication and Media of Presidium of SAS. In 2015 we appointed an employee, who is in charge of communicating with media and coordination of popularization activities in the Institute.

2.8. Background and management. Human resources and implementation of recommendations from previous assessment

2.8.1. Summary table of personnel

Personnel	2012	2013	2014	2015
All personnel	89,0	85,0	81,0	79,0
Research employees from Tab. Research staff	0,0	0,0	0,0	0,0
FTE from Tab. Research staff	0,000	0,000	0,000	0,000
Average age of research employees with university degree	47,0	47,6	47,8	49,2

2.8.1.1. Professional qualification structure (as of 31.12. 2015) FEMALE

FEMALE	AGE								
Number of	< 30	31 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59	60 - 64	> 65
DrSc. / prof. [5]	0	0	0	0	0	0	0	0	0
II.a / Assoc. prof. [6]	0	0	0	0	0	1	0	0	0
Other researchers PhD./CSc.	0	0	1	2	0	0	0	1	0
doc. / Assoc. prof.	0	0	0	0	0	0	0	0	0

2.8.1.2. Professional qualification structure (as of 31.12. 2015) MALE

MALE	AGE								
Number of	< 30	31 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59	60 - 64	> 65
DrSc. / prof. [5]	0	0	0	0	0	0	1	1	2
II.a / Assoc. prof. [6]	0	0	1	1	0	1	1	0	2
Other researchers PhD./CSc.	1	3	6	3	0	0	0	2	0
doc. / Assoc. prof.	0	0	0	1	0	0	0	2	2

2.8.2. Postdoctoral and mobility scheme

2.8.2.1. Postdoctoral positions supported by national and international resources

2.8.2.2. Postdoctoral positions supported by external funding

2.8.2.3. SAS stipends and SASPRO stipends

SASPRO stipends - 3 applicants in the 3rd call, 1 passed to the 2nd round

2.8.2.4. Internal funding - the Slovak Academy of Sciences Supporting Fund of Stefan Schwarz

2.8.3. Important research infrastructure *(max. 2 pages)*

1) Computing resources (cluster, grid, cloud, hadoop-cluster):

IISAS is one of partners of EGI - European Grid Infrastructure - A federation of shared computing, storage and data resources from national and intergovernmental resource providers that delivers sustainable, integrated and secure distributed computing services to European researchers and their international partners. IISAS provides its HPC cluster [1] with 28.5 TFlops = 8.8 TFlops (776 Intel cores) + 19.7 TFlops (40'832 CUDA cores) and 144TB disk storage to grid and cloud users in the scope of EGI, which is also used for local users in the scope of SIVVP project, i.e. users coming from Slovak academic institutes, universities and research centers. IISAS provides one part of its cluster [4] with 96 cores, 3GB RAM per core and with 16TB storage to the cloud users in the scope of EGI and other part of cluster [4] is used as the testing site with 28 cores, 3GB RAM per core and 2TB storage. One half of cluster [4] is used for IISAS research in area of Big Data: the use of DAS (Data Analytics Supercomputer i.e. our Hadoop cluster) is essential. However, certain problem-solving techniques (e.g. in ML/DM) can cause independent computational intensive tasks. In these cases, HPC computing cluster [1] and its available GPU capacity are utilized to accelerate computations.

No.	Cathegory	Starting date	Project code	Financial source	Price (EUR)
1.	computing cluster	2012, +2014	SIVVP, ITMS=26230120002	ERDF	948'259
2.	software: Matlab MDCS 128 cores	2015	SIVVP, ITMS=26230120002	ERDF	15'000
3.	software: compilers Intel and PGI	2013	SIVVP, ITMS=26230120002	ERDF	5'545
4.	computing cluster	2010, +2012	SMART-II, ITMS=26240120029, SMART, ITMS=26240120005	ERDF	397'368

2) Electron beam litography

Among **the unique and key equipment** of the R&D infrastructure of the Department of electron-beam lithography II SAS belong 2 electron-beam lithography systems with variable beam cross-section of the electron beam: the electron-beam pattern generator ZBA 21S and ZBA 23 (Vistec) with energy of electrons 20 keV. Electron-beam lithography system ZBA23 was upgraded with 40 keV directly heated electron gun, Osprey processor and new control system software including sotware for proximity effects correction (financial support from project ERDF CENTE2, ITMS 26240120019, 2009/2013).

II SAS was the partner in the projects OPVaV-2008/4.1/01-SORO, ITMS-26240120011 and ITMS-26240120018 CENTE1 and 2 - Centre of Excelence for New Technologies in Electrical Engineering supported by European Regional Development Fund, (2009/2013).

The main results: The exploitation of new research infrastructure for R&D projects obtained in the frame of the projects after the project duration. The main new equipment operated was ZBA23 (Vistec) electron-beam lithography system upgraded with directly heated cathode at 20 and 40 keV electron energy and new operation software and proximity effects correction software.

Other equipments of infrastructure of the Department of EBL enables the evaluation and analysis of lithographic structures, preparation of thin films, photolithography, thickness measurement of thin films, processes with polymers, polyimides, chemicals and solutions and chips finalization.

The R&D infrastructure of the the Department of electron-beam lithography, II SAS, was used in the following research projects of the Institute of informatics, other Institutes of the Slovak Academy of Sciences and Institutes outside of the Slovak Academy of Sciences, and for training of students and PhD. students of FEI STU (the Slovak university of Technology):

Projects of the Institute of informatics SAS: The grants VEGA 2/0021/12 Advanced micro- and nano-technological processes using electron-beam lithography, (2012/2014); the rant VEGA 2/0134/15 Development of advanced patterning processes for nanoscale devices, (2015/2017); the international bilateral project APVV SK-GR-047-11 Molecular-friendly processes for fabrication of molecular electronic devices – MOLFAB (2013/2014); the international bilateral project APVV SK-BG-0037-10 Robust Lithography of Submicron nad Nano-dimensional Structures – RoNaLit, (2012/2013); the international bilateral project APVV SK-FR-2013-0032 Electron Spin PolaRImeTer based on thin ferromagnetic membranes, (2014/2015); the international project MAD SK-BUL Study of electron beam resists and patterning of nano-structures by electron beam lithography for gas sensor applications (2015/2017).

Projects of other Institutes of SAS: the project APVV-14-0613 Broadband MEMS detector of terahertz radiation, coordinator IEE SAS, (2015/2018).

Projects of outside of the Slovak Academy of Sciences: VEGA-1/1106/12 MEMS sensors based on nanostructured thin films for gas detection and determination of heavy metals, FEI STU (2012/2015); FEI STU; project APVV 0395-12 Photonic structures for integrated optoelectronics, FEI STU, (2013/2016); project ENIAC-JU SAFESENS No. 621272-1 Active materials for gas sensors and preparation methods, FEI STU.

The R&D infrastructure and skilled team of the the Department of electron-beam lithography, II SAS, is regurarly involved in **training of students** and PhD. students of FEI STU (the Slovak university of Technology) and **support of PhD. thesis** (FEI STU, FMFI UK, IEE SAS) with microstructures or photomasks made by e-beam lithography.

3) Speech analysis and synthesis laboratory

At the Institute of Informatics there is an acoustically treated recording studio, which was recently supplemented by new modern mixing and recording devices. The acoustic properties of the room on the low frequencies were improved in 2014 by installing effective "bass traps". The Department of speech analysis and synthesis uses the studio for taking the speech recordings and development of the speech databases.

Fig. 11 Ing. Martin Dravecký preparing the recording chain for the comparative measurements in the recording studio of II SAS

2.8.4. Description of how the results and suggestions of the previous assessment were taken into account

Suggestion 1: Active participation in the process of systematic improvement of conditions for PhD studies at the institute

The Institute management has established motivational tools to reward excellent postdocs. The management together with the Scientific Board (SB) aim to ensure that all eligible employees publish topics for prospective dissertation thesis each year. The management and the SB support activities that aim to admission of new PhD students, above all supervision of bachelor and diploma theses.

The SB and the management of the Institute are continuously making effort to increase the share of young scientists and researchers with higher qualification levels in order to increase a number of potential PhD supervisors and guarantees for both PhD programs.

Internationalization of doctoral studies at the Institute is realized by presenting the current achievements at national and international conferences, involving doctoral students in national and international research projects, as well as their involvement in the preparation of project proposals. The Institute is open to welcome students from other countries and to involve them into research in our departments and laboratories, and into projects. The problem is starting date of the PhD study. According to the law in Slovakia, PhD students can start the study only on September 1st. It would be desirable to take students according to project starting and closing dates, like in other EU countries.

The Institute and the SB organize special workshops, on which doctoral students have the opportunity to present their results and get feedback from more experienced colleagues. There are regular workshops organized in the Institute by its own researchers or by visitors of the Institute. Doctoral students take part at these workshops, too. PhD students are involved in teaching at FIIT STU.

The issues related to doctoral studies have been discussed at the SB meetings with the participation of representatives of the three major informatics faculties in Slovakia (Faculty of Informatics and Information Technology of Slovak Technical University in Bratislava, Faculty of Electrical Engineering and Informatics of Slovak Technical University in Bratislava, and Faculty of Electrical Engineering and Informatics of Technical University in Košice).

Suggestion 2: Involvement in international collaboration in basic research, possibly even in internationally funded projects

In basic research, the most valuable is an international cooperation of Dr. Britaňák with Prof. K. R. Rao (University of Texas at Arlington, Arlington, TX, USA) that led to the preparation of the book entitled "*Cosine and Sine Modulated Filter Banks: General Properties, Fast Algorithms and Integer Aproximations*". Based on the contract No. 28141 with the publisher *Springer Science+Bussiness Media*, New York, USA, the assumed deadline is to be March 31, 2017. Currently, the preparation of the book is in its final stage. Dr. Britaňák presented his results on IEEE conference ICASSP 2013, on May 26 -31, in Vancouver, Canada. Following this presentation, he was invited by dr. Grant A. Davidson from Dolby Laboratories Inc., San Francisco, USA to visit the laboratories and present his research results.

In the frame of the FP7 projects and other international projects, II SAS closely cooperates on basic research in relevant areas. One of the most valuated results in basic research was in the domain of graph data mining. It was motivated by the observation that there is a class of networks for which the community detection methods fail to deliver good community structure. The assortativity coefficient of ground-truth communities was examined and results show that assortativity of a community structure can be very different from the assortativity of the original network. The possibility of exploiting the latter by weighting edges of a network with the aim to improve the community detection outputs for networks with assortative community structure was examined. This results was obtained in connection with FP7 project VENIS and in cooperation with Department of computer and information science (IDI), NTNU, Norway.

In the frame of the FP7 project GAMMA the Department of Speech Analysis and Synthesis led by Dr. Rusko closely cooperates on basic research and development of a new security tool for Air Traffic Control with Deutschen Zentrums für Luft- und Raumfahrt (DLR), Braunschweig. The first bi-lateral meeting took place in 2015 in Braunschweig. The speaker authorization module and stress detection module of II SAS will be integrated in the DLR's Air Traffic Management and Operations Simulator (ATMOS) located in Braunschweig. The results of the common research will be published in 2016 (3 publications).

Suggestion 3: Enhancement of mutual cooperation with universities

The Institute continuously enhance mutual cooperation with universities. Cooperation is based on joint projects (VEGA, APVV, ASFEU), and on participation on educational activities at universities in Bratislava, namely Faculty of Informatics and Information technology and Faculty of Electrical Engineering and Information Technology, Slovak Technical University in Bratislava.

Among the most important joint projects are:

SMART, SMART II – with Slovak Technical University

KC – IntelinSys – with Slovak Technical University

CRISIS – with Slovak Technical University – Institute of automotive mechatronics

TraDiCe – with Slovak Technical University and Technical University Košice

BioMRCS – with Slovak Technical University – Institute of Robotics and Cybernetics

The details of the projects are in Chapter 2.4

The Institute is a member of a Central Slovak Region Center for science and education of SAS and University of Matej Bel in Banska Bystrica.

List of selected universities and departments the Institute cooperates with:

Slovak Technical University (STU), Bratislava

Faculty of Informatics and Information Technology STU Bratislava

Faculty of Electrical Engineering and Information Technology STU Bratislava

Technical University (TU) Košice

Faculty of Electrical Engineering, TU Košice

Faculty of Mechanical Engineering, TU Košice

University of Žilina, Žilina

Faculty of Arts, Comenius University Bratislava

Faculty of Mathematics, Physics and Informatics, Comenius University Bratislava

Armed Forces Academy of general Milan Rastislav Štefánik, Liptovský Mikuláš

Faculty of Mechatronics Trenčín University of Alexander Dubček, Trenčín

Pavol Jozef Šafárik University, Košice

University of Matej Bel, Banská Bystrica

- **Supplementary information and/or comments on management, research infrastructure, and trends in personnel development**

The Institute is strongly oriented on projects implementation. Project leaders together with heads of the scientific departments form the Management Boards of the Institute. The Board holds sessions at least twice a year. The role of the Board is to handle problems related to project management, financial questions and future development of the Institute. Each researcher at the Institute has to be and currently is involved at least in one project.

The Institute is well known for its success in obtaining FP projects. According to a report about the Slovak organizations participation in FP7, from the year 2012, the Institute of Informatics was the most successful organization (Slovak Academy of Sciences as a whole – all institutes together, has taken 1st place in the table bellow) in participating in FP7.
http://www.7rp.sk/uploads/tx_main/2013/02/21/Sprava_o_ucasti_SR_7RP_01.pdf

Tab. 8 Slovenské výskumné inštitúcie (REC) zapojené do 7.RP

Názov organizácie	Príspevok EK	Počet účastí	Podiel na EK príspevku
SLOVENSKÁ AKADÉMIA VIED (všetky ústavy)[29]	9 891 807,85	68	3,56
USTAV INFORMATIKY, SLOVENSKA AKADEMIA VIED	1 973 796,00	6	2,72
VIROLOGICKY USTAV SLOVENSKEJ AKADEMIE VIED	1 429 462,80	5	4,65
Institute of Electrical Engineering, Slovak Academy of Sciences	740 741,00	4	2,56
FYZIKALNY USTAV SLOVENSKEJ AKADEMIE VIED	725 400,00	3	9,86
USTAV MATERIALOV A MECHANIKY STROJOV SAV	706 070,67	3	10,40

The management together with the Scientific Board (SB) of the Institute organize once in a year evaluation seminar, where all scientific departments are evaluated according to criteria approved by the SB for the year. Criteria are elaborated for each of the researchers and include all areas that also the Institute is evaluated for.

The SB actively participates in the elaborating and commenting on materials related to conceptual and evaluation tasks of II SAS and of SAS.

The management has taken significant steps to streamline management and service activities of the Institute through optimizing the activities, and concentration of service activities in one place. The number of service employees (accountants, managers, etc.) was considerably decreased in the period of 2012-2015.

3. Research strategy and future development of the institute for the next five years (2016-2020) **(**Recommended 3 pages, max. 5 pages)

The Institute has a long-term research strategy in both the national and international context to be followed by the European Research Area, in particular within the Framework Programs and currently it is the H2020. II SAS targets are in the research of knowledge management, semantic search, semantic cloud, high performance computing (HPC), high throughput computing (HTC) and high scalability computing (HSC) applied in several areas.

In the past II SAS was engaged in security-related research (SECRICOM, REDIRNET, CRISIS) and will also do so in the future. We are dealing with security issues in different meanings, from security of citizens, protection of population, assets, IT support for crisis management, etc. Almost all research teams at the Institute are concerned with some kind of security issues. Also Cyber-security is a research area with a great potential, and one of the future research areas for II SAS, as terrorism has grasped at the web and started to use it as a potent recruitment platform.

Demand for highly dependable and secure systems is rapidly growing. Miniaturization of integrated circuits brings smaller sizes and cost reduction on one hand, but on the other hand, it also diminishes the system reliability, lifespan and smaller production yield. Increase of the reliability can be achieved on architectural level by designing the built-in self-repair (BISR) capability. The research in this area is very complex and specific for different types of cores in integrated circuits.

Another vast research domain is internet-of-things (IoT). Recent advances in the IoT technologies enabled fast development of various systems of collaborating computational devices, also called networked embedded systems. Usage of these systems is wide, one subgroup mostly consists of low-power devices and can collect various data from their environment and then it takes actions based on the results of the processed information. These systems are called cyber-physical systems (CPS). There are many different challenges in IoT and CPS, on various levels of design and integration.

Research in fields of sensor and smart robotic devices will continue in theoretical elaboration of methods and concepts to design and control complex mechatronic systems; smart or reconfigurable multi-robotic devices.

3.1. Present state of the art in both the national and the international contexts

3.2. Research strategy of the institute in the national and the international contexts, objectives and methods

The rest of this part is structured according different research areas.

Parallel and distributed computing, software engineering and complex applications

Knowledge and semantic oriented technologies

The strategy of II SAS is aimed also to help users of resource-hungry software applications to maximize the moneyand performance related benefits from adopting cloud computing. That is, taking a user application into account, we are aiming to diminish the money spending gap between the statistically average choice of a provider/service/provision and the best economical choice which is not statically known, but it requires real-time reasoning about dynamically changing rich resources within a great number of heterogeneous cloud providers. This will be achieved by developing an automated, open-source tool chain for real-time resource provision and reasoning, application deployment and management. Along with the main target of development of the automated tool chain the project has also identified additional objectives for the successful and quick on the uptake, for promotion and deployment of the developed tool chain.

II SAS has the ambition to participate in the creation of European Open Science Cloud and wants to contribute to the creation of the new knowledge based cloud tools for the European strategic area. II SAS would like to test services and tools for nanotechnology with the possibility of using the technology also for other sciences. Research strategy is also based on previous experiences in the projects of FP7 and H2020, mainly from building up the European Federative Cloud.

II SAS is focusing in its strategy on the information integration, knowledge extraction and e-service provision topics. II SAS is trying to apply the accumulated know-how in the provision of e-services to public administration bodies. The merger of service-oriented architecture, cloud computing and semantic web technologies provides a platform with unique strengths – interoperability, scalability and understanding of services and data. Web Services, as the ultimate technology implementing the service-oriented architecture concept, are very well standardized, and the interoperability of services provided by different vendors and based on different platforms is already the established fact. By applying semantic web technologies to Web Services, we can provide machine-processable descriptions of data exchanged among services and of the services themselves – their interfaces and groundings, capabilities and compositions. On the other hand, the clear definition of standards in Web Services allows us to treat the ontology defining the semantic concepts in the same way, and to provide a modular and adaptable system, which can be reused, adopted to specific scenarios and extended if necessary. II SAS prepared a H2020 project proposal also within this topic (Cassiopeia, 2014) and in the future it will continue to propose projects in this area if calls on similar topics open up. In Cassiopeia the partners were: II SAS (UISAV) Slovakia, UIBK Austria, AGH Poland, SILO Greece, UVA Netherlands, SOFT Italy, DLN Slovakia, ENU Netherlands.

Free and open access to the outputs of scientific research is crucial for accelerating scientific progress and for building of the knowledge oriented economy. Open access publishing is an integral part of open science and many authors publish in open access journals. They publish their research data openly and make available their software and models under open source licenses. Unfortunately, this information is often

buried in the text of papers and stays hidden, out of reach of machine assisted search and discovery services. II SAS seeks to improve the tooling for open access repositories by leveraging existing platforms for open access publishing with advanced semantic capabilities.

II SAS's strategy is aimed also on Public Administrations (PAs) which are a major victim of cyber-attacks: fixing, maintaining and extending their cyber-security safe boundary (while minimizing attack surfaces) is a first-class concern. The best way to tackle these challenges (optimizing the cost/benefit ratio) is to consider firstly the "human factor", a pivotal element in the security scenario: the personal behaviors must comply with the defined security policies. PAs are aware of risks and adopts policies compliant with EU and national directives. However, the enforcement of these policies is difficult, in particular as for employees' behavior. Scenarios include: 1) Bring Your Own Device (BYOD) Policies: personal devices entering the PA's boundary must strictly adhere to the security policies established; 2) Work Asset Use Policies: portable work devices (e.g. laptops) temporarily leaving the PA's boundary must strictly adhere to the security policies established once returned back; and 3) Private Asset Use Policies: work portable devices that can be used at home can check the employee's private network in order to secure it, thus defending the enlarged PA's security boundary. II SAS is preparing in the near future the SIMPATICO project within HORIZON 2020 which will address the "human factor" developing a Personal Security Assistant platform for Public Administrations, which will include: 1) a Personal Assistant Application which will address individuals/employees, monitoring behaviors (as for professional, behavioral and psychological profiles), informing about cyber-security risks, and suggesting mitigation actions; 2) an Organizational Assistant Application which will take into account the organization profile (including relations between employees) to check consistency and effectiveness of applied policies, monitor the global PA's behavior, and suggest actions to mitigate the risks; 3) a Security Notification Dashboard which will motivate and engage employees, providing immediate and easy-to-perceive messages on threats.

Cyber-security is a research area with a great potential, and one of the future research areas for II SAS, as terrorism has grasped at the web and started to use it as a potent recruitment platform.

Public web forums serve a number of purposes, all of which need to be understood in order to exploit their potential for intelligence services effectively. In the context of terrorism, the use of public media as means of ideological conversion to radicalism, to committing or supporting terroristic threats, has already been well documented. In a liberal society, however, police and security forces tend not to interdict such broadcasting - in general, this is unfeasible - rather they are seeking to use them as means of intelligence information source. Acquiring details of viewers or subscribers to relevant services is often the first step to identify a potential individual prone to radicalism. This is the first building block of intelligence - establishing an online identity of a person of interest, and then developing a wider picture, tracking groups with weird sentiments, growing networks, locations, life patterns and converting an online ID into a real physical identification, which opens up the chances for a physical pursuit of terrorists. The tools to do this include web crawlers, which can seek out activities of a particular kind on the web and report back, speculative searching for combinations of keywords, building network maps through means similar to those used for the other forms of social media intelligence (such as used for marketing, etc.), and developing basic grounds for suspicion based on the kind of the information viewed, etc. Some service providers can be more supportive than others in assisting such efforts and only in certain circumstances a relevant law would place a duty to act against suspicious individuals. For example converting an online ID into a real-world ID can be straightforward where the service provider is obliged to do so, but in up to 25% this is not the case, therefore further intelligence effort is required in order to triangulate the ID involved through a larger quantity of online activity data, or monitor the activity for a longer time in hope that a new online ID (offenders of course often create several IDs) would provide the missing opportunity.

As criminals, terrorist or offenders hiding out, grow in sophistication, their tendency to gravitate to more secure online habitats, such as peer to peer networks, or dark web applications, increases. However, it is a mistake to assume that only the most sophisticated guys would perpetrate a crime or closely support real attacks. Thus, monitoring the public-space activity at low levels of sophistication, using relatively straightforward techniques, is still being worthwhile.

There is an immense scope for significant and impactful innovation in support of law enforcement endeavors against serious, organized crime and terrorism. The technology that is capable of delivering such innovations may already exist, but so far not linked with law enforcement goals; or, it can also happen that a new ground is broken in pursuit of a law enforcement goal - and then become applicable for a wider picture.

The traditional intelligence development against such targets has been more geared up to offline methods. Police needs tools that can be used in the new normality of a high connected, mobile and data-rich world. However, these must be understood as tools that serve a core set of law enforcement functions - to identify, manage and mitigate risks.

To address the growing use of web by terrorists, II SAS has initiated the preparation of the H2020 proposal TRICE in 2015, together with an international consortium targeting mainly Central Europe, with the help of experts from UK and France: II SAS Slovakia, TUW Austria, SEL United Kingdom, SBA Austria, CUNI Czech

Republic, AGH Poland, ADS France, DLN Slovakia, PPBW Poland, DLP Hungary. The goal of II SAS was to create the environment for fusion and archiving multi-modal data from the web, including text, videos and images, and to provide tools to extract information from these data which can be analyzed with the goal to identify potential terrorism-related information, as well as authors.

II SAS has a tradition in the R&D within crisis management and its strategy is geared to a new technology. The individual (separated) approach is typical for tactical and command point of view in registering of task forces and resources of emergency service (ES) agencies, nowadays. Described situation at regional and/or cross-border scope blocks effectively response planning and scenario building, especially in case of middle and large disasters across country borders.

One of the application areas for HPC, HTC and HSC areas is nanotechnology. Nanotechnology is a dynamic multidisciplinary area of research with roots in physics, chemistry, biology, materials science and engineering, and in other sciences with a mission to observe, understand and to manipulate matter at the nanoscale with the ultimate objective to integrate nanotechnology into our everyday lives. The main problem the nanotechnology community currently has to face is the need for frequent and cumbersome porting and moving application codes onto or between different HPC platforms, the necessity to be an expert in performance tuning on the platforms on which the application codes are ported and a slow and cumbersome data exchange/flow between different research participants (in simulation – experiment, simulation-simulation, and experiment -experiment settings).

In this context, II SAS is engaged in the development of a platform targeting the whole nanotechnology community. Since we have identified this community as a cross-domain community, the platform should be also cross-domain oriented. It targets the areas, which have been identified by the community asking for the greatest improvements: in collaboration, sharing of data and resources, joint definition and execution of virtual experiments as well as in the systematic support of indexing and search capabilities for publications, experiments and data produced by the nanotechnology community. The platform should enable the increased use of the HSC computing paradigm, granting easy, comfortable and secure access and using even larger computing facilities. It should help to address the needs of huge data exchange/sharing among the diverse research participants (theory/simulation, experiment) with access to a long-term, indexed and well organized data storage, and it should improve the convenience and quality of visualizations and data animation. The communication channels would also be improved by the application of semantic and knowledge technologies. In order to achieve this goal, II SAS has initiated two H2020 proposals, one (NanoCloud, 2015, 12.5 points out of 15) in the topic of Virtual Research Environments, and another one (NanoWorks, 2016, under evaluation) in research infrastructures related topics for beginners´ communities. Both projects were prepared by a strong international research consortia with partners from nanotechnology area, from ICT, as well as from academia and industry: MTA SZTAKI Hungary, IPSAS Slovakia, PSNC Poland, KIT Germany, II SAS (UI SAV)Slovakia, STFC United Kingdom, ThalesNano Hungary, COMCIX Hungary, TUW Austria, UREG Germany, EKUTGermany, KCL United Kingdom, JLU Germany, ICN2 Spain, MYUK United Kingdom, NCSUUSA, OSU Japan.

Electron-beam lithography

3.1 State of art of the research in the national context:

The research in the field of advanced micro- and nanotechnological processes using electron-beam lithography is limited by equipment available. Only 3 research institutes in Slovakia deal with the electron beam lithography. All equipments are limited by resolution, precision and writing speed: the VEGAII (Tescan, Czech Republic) – system on students level, FMFI UK (Faculty of Mathematics, Physics and Informatics at the Commenius University), Elphy Quantum (Raith, Germany) - the simplest nanolitographic system installed to the scanning electron microscope IEE SAS (Institute of Electrical Engineering of the Slovak Academy of Sciences), ZBA23 (Vistec, Germany) - variable shaped electron beam system for sub-micrometer technology, UI SAV (Institute of Informatics of the Slovak Academy of Sciences).

State of art of the research in the international context:

Electron-beam lithography is the key technology in the top-down fabrication of nanoelectronic devices and systems and it is supposed to play a crucial role in the production of nanometer-scale devices in nanophotonics, nanomagnetic devices, molecular nanotechnology, including NEMS and NEOMS systems as well. Currently, the best resolution can be obtained with Gaussian Beam e-beam tools due to the very small spot size and structures below dimensions of about 10 nm width can be fabricated. With the most advanced Variable Shaped Beam tools minimal structures 8 nm are realizable on substrates up to 300 mm.

3.2 Research strategy

Our research strategy in the field of new micro- and top-down nanotechnological processes and techniques is the transistion from the preparation of structures in sub-micrometer range of dimensions (> 250 nm) to nanometer dimensions (10 nm–100 nm). Our focus is on the obtaining of new knowledge and its exploitation in the field of electron-beam lithography on nanometer dimensions scale.

It will extend the research of microelectronic devices and micro-electro-mechanical systems (MEMS) to nanoelectronic devices and nano-electro-mechanical systems (NEMS) in Slovakia and collaborating foreign institutions.

Important role in this strategy plays modernization of the Laboratory infrastructure, which would allow to prepare structures in a variety of thin layers up to 10 nm with a high positioning precision on substrates sized from 10 mm up to 200 mm.

Speech analysis and synthesis

In the coming years, the Department of speech analysis and synthesis will perform basic research in the border area of verbal and multimodal communication research, speech acoustics and psychology. The research will focus on the impact of emotional states and stress on speech communication. Another major area of research will be automated speech processing using sophisticated machine-learning algorithms and large speech databases. The results will be used in practical applications in the field of emotion and stress-aware interfaces and systems to identify the speaker's speech by the presence of emotions.

3.1. Present state of the art in both the national and the international contexts

In recent decades Automatic Speech Processing is receiving more and more attention of scientists and developers. The modern computers, clusters and cloud technologies have enough computing power to fulfill the needs of the demanding speech processing algorithms. The systems have gained reliability and security level, which is good enough to be used for identification in commercial banking and insurance systems, or controlling a vehicle by voice. The most recent area of research is that of emotions in voice and multimodal communication or multimodal biometrics.

In Slovakia there are only several groups of researchers who have kept abreast of the newest trends and results in international research in automatic speech processing. The Department of the Speech Analysis and Synthesis stays in touch with them and cooperates with them whenever a complex task requires greater research team and higher working capacity.

3.2. Research strategy

The Department will continue in the cooperation with the Deutches Zentrum für Luft- und Raumfahrt (DLR) on the research and development of the security tools for the Air Traffic Controller to Pilot radio vocal communication and on the stress detection.

Practical applications of the modern Speech processing systems will be designed for government, National council (“running line” on-line transcription), local councils (meeting transcription), medical applications and media. Strong emphasis will be placed on the optimization, personification and user-friendliness of interfaces.

According to the new law the TVs have subtitle much more of their broadcast, than in the past. Therefore we have started a new project with TV Markíza on automatic subtitling of TV broadcast and debates, which has been funded by the APVV agency.

Design and diagnostics of digital systems

3.1. Present state of the art in both the national and the international contexts

Demand for highly dependable and secure systems is rapidly growing. Miniaturization of integrated circuits brings smaller sizes and cost reduction on one hand, but on the other hand, it also diminishes the system reliability, lifespan and smaller production yield. Increase of the reliability can be achieved on architectural level by designing the built-in self-repair (BISR) capability. The research in this area is very complex and specific for different types of cores in integrated circuits.

Another vast research domain is internet-of-things (IoT). Recent advances in the IoT technologies enabled fast development of various systems of collaborating computational devices, also called networked embedded systems. Usage of these systems is wide, one subgroup mostly consists of low-power devices and can collect various data from their environment and then it takes actions based on the results of the processed information. These systems are called cyber-physical systems (CPS). There are many different challenges in IoT and CPS, on various levels of design and integration.

3.2. Research strategy

Design of the built-in self-repair architectures for special cores with irregular structure (VEGA project). Research in the field of IoT (project in preparation in the cooperation with an industrial partner for the European Regional Development Fund).

Design of custom-based integrated circuits to perform specific algorithms processing vast amount of data (project in preparation in the cooperation with an industrial partner for the European Regional Development Fund).

Design of new intelligent bio-inspired methods to process data from heterogenous and distributed resources in connection with IoT (VEGA project – 2016-2018, CA15140 - Improving Applicability of Nature-Inspired Optimisation by Joining Theory and Practice - ImAppNIO).

Mechatronic and visual systems

Research in fields of sensor and smart robotic devices will continue in theoretical elaboration of methods and concepts to design and control complex mechatronic systems; smart or reconfigurable multi-robotic devices.

Application / task oriented research related to electro-mechanical structures and small / MEMS devices will be in focus in the following themes:

Design of electro - mechanical structures for sensors and small robotic devices with the possibility of non-contact/wireless energy/signal transmission (Rem: Objectives of the APVV ongoing project together with one industrial partner).

Design and control of "smart" robotic tools for specific purposes, providing new application possibilities for UAV. (Part of the new VEGA project "Network control of heterogeneous multi-agents systems", 2016-2018)

All these methods and tools represent strategic importance for application of micro- technologies and further research in advanced robotics.

The future research is going to follow the current trends in robotics heading towards the multi-agent systems a specific attention to control heterogeneous mobile robotic agents with the equipment for performing various and complex tasks. It is supposed that IoT will be the common communication and control platform.

Project APVV " **MEMS structures based on compliant mechanisms**"; the new starting project (2015 - 2018) has been oriented on investigation of MEMS structures with possibility of non-contact/wireless energy/signal transmission. The complex approach includes design, analysis and modelling of MEMS devices, mainly sensors and actuators. The goals of the projects are:

- development of tools and methods for designing, analysis and modelling characteristics of micro/ electro/ mechanical structures and systems,
- new principles of sensing together with the elaborate preparation of methodologies for designing and problem solving in MEMS sensors / actuators.

Expected outputs of the project are the methods for design, construction of experimental and specific devices and technological procedures.

Numerical mathematics and scientific calculations, and mathematical modelling and computer simulation of complex nature phenomena

3.1. Present state of the art in both the national and the international contexts

In the field of mathematical modelling and computer simulation of fires a considerable effort has been currently devoted to precising mathematical and physical models of forest fires, fires in buildings, shopping centres, road tunnels and subsequently to development of program tools. In the recent years, computer simulation of fire is used as the economically least expensive method to obtain the knowledge about ongoing fire processes and their visualization. This approach is especially valid in the case of fires in human structures (tunnels, car parks and buildings) because full-scale fire experiments in such structures could cause serious damages. Nowadays, monitoring the development of processes in the fire environment allows achieving relatively good knowledge about the dynamics of liquids and gases and existing software tools provided by CFD (Computational Fluid Dynamics) simulation enable to visualize their development. The careful verification and validation of these systems continue to enhance their quality and reliability. An important progress in such activities has been achieved by the National Institute of Standards and Technology, SP Swedish National Testing and Research Institute of Fire Technology, University of Greenwich, ETH Zurich, Lund University, and others. Fire Dynamics Simulator (FDS) is an advanced CFD-based system for simulation of fires in complex environments. Outstanding world research institutions take part in testing, verification and validation of fire simulations realized by FDS and carrying out proper fire experiments. II SAS is known as a coordinator of several full-scale fire experiments with automobiles and by carrying out their subsequent simulations using FDS. Members of the fire group were invited several times to attend fire experiments and smoke tests in SR and CR. There are not many papers dealing with parallelization of fire simulation realized by FDS, although it is often required and can significantly influence the simulation accuracy. However, such knowledge is only desired and hoped-for by the FDS-users community. Our preliminary results have shown that it is necessary to consider inaccuracies caused by parallelization, and that parallel efficiency is influenced not only by proper choice of parallelization model but also by the way of the simulation realization on a computer cluster. This research will continue. Completion of the contracts about cooperation with NDS and PPA is prepared (NDS, a.s. is a joint stock company responsible for the Program of Motorway Preparation and Construction approved by the government of the Slovak Republic providing several very important and state-regulated activities in particular: planning, preparation and construction of motorways, their maintenance, repairs and development; it was established

by the state as its 100% owner to manage the superior road infrastructure in SR; PPA Inziniering, s.r.o. is a subsidiary of PPA Control, a.s., one of leading companies at Slovak market in the field of supply of road management (motorway tunnels and motorways) and for construction companies; delivers technological equipment of motorways and tunnels). Within these contracts (in collaboration with the UNIZA University in Zilina) computer simulation of selected fire scenarios in 2 road tunnels in Slovakia (managed by NDS) will be carried out and validated by smoke experiments in situ, and visualization of smoke stratification in virtual road tunnel in the Traffic&Operation Simulator (TOS) at UNIZA (created by PPA) will be carried out by computer simulation to create an original didactic tool for tunnel operators training included in TOS.

3.2. Research strategy

The intended research is in accordance with world research trends and European and Slovakian strategic initiatives (EU tends to stimulate research, innovations, new methods, methodologies and technologies, and utilize potential of ICT for contribution to sustainable development of society and protection of citizens, communities and environment - Horizon2020, Europe2020, RIS3). The fire research team has achieved a high degree of the results acceptance on national level and abroad. A team of experts (from II SAS and TU Zvolen) established during the previous collaboration is able to model the course of forest fires by computer simulation. The outcome of their research has received a great publicity and assumptions are that computer simulation will become the subject for training specialists and will be introduced for practical HaZZ application. II SAS (in cooperation with experts from the Faculty of Special Engineering of University in Zilina) ranked among few outstanding foreign institutions that have successfully conducted full-scale automobile fire experiments in different conditions. The experimental data gathered, the experienced use of advanced fire simulators, and the knowledge about fire models and their implementations suggest a promising basis for the future research. An efficient reliable realization of fire simulations (for structures that should be carefully analyzed in terms of the fire risk – road tunnels, car parks, industrial zones, etc.) on high-performance computational infrastructure available at II SAS is a challenging issue. The fire research group at II SAS is small, but viable with a great potential of growth. It consists of mathematicians, informaticians and physicist. The group earns benefits from its interdisciplinary approach, more than 10-year knowledge and experience in the fire research field, as well as from broad contacts with relevant authorities responsible for fire safety in Slovakia and CR. A growth of the group is expected (new PhD students will be included, Ing. L. Valasek will defend his PhD theses in 2016/2017 and he will continue to work for II SAS as a postdoc). Series of workshops with representatives of FBI VSB-TUO in Ostrava (leading Czech institution in safety engineering) were organized to negotiate cooperation in selected areas. The workshops resulted in preparation of a joint research project proposal (with FBI). 3 research fellowships at FBI and II SAS were realized for PhD students (2 Czech and 1 Slovak - Ing. L. Valášek).

Processing and coding of digital signals in multimedia systems

3.1. Present state of the art in both the national and the international contexts

Perfect reconstruction cosine/sine-modulated filter banks (TDAC-MDCT, TDAC-MDST, MLT, MCLT, LD-MDCT), various exponential- and cosine-modulated filter banks are fundamental processing components in many current international audio coding standards and proprietary audio compression algorithms for the time-to-frequency representation of digital signals. Beside new filter banks these systems define quite different transform lengths which are not a power of two, specifically, the mixed-radix or composite transform lengths. Such transform lengths require new fast and efficient computational structures to be designed. Consequently, new established audio/speech coding standards have become the motivating and driving force for the research activities to design new fast algorithms or fast computational structures necessary for their efficient implementation for variety of composite transform lengths.

3.2. Research strategy

According to world and European research trends, the basic research in perfect reconstruction cosine/sine-modulated filter banks would extend knowledge in the theory of fast algorithms for their efficient implementation for variety of composite transform lengths. On the other hand, the book by V. Britanak and K. R. Rao, “Cosine and Sine Modulated Filter Banks: General Properties, Fast Algorithms and Integer Approximations”, Springer Science+Bussiness Media, New York, USA, covering the theory of perfect reconstruction cosine- and sine-modulated filter banks and theory of fast algorithms for their efficient implementation in hardware or software for modern information transform-based coding technologies will serve as an excellent source for graduate students, PhD students as well as for corporate and academic researchers studying/working in the field of audio coding and in designing audio compression systems.

Project proposals submited to 7RP or H2020	2012	2013	2014	2015
Institute as coordinator	1	2	2	1
Institute as participant	6	5	5	3

List of the projects proposals submitted to FP7 and H2020

2015

- e-Infrastructures for virtual research environments (VRE) 4. TeRrorIstic Content Extractor, TRICE, H2020-FCT-2015 Fight Against Crime and Terrorism, Topic: FCT-06-2015 Law Enforcement capabilities 2: Detection and analysis of terrorist-related content on the Internet – coordinator
- Virtual Enterprises by Networked Interoperability Services – Product Launch, VENISplus, Call: H2020-FTIPilot-2015-1, Topic: FTIPilot-1-2015, Type of action: IA 2.
- Virtual NanoTechnology Environment for Collaboration, NanoCloud, Call: H2020EINFRA-2015-1, Topic: EINFRA-9-2015, Type of action: RIA 3.
- An Interdisciplinary Research e-infrastructure Serving Climate Change Impact Modelling, Adaptation and Risk Mitigation, IRIS, Topic: EINFRA-9-2015

2014

- OPENTEL Route – "Optimal Green Intelligent Routing in real-time environment", H2020, MG-7.1-2014, coordinator
- Cassiopeia – "Cloud-based Semantic-powered Service-oriented Interoperability-ready Orchestration Platform for e-service Applications", H2020, ICT-07-2014, coordinator
- JEWEL – "Japan Europe IPTV testbed for health care and WeLl being", H2020, EUJ-4-2014
- BIOGRAPHIKA, "Next Generation Analytics for Genomics Big Data. Scalable user-oriented querying and data visualization for genomics data through innovation on graph-based cloud-powered solutions", H2020, PHC-32-2014
- EGI-Ingage – "Engaging the EGI Community towards an Open Science Commons", H2020, EINFRA-1-2014
- EBEAM – „Electron beam lithography applications" (EBEAM - Aplikácie v elektrónovej litografii) FP7-PEOPLE-2013-ITN
- SCOTTIE – "Simulator for COunter-Terrorism TraIning and Evaluation", H2020-FCT-2014

2013

- CRIIIMWEX, "CRItical Infrastructure Impacted by Weather Extremes" FP7-SEC-2013-1, coordinator
- SecureStack - "Stack of Agent-based Tools, Technologies and Practices for Secure, Trusted and Privacy-ensuring Cloud Infrastructure", FP7, ICT-2013.1.5, coordinator
- REDIRNET - „Emergency Responder Data Interoperability Network" FP7-SEC-2013-1,
- eFlock – "Cooperating Gliders for Long Term Missions", FP7, ICT-2013.2.1
- eDaddis – "Electricity Data Distributed Distiller for Integrated Services", Call FP7-ICT-2013-11, Objective ICT-2013.6.1 Smart Energy Grids
- KNOWN – "Knowledge Management Tools for QoE Evaluation and Policy Modelling", FP7, ICT-2013.5.4
- BIOGRAPHIKA – "BIOGRAPHIKA - Next Generation Analytics for Genomics Big Data. Scalable user-oriented querying and data visualization for genomics data through innovation on graph-based cloud-powered solutions", FP7-ICT-2013-11

2012

- SENSE - „Social Media Analysis for Emergency Management“ FP7-SEC-2013-1, coordinator
- STRUDEL -„STRuctured and Unstructured Data Extraction Learning“, FP7-ICT-2011-8
- SEC4SME - “Real-Time Risk Assessment and Big Data Analysis Platform for Secure eCommerce in SMEs“ FP7-SME-2013
- E-Flock - “Long Term Observation by a Flock of Regenerating Gliders”, FP7-ICT-2011-9
- CLOUDPLATFORM – “High-level platform for development and deployment of cloud services”, FP7-ICT-2011-8
- FASADA – “FPGA-based Advanced Stereoscopic Autonomous Distance-measuring Apparatus”, FP7-ICT-2011-9
- ADSIGN – “Tools for E-learning support of hearing impaired people with additional sign language information”, FP7-ICT-2011-8

4. Other information relevant for the assessment

II SAS acts as a certification authority (SlovakGrid CA, http://ups.savba.sk/ca)

IISAS operates SlovakGrid Certification Authority, which provides certificates to natural persons and to computer entities. The entities that are eligible for certification are all those entities related to organizations, formally based in and/or having offices inside Slovakia, that are involved in the research or deployment of multi-domain distributed computing infrastructure, intended for cross organizational sharing of resources, like EGI and PRACE.

Management and Scientific Board of the Institute is going to face several challenges in the next period related to transformation of SAS. In addition to many advantages of the trasformation, the Institute has to take actions to eliminate risks, especially for the smooth continuation of international projects and other cooperations. Building on our successful history in getting FP projects, to keep on in submitting projects in H2020 or the ESF. According to the rules of the EC, hourly rate for the same type of work is several times lower for researchers from new EU member states comparing to the old ones. It is a challenge for SK representatives at the EC to negotiate equal conditions for Slovak researchers in EU projects.
The Institute keeps on in developing cooperation with universities and companies in Slovakia and abroad, maintaining and developing the application potential of the Institute based on thorough research and professional experience, advanced technology and advanced research infrastructure.

The research carried out at the Institute is not focused mainly on theoretical work in the field of theoretical informatics and computer science, but mostly on research in the field of applied informatics and cybernetics, where the Institute is achieving very good results, carries out successful PhD studies and guaranties outstanding level thereof.

Bratislava, 5 August 2016

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Ing. Ivana Budinská, PhD.
director of II SAS