DEPARTMENT OF ELECTRONICS AND MULTIMEDIA TELECOMMUNICATIONS

Annual Report

2015

Technical University of Košice

Faculty of Electrical Engineering and Informatics

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Faculty of Electrical Engineering and Informatics
(Slovak Republic)

DEPARTMENT OF ELECTRONICS AND

MULTIMEDIA TELECOMMUNICATIONS

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1 DEPARTMENT PROFILE

1.1 Brief overview

The Department of Electronics and Multimedia Communications was founded in 1969. The original name of department was Department of Electronics. The Department offers three types of full-time courses:

Bachelor's Degree course lasts in normal way 3 years and is leading to degree Bc. The graduates get more-or-less practical skills in mastering

- Smart Electronics,
- Multimedia Communication Technologies.

Master's Degree course lasts in normal way 2 years and is leading to degree Ing. The graduates get theoretical and practical skills in specialization

- Smart Electronics,
- (Multimedia Communication Technologies.

Doctoral Study course lasts in normal way 4 years and is leading to degree PhD. The graduates get erudition in scientific areas

- Electronic Systems and Signal Processing,
- Multimedia Communication Technologies.

Teaching and research activities of the department are focused on advanced technologies of electronics, telecommunications and smart measuring systems. In addition to the theoretical and practical basics, the teaching is more concentrated on mobile and satellite technologies and services, automotive electronics, digital processing and transmission of multimedia signals (image, video, speech), cryptography and security in telecommunication networks, optoelectronics and optical communication, sensor systems, interactive telecommunications systems and services.

1.2 Department staff and structure

Total number of staff members is 34.

- <u>Professors:</u>   Anton Čižmár, Jozef Juhár, Dušan Kocur, Dušan Levický, Stanislav Marchevský, Ján Mihalík, Linus Michaeli, Ján Šaliga, Ján Turán
- <u>Associate Professors:</u>   Ľubomír Doboš, Miloš Drutarovský, Pavol Galajda, Ján Gamec, Ľuboš Ovseník
- <u>Assistant Professors:</u>   Gabriel Bugár, Mária Gamcová, Iveta Gladišová, Daniel Hládek, Ľudmila Maceková, Stanislav Ondáš, Ján Papaj, Ján Staš,
- <u>Research Assistant:</u>   Eva Kiktová, Martin Lojka, Matúš Pleva, Mária Švecová, Michal Varchola, Jozef Vavrek, Peter Viszlay
- <u>Support staff:</u>   Zuzana Ciulisová (Natália Topoľčanská), Viera Šumáková

2 DIVISIONS OF THE DEPARTMENT

2.1 Teaching and research laboratories

Laboratory of Multimedia Communications
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Laboratory of Optoelectronic Communications
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2.2 Special laboratories and equipments

Laboratory of measurement *is equipped by various analog and digital electronic instrumentations, data acquisition cards, computers and software as follows:*
- Agilent 81150A-002 2-channel 120 MHz Pulse-Function-Arbitrary Generator,
- Fast precise digitizer NI PXI-1033, NI PXI-5922, NI PXI-6552 100 MHz, 24 bits,
- 3 GHz spectrum analyser N9320B-TG3 3GHz with Tracking Generator,
- RF vector signal generator and analyser based on PXI by National Instruments,
- Sound and vibration analyser based on PXI - NI PXI-1033, NI PXI-4461, (24 Bit, 204.8 kS/s), NI PXI-6251,
- Reconfigurable PXI system based on FlexRIO by NI,
- Precise multimeter Agilent 3458,
- 500MHz oscilloscope with logic analyser Agilent MSO7054,
- EMC chamber,
- RLCG meter 3532-50 LCR HiTester,
- NI ELVIS II + Emona DATEx Telecommunication Board for ELVIS; Emona ETT-211 FOTEX-Fiber Optic Comm Trainer, FPGA development boards,
- Agilent N9310A RF Signal generator 9KHz to 3.0GHz,
- Logic analyser Tektronix TLA5201B,
- Arbitrary generators Agilent 33220A, Rigol, etc.,
- Digital oscilloscopes (Agilent, Tektronix, Rigol, etc.),
- Function signal generators (Agilent, Panasonic, Metex),
- Handheld multimeter (Metex, Unitest),
- Calibrator Stanford Research,
- Multimeters (Agilent 34405A, Unitrend),
- Programmable power supplies Agilent,
- Measurement systems based on PXI by National Instruments,
- Multifunction DAQ cards up to 2MHz and 18 bits by National Instruments,
- Communication cards and modules by National Instruments, e.g., GPIB, CAN, RS488, etc.,
- Remotely accessible (across the Internet) demonstration and educational stand with DAQ cards and electronic boards,
- Department multilicense for all software by NI (LabVIEW, CVI, ...).

Laboratory of communication technologies and advanced digital signal processing
- Equipment for interactive multiview video streaming for supporting education:
  - Server HP ML350pT08 E5-2609v2; HDD HP 3TB 6G SATA 7.2k
  - 3 x camera system (Bosh NBN-932V-IP DinionHD; Objektiv BoshLVF-5003N-,1/2", Cmount, 3.8-13mm, SR-IRIS; Stativ Velbon EX-630)
  - Cisco WS-C2960C-8PC-L (PoE switch)
- Advanced measurement equipments:
  - M-sequence UWB radar (frequency band: 0.2-6.5 GHz),
  - M-sequence UWB radar (frequency band: DC-2.25 GHz),
  - impulse UWB radar (frequency band: 0.1-6 GHz),
  - Anritsu MG3700A vector signal generator,
  - Tektronix digital storage oscilloscopes,
  - Agilent logic analyzer,
  - WiFi 802.11a/b/g link.

- Video and audio processing equipments:
  - Handycam SONY DCR SR 290,
  - 3CCD HDD camera Everio for HDD recording,
  - computer INTEL Pentium IV with satellite card STAR for reception and recording of packet oriented services and transmission of video-streams into IP networks,
  - satellite Dreambox receiver supported by computer with Linux operating system,
  - satellite receiver with 125cm parabola antenna and DISEC motor, combined DVB-S and DVB-T receiver,
  - GPS receivers ASUS, large plasma SAMSUNG display with 108 cm diagonal,
  - Pioneer sound laboratory system with recording and reproducing capabilities.
- Computers:
  - 4-core application DELL server,
  - 11 PC Pentium IV computers (2,8 GHz, HDD 200GB) and 10x 17''-LCD monitors.
- Software tools and development boards:
  - SystemView and IT ++ simulation software,
  - CAD-CAE development tools for FPGA Mentor Graphics (26 licenses) and Altera; FPGAs (16 licenses), Nanometer IC Design- HEP (Higher Educational Program) Mentor Graphics (30 licenses)
  - development tools for Analog Devices Blackfin DSPs (16 licenses),
  - Altera FPGA development boards:
    - 1x UP-1 basic development board for Altera FLEX10K FPGA family,
    - 2x UP-3 basic development board for Altera Cyclone FPAG family,
    - 1x NIOS II development board for synthetic 32-bit soft processors in Altera Cyclone FPGAs,
    - 1x Stratix DSP development kit for testing and development DSP algorithms in Stratix FPGA, support for analog signal processing up to 100 MHz , integrated AD and DA converter; 1xCyclone II DSP development kit with video input daughtercard for testing and development of video signals in Cyclone II FPGA.
  - Analog Devices Blackfin DSP development boards:
    - 8x development board EZ-KIT 533 600 MHz with Analog Devices signal processor Blackfin ADSP21533,
    - 2x development board EZ-KIT 561 600 MHz with Analog Devices signal processor Blackfin ADSP21561,
    - 5x development board EZ-KIT 535 350 MHz signal processor Analog Devices Blackfin ADSP21535,
    - 2x extender for video signal processing with Blackfin DSPs; 1x HS-USB Emulator for Blackfin DSPs.
  - Development boards for 32-bit Freescale microcontrollers:
    - 10 x development board of 32-bit microcontroller Freescale M52233DEMO with ColdFire V2 core and integrated Ethernet communication interface,
    - 2 x development board Freescale M5329EVB with ColdFire V3 core and cryptographic coprocessor.
  - Freescale development tools for RadioFerequency (RF) ZigBee networks:
    - 1x 1321xNSK: Freescale Network Starter Kit with highly integrated chips (CPU + RF), external emulation interface,
    - 8x ZigBee RF interface with integrated 2.4 GHz antenna and SPI interface.
  - Development tools for 8-bits microcontrollers:
    - 7x development boards based on Analog Devices ADuC83x microconverters with embedded 16 a 24-bits AD converters.

Laboratory of optoelectronics
- Fiber optic education system:
  - Optical bench with 2 x HeNe laser,
  - Fiber optic power meter,
  - Fibre optic transmitter (7 x transmit module with LED diode – 565, 583, 635, 660, 830, 850 and 900 nm),
  - Fibre optic receiver (2 x receive module with PIN diode),
  - Optical bench (the simulate attenuation: air gap, axial displacement and angle of approach),
  - Fiber optic (plastic fibre 0.5, 5, 10, 20 and 50 m; glass fibre 1 and 20 m),
  - Coaxial cable (100 m),
  - Storage case (add-on transformer),
  - Opto-couplers.
- Unique optoelectronic devices:
  - Optical Cambridge correlators,
  - Fiber optic refractometer,
  - Optically powered system,
  - Weather sensor (measured: temperature, relative humidity, density of floating particles in the air).
- Advanced optoelectronic equipments:
  - FSO system LightPointe Flight Strata 155E (Free-space wavelength 850 nm, full-duplex 155 Mbps, operational range 2000 m clear air and 1000 m extreme rain),
  - FSO system FSona SONAbeam™ 155-E (Free-space wavelength 1550 nm, full-duplex 125 Mbps, operational range 3500 m clear air and 1700 m extreme rain),
  - Near-Infrared Spectrometer NIRQuest256-2.1 (wavelength range: 900 to 2050 nm),
  - OTDR: EXFO FTB-200 (compact platform for multilayer, multimedium testing),
  - All-Fibre Handheld OTDR—AXS-110 (wavelengths: 1310/1490/1550/1625/850/1300 nm),
  - Fusion splicer Fitel S178 (applicable fibers: SM, MM, DSF, NZD, EDF, BIF/UBIF (Bend insensitive fiber)),
  - Fiber Power Meters KI 7600C Series (options for 600 - 1700 nm, +27 to -70 dBm, SMF, MMF and large core (0.2 - 3 mm) fiber).
- Computers:
  - Server (PC Pentium III),
  - 2 x PC Pentium IV computers (2,8 GHz, HDD 200GB),
  - 6 x Laptop,
  - Switches (16 ports and 8 ports)
  - Web cameras, printers, scanners,…
- Software tools:
  - System RSoft's simulation software of optical communication:
    - Software OptSim (simulate single mode optical communication systems at the signal propagation level),
    - Software ModeSYS (simulate multimode optical communication systems at the signal propagation level),
- Microwave measuring bench for cm waves with klystron power.

Laboratory of multimedia and network security
- Advanced equipments:
  - 6x VoIP phones,
  - 3x Wireless LAN controllers,

- ◆ Intrusion detection system,
- ◆ 3x Terminal server AUX,
- ◆ Exchange for DSL,
- ◆ Exchange for PSTN.
- Computers:
  - ◆ Server (Monitor, CD/DVD/Blue ray,…),
  - ◆ 6x Switch,
  - ◆ 9x L3 Switch distribution,
  - ◆ Wifi 802.11a/b/g Access Point (Asus WL 520g),
  - ◆ 6x Access point,
  - ◆ 6x Lightweight Access Point,
  - ◆ 12x PC Pentium IV (2,8 GHz, HDD 200GB, Windows/Linux),
  - ◆ 13x 17''-LCD monitors, LCD TV Samsung 40" Full HD,
  - ◆ 6x Web cameras,
  - ◆ 10x Routers (3x with VoIP accessories),
  - ◆ 2x Firewall (for VoIP services).
- Videoconferencing system Eagle,
- Magio box.

Laboratory of speech and mobile technologies in telecommunications

- Telecommunication server, equipped with 12 port Dialogic D120JCT, three GSM gateways, Skype box, SIP Linksys Gateway, Cisco VoIP Gateway a PSTN link,
- Spoken language dialogue system, developed in the scope of national research project, enabling information retrieval using voice interaction between human and computer in Slovak language through telecommunication network and it finds information distributed in Internet(prototype). It serves as platform for development of speech and mobile technologies and human – computer interaction,
- Application server for research and development in the domain of speech and language technologies (XEON 2GB RAM, 2TB HDD, OS Debian Linux),
- Computing server for speech analysis and synthesis (HP ProLiant DL380 G7, 2xCore2Quad 2.4GHz, 12GB RAM, 4x HP 146-GB 6G 10K 2.5" DP SAS HDD),
- CorpusServer (DVB-T, speech data recording, text data collecting),
- Collection of „opensource" and own software tools for research and development of speech and language technologies,
- Speech and text corpuses, containing more than 500 hours of annotated speech recordings and 2 billion tokens of text in Slovak language
- PC workstations (6 pcs) and notebooks (15 pcs),
- IBM DS3300 + 2x x3650 M3 + x3850 X5 + x3650 M4 + 2x x3630 M4 computing and data storage centre. The DS3300 provides scalable storage array which is used for text and speech databases, consisting of 12 SATA disk bays (23TB installed) with iSCSI interface. The high performance 6x4CPU servers are used for acoustical and language modelling issues, which could be parallelized and needs also a huge storage and high performance access to the databases. One of them contain Tesla K40 GPGPU card for massive parallel computing tasks. These servers provides also totally 404GB of memory which is necessary for this type of tasks,
- The VoIP Traffic Generator and Analyzer consisting of the Abacus 50 GigE test system and ClearSight™ Analyzer & Network Time Machine,

- TIMS (Telecommunication Instructional Modelling System) - hardware and software based platform for modelling telecoms theory and techniques within the laboratory telecommunications and signal processing courses,
- OPNET Modeller Simulator is the world leading discrete event R&D network tools, providing research environment for design, modelling, simulation and analysis of many types of communications networks,
- Hand-held Bruel & Kjaer Analyzer Type 2270 for sound and vibration measurement, analysis and recording,
- Acoustic measurement system Audiomatica (Clio FW Standard 10, Clio Pre-01 Mk2, Clio QC Box Model 5, CLIO accelerometer ACH-01, mics, notebook.

3 TEACHING

3.1 Courses

Bachelor Degree Course (title Bc.) –Smart Electronics
Bachelor study is aimed at achieving the theoretical basics and practical skills of automotive, industrial and consumer electronics. Students achieve a good understanding of linear and nonlinear circuits, digital electronics and microprocessor technology, electronic measuring systems, optoelectronics and RF technology.

Bachelor Degree Course (title Bc.) –Multimedia Communication Technologies
Bachelor study is aimed at achieving the theoretical basics and practical skills in telecommunications systems and networks. Students achieve good knowledge of telecommunications services, telecommunications management and economics in telecommunications.

Master Degree Course (title Ing.) –Smart Electronics

The Master degree engineering program is oriented to achieve advanced skills in electronics for information and communications technology. The object of study is the methods of analysis and design of advanced systems based on signal processors, optoelectronics, smart measuring systems, digital signal processing and cryptography.

Master Degree Course (title Ing.) – Multimedia Communication Technologies
The Master degree engineering program is oriented to achieve advanced skills in digital communication and transmission systems, mobile and satellite communications, optoelectronics communication systems and multimedia communication.

Ph.D. Degree Courses (title Ph.D.) –Electronic Systems and Signal Processing

The Ph.D. degree program is orientated into the field of digital image and speech encoding and transmission, optoelectronics systems and digital filtering as well as design of electronic and optoelectronics systems, sensor systems and digital circuit's simulation.

Ph.D. Degree Courses (title Ph.D.) –Multimedia Communication Technologies

The Ph.D. degree program is orientated on achieving expert level knowledge in the field of multimedia communications, mobile and satellite communications as well as modern telecommunication technologies and networks, digital signal processing in telecommunications.

3.2 List of subjects taught

3.2.1 Study plan for Bc. degree

Undergraduate Study (Bc.) – Automotive Electronics

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Basics of electronics	2nd	2/3	Galajda
Analogue circuits	3rd	3/2	Kocur
Digital electronics	3rd	3/2	Galajda
Signals and systems	3rd	3/2	Mihalík, Gladišová
Measurements in electronics and telecommunications	4th	2/3	Šaliga
In electronics design environment	4th	3/2	Galajda
Active and passive safety systems of cars	5th	3/2	Gamec
Automotive electronics	5th	3/2	Gamec
Microwave circuits and systems	6th	3/3	Gamec
Programming of embedded systems	6th	2/3	Drutarovský

Undergraduate Study (Bc.) – Smart Electronics

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Basics of electronics	2nd	2/3	Galajda
Analogue circuits	3rd	3/2	Kocur
Basics of telecommunications technology	3rd	3/2	Levický
Digital electronics	3rd	3/2	Galajda
Signals and systems	3rd	3/2	Mihalík, Gladišová
Measurements in electronics and telecommunications	4th	2/3	Šaliga
Microwave circuits and systems	4th	3/3	Gamec
In electronics design environment	4th	3/2	Galajda
Networks technology 1	4th	3/2	Levický
Communication acoustics	4th	3/2	Juhár
Bachelor thesis	5th	0/6	Juhár
Graphical programming	5th	3/2	Šaliga
Microprocessor technology	5th	3/2	Drutarovský
Networks architecture	5th	3/2	Čižmár
Automotive electronics	5th	3/2	Gamec
Electromagnetic waves and antennas	5th	3/2	Ovseník
Interactive electronic and communication systems	5th	2/3	Juhár
Videocommunications	5th	3/2	Mihalík
Multimedia database systems	5th	2/3	Juhár
Networks technology 2	5th	2/2	Levický
Programming of embedded systems	6th	2/3	Drutarovský
Active and passive safety systems of cars	6th	3/2	Gamec
Optoelectronic systems	6th	3/2	Turán
In electronics design environment	6th	3/2	Galajda
Satellite technology and services	6th	3/2	Marchevský

Undergraduate Study (Bc.) –Multimedia Communication Technologies

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Basics of electronics	2nd	2/3	Galajda
Analogue circuits	3rd	3/2	Kocur
Basics of telecommunications technology	3rd	3/2	Levický
Digital electronics	3rd	3/2	Galajda
Signals and systems	3rd	3/2	Mihalík, Gladišová
Measurements in electronics and telecommunications	4th	2/3	Šaliga
Multimedia technology	4th	3/2	Levický
Networks technology 1	4th	3/2	Levický

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Communication acoustics	4th	3/2	Juhár
Microwave circuits and systems	4th	3/3	Gamec
Bachelor thesis	5th	0/6	Juhár
Communication technology 1	5th	3/2	Marchevský
Networks architecture	5th	3/2	Čižmár
Electromagnetic waves and antennas	5th	3/2	Ovseník
Graphical programming	5th	3/2	Šaliga
Interactive electronic and communication systems	5th	2/3	Juhár
Multimedia database systems	5th	2/3	Juhár
Mobile technologies and services	5th	3/2	Doboš
Videocommunications	5th	3/2	Mihalík
Networks technology 2	5th	2/2	Levický
Communication technology 2	6th	3/2	Maceková
Programming of embedded systems	6th	2/3	Drutarovský
Optoelectronic systems	6th	3/2	Turán
Satellite technology and services	6th	3/2	Marchevský

3.2.2 Study plan for MSc. degree

Graduate Study (Ing.) – Smart Electronics

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Circuit theory	1th	3/2	Galajda
Digital signal processing	1th	3/2	Mihalík, Gladišová
Optoelectronics	1th	3/2	Turán
Signal and communication interfaces	1th	3/2	Šaliga
Applied cryptography	1th	3/2	Levický
Programmable logic circuits	1th	3/2	Drutarovský
Signal processors	1th	3/2	Drutarovský
Smart antennas	1th	3/2	Ovseník
Digital image processing and coding	2nd	3/2	Mihalík
Diploma project 1	2nd	0/6	Juhár
Processing and transmission of speech and audio signals	2nd	3/2	Juhár
Smart measuring systems	2nd	3/2	Šaliga
Design of integrated circuits for smart applications	2nd	3/2	Galajda
Optical communication systems	2nd	3/2	Turán
High frequency and microwave technology	2nd	3/2	Gamec
Telecommunication systems theory	2nd	3/2	Čižmár
Diploma project 2	3rd	0/6	Juhár
Digital television systems	3rd	3/2	Marchevský
Photonics	3rd	3/2	Turán
Advanced speech applications for communication technology	3rd	3/2	Juhár
Advanced communication systems	3rd	3/2	Kocur
Medical electronics	3rd	3/2	Michaeli
Smart security systems	3rd	3/2	Marchevský
UWB sensor networks	3rd	2/2	Kocur

Graduate Study (Ing.) – Multimedia Communication Technologies

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Applied cryptography	1th	3/2	Levický
Digital signal processing	1th	3/2	Mihalík, Gladišová
Optoelectronics	1th	3/2	Turán
Signal and communication interfaces	1th	3/2	Šaliga

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Programmable logic circuits	1th	3/2	Drutarovský
Signal processors	1th	3/2	Drutarovský
Smart antennas	1th	3/2	Ovseník
Localization in wireless and mobile systems	1th	3/2	Doboš
Diploma project 1	2nd	0/6	Juhár
Processing and transmission of speech and audio signals	2nd	3/2	Juhár
Optical communication systems	2nd	3/2	Turán
Telecommunication systems theory	2nd	3/2	Čižmár
Design of integrated circuits for smart applications	2nd	3/2	Galajda
Digital image processing and coding	2nd	3/2	Mihalík
High frequency and microwave technology	2nd	3/2	Gamec
Smart measuring systems	2nd	3/2	Šaliga
Diploma project 2	3rd	0/6	Juhár
Mobile communications	3rd	3/2	Doboš
Multimedia technologies	3rd	3/2	Levický
Advanced speech applications for communication technology	3rd	3/2	Juhár
Advanced communication systems	3rd	3/2	Kocur
Digital television systems	3rd	3/2	Marchevský
Photonics	3rd	3/2	Turán
UWB sensor networks	3rd	2/2	Kocur
Satellite technology and services	6th	3/2	Marchevský

Graduate Study (Ing.) – – Advanced Materials and Technologies in Automotive Electronics

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Digital signal processing	1th	3/2	Mihalík, Gladišová
Programmable logic circuits	1th	3/2	Drutarovský
High frequency and microwave technology	2nd	3/2	Gamec
Design of integrated circuits for smart applications	2nd	3/2	Galajda
Smart measuring systems	2nd	3/2	Šaliga
Advanced communication systems	3rd	3/2	Kocur
Smart security systems	3rd	3/2	Marchevský
UWB sensor networks	3rd	2/2	Kocur

3.2.3 Study plan for Ph.D. degree

Graduate Study (PhD.) –Electronic Systems and Signal Processing

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Electronic circuits and signals and systems theory	1th	0/5	Kocur
Foreign language 1	1th	0/2	
Research activities 1	1th	0/5	Turán
Foreign language 2	2nd	0/2	
Complex electronic systems and advanced signal processing methods	2nd	0/5	Kocur
Specialization subject	3rd	0/5	Turán
Research activities 2	3rd	0/5	Turán
Research activities 3	5th	0/5	Turán
Research activities 4	6th	0/5	Turán
Research activities 5	7th	0/5	Turán

Graduate Study (PhD.) – Multimedia Communication Technologies

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Multimedia and communication systems theory	1th	0/5	Juhár
Foreign language 1	1th	0/2	
Research activities 1	1th	0/5	Levický
Foreign language 2	2nd	0/2	
Modern multimedia communication technologies	2nd	0/5	Juhárr
Specialization subject	3rd	0/5	Levický
Research activities 2	3rd	0/5	Levický
Research activities 3	5th	0/5	Levický
Research activities 4	6th	0/5	Levický
Research activities 5	7th	0/5	Levický

4 RESEARCH AND PROJECTS

4.1 International scientific projects

Project title: **Trustworthy Manufacturing and Utilization of Secure Devices**
Acronym: TRUEDEVICE
Number: COST Action IC1204
Program/agency: COST
Coordinator from TU: doc. Ing. Miloš Drutarovský, CSc.
Project partners: 17 partners from university, research and industrial institutions
Start of project: December 12/2012
End of project: December 11/2016
Total founding: not defined
Annotation: Hardware security is becoming increasingly important for many embedded systems applications ranging from small RFID tag to satellites orbiting the earth. Its relevance is expected to increase in the upcoming decades as secure applications such as public services, communication, control and healthcare will keep growing. The vulnerability of hardware devices that implement cryptography functions (including smart cards) has become the Achilles's heel in the last decade. Therefore, the industry is recognizing the significance of hardware security to combat semiconductor device counterfeiting, theft of service and tampering. This COST Action aims at creating a European network of competence and experts on all aspects of hardware security including design, manufacturing, testing, reliability, validation and utilization. The network will play a key role in developing solutions responding to the hardware security challenges, hence strengthening the position of Europe in the field.

Project title: **Wireless Power Transmission for Sustainable Electronics**
Acronym: WiPE
Number: COST Action IC1301
Program/agency: COST
Coordinator from TU: doc. Ing. Pavol Galajda, CSc.
Project partners: 22 partners from university, research and industrial institutions
Start of project: October 24/2013
End of project: October 23/2017
Total founding: not defined
Annotation: The COST Action activity aims to address efficient Wireless Power Transmission (WPT) circuits, systems and strategies specially tailored for battery-less systems. Battery-free sensors, passive RFID, Near Field Communications (NFC) are all closely related concepts that make use of WPT and energy harvesting systems to remotely power up mobile devices or to remotely charge batteries, contributing to develop and foster the Internet of Things (IoT) evolution.
In this context, this COST Action aims at bringing together RF circuit and system designers with different backgrounds to: 1) provide enhanced circuit and subsystem solutions to increase the efficiency in WPT; and 2) investigate the use of novel materials and technologies that allow minimizing cost and maximizing integration of the electronics with the environment and with the targeted applications.

Project title: **Innovative ICT Solutions for the Societal Challenges**
Acronym: INNOSOC
Number: 2015-1-HR01-KA203-013124
Program/agency: Erasmus+

Coordinator from TU: Ing. Mária Gamcová, PhD.
Project partners: Croatia, Slovakia, Hungary, Spain, Romania, Bulgaria, Germany, France
Start of project: 09/2015
End of project: 08/2017
Total founding: not defined
Annotation: The main objective of the INNOSOC project is to set up a transnational multidisciplinary intensive study program in the field of innovations based on information's and communication technology targeting societal challenges defined by Europe 2020 and Horizon 2020 programs.
Student projects will be based on the "blended" mobility approach and organized in two phases: (i) preparatory (virtual mobility); and (ii) execution phase (physical mobility). Physical mobility will be implemented through three two-week workshops hosted by partner universities in 2016 (Zagreb), 2017 (Leipzig) and 2018 (Valencia). Workshop participants will be professors (16 professors from 11 universities from 8 countries) and students (100 students from 11 universities from 8 countries) from partner universities.
Multilingual (on 8 EU languages) open course materials on innovation and entrepreneurship including case studies on how ICT can contribute to innovative societal development will be made free to access through the project web site. In that way INNOSOC project will have significant impact on national and EU level through serving on the long-term benefit of all citizens, academia and industry.

Project title: **Wireless Sensor Network for Water Quality Monitoring**
Acronym: WSN-AQUA
Number: HUSK/1101/1.2.1/0091
Program/agency: Hungary-Slovakia Cross-border Co-operation, Programme 2007-2015
Coordinator from TU: prof. Ing. Dušan Kocur, CSc.
Project partners: LP - BME-Infokom Innovátor Nonprofit Ltd., Budapest, Hungary
Start of project: 07/2013
End of project: 06/2015
Total founding: 164.462,00 EUR
Annotation: The overall objective of the joint research project is to build an intensive co-operation between Hungarian and Slovak R&D partners in order to strengthen the economic competitiveness of the cross-border area and to develop the capacities on both sides of the border jointly. The specific purpose of the project is to develop a wireless sensor network applied for water quality monitoring in order to contribute to environment protection with stress to the river Dunaj which can be extended to further rivers and water. It will show good engineering solution to be applied for a lot of applications in the field of environment protection on both sides of the border. The main result of the joint research project will represent the new, vintage technological solution for the water quality monitoring of the river Dunaj represented by the wireless sensor network based on the application of the advanced information and communication technologies, electronics, signal and data processing. It is expected that the utilization of the project results could be included into a production programme of Hungarian and Slovak companies. The implementation of that approach will result in strengthening the economic competitiveness of this area.

Project title: **Research and Development of Modules for Language-Adaptive Multimodal Interfaces**
Acronym: MOLAMI
Number: SK-HU-2013-0015
Program/agency: APVV
Coordinator from TU: Ing. Stanislav Ondáš, PhD.

Project partners: University of Miskolc, Hungary
Start of project: 01/2015
End of project: 12/2016
Total funding: 3.000,00 EUR
Annotation: Goals of the proposed project are research and development of the modules of the multimodal human-machine interfaces, where the multilingualism resp. easy language adaptation plays the important role. Designed interface will be tested on Slovak as well as Hungarian languages. Modules for the language-adaptive multimodal HMI together with joint publications and joint participation on conferences will be the results of proposed project.

Project title: **Integrating Biometrics and Forensics for the Digital Age**
Acronym:
Number: COST Action IC1106
Program/agency: COST
Coordinator from TU: Ing. Matúš Pleva, PhD.
Project partners: 27 partners from university, research and industrial institutions
Start of project: March 14/2012
End of project: March 13/2016
Total founding: not defined
Annotation: Forensics is the application of a broad spectrum of sciences to answer questions of interest to a legal system. This may be in relation to a crime or a civil action" [Wikipedia]. Since many such questions boil down to identifying, or verifying the identity, of people allegedly involved in some action, a clear relationship exists between forensics and biometrics. Biometrics developed a number of techniques which can clearly facilitate the identification of people involved in criminal actions or civil incidents. Thus, although the two communities have traditionally often operated in relative isolation, there are many scenarios where the synergic cooperation of multimodal biometrics and forensics can be successfully applied. To address such multifaceted areas it is important to develop an interdisciplinary network with complementary competences, to foster the birth of a new community which can develop novel technological solutions to crucial issues and new challenges in forensic science.

Project title: **Technological Transfer Network**
Acronym: TecTNet
Number: 544197-TEMPUS-1-2013-1-IT-TEMPUS-JPHES
Program/agency: TEMPUS
Coordinator from TU: prof. Ing. Ján Šaliga, PhD.
Project partners: 11 partners from university, research and industrial institutions in Italy, Portugal, Romania and Moldavia
Start of project: December 1/2013
End of project: November 30/2016
Total founding: 513.091,98 EUR
Annotation: The project proposal called TecTNet is motivated to solve some uncovered issues in the public universities in the Rep. of Moldova:
a) the lack of availability of a Master Course Program (MCP) providing advanced knowledge about the management of innovation, research and development, project management, intellectual property (IP) and technology transfer (TT), law and economy about IP protection, marketing of new products, etc.
b) the lack of availability of a standalone Office of Technology Transfer (OTT) in each university for innovation/ technological transfer and the cooperation among the public universities in Rep. of Moldova and the industry/private sector;

c) the low cooperation/promotion among Moldavian universities and the national industry/private sector in the fields of: (i) TT, (ii) IP, (iii) management of innovation, and (iv) project realization and management.

The goal of the project is to improve the quality of education and management of education in universities and industry partners in Moldavia and to enhance the technology transfer among universities and industry in Moldavia and EU countries. The expected impacts cover education (master courses), economics (Moldavian universities will improve their equipment) and social effects (new specialists for 21st centuries challenges upon the worldwide economy.

4.2 National scientific projects

Project title: **Agent Based Modelling of the Spectrum Distribution in the Cognitive Radio Networks**
Acronym: AMSD_CRN
Number: 1/0766/14
Program/agency: VEGA
Coordinator from TU: Ing. Juraj Gazda, PhD.
Project partners:
Start of project: 01/2014
End of project: 12/2016
Total funding: not defined
Annotation: The goal of the project is the design of the novel and efficient models of the spectrum trading mechanisms in CR networks. The special emphasis is put on the exploiting of the agent-based models incorporating strong interdisciplinary character. Algorithms including Bak-Sneppen model of co-evolution, Potts model describing the interacting spins on a crystalline lattice and Demon algorithm are extensively used in the assumptions. The proposed models developed within the project are able to capture the behaviour of dozen entities operating in CR network, thus provide more general solutions compared to the existing models.

Project title: **Persons Localization in 3D Under Emergency Event based on UWB Radar System**
Acronym: PerLoc-3D-UWB
Number: APVV-0404-12
Program/agency: APVV
Coordinator from TU: prof. Ing. Dušan Kocur, CSc.
Project partners:
Start of project: 10/2013
End of project: 09/2016
Total founding: 202.000,00 EUR
Annotation: Detection and positioning of human beings situated behind an obstacle have been very interesting for military, security and emergency rescue operations. Here, UWB radars using low frequencies (0.1-5 GHz) have been proposed for through wall localization of vital persons. The UWB sensors developed recently for the mentioned applications usually provide the localization in 2D only. However, the specialists for the security and rescue operations have indicated that the person localization in 3D is strongly requested. The state-of the art of person positioning in 3D has shown that the range of applications of UWB radars for the outlined scenarios are limited on the present because of the absence of efficient procedures of radar signal processing capable to localize human beings in 3D. Motivated by this state of affairs, PerLoc-3D-UWB project is intent on the development of new procedures of UWB radar signal processing to be applied for the person

detection, localization and tracking in 3D. The procedures appropriate for real-time applications will be developed for the localization of persons situated behind an obstacle for the scenarios typical for person saving and their safety increasing. The efficiency of the proposed procedures will be tested by the measurements for proper scenarios. The experimental 3D through wall UWB scanner employing the developed signal processing methods will be constructed within the PerLoc-3D-UWB project, too.

Project title: **Short-Range UWB Sensor Networks for Detection, Localization and Tracking of Moving Persons**
Acronym: UWB-SeNet
Number: 1/0563/13
Program/agency: VEGA
Coordinator from TU: prof. Ing. Dušan Kocur, CSc.
Project partners:
Start of project: 01/2013
End of project: 12/2015
Total founding: 40.931,00 EUR
Annotation: Moving person detection, localization and tracking has found a variety of applications such as object monitoring, through wall detection of moving persons during security operations and human lives saving at unrestrained disasters. UWB radars have been identified as the attractive tool for the person localization under these circumstances. The analysis of their performance has shown that due to the shadowing effect the single UWB radar cannot provide a high reliability of multiple target detection for multiple-moving person scenarios. The solution of that problem can be provided by UWB radar/sensor network (SN). Project „Short-Range UWB Sensor Networks for Detection, Localization and Tracking of Moving Persons (UWB-SeNet)" is intent on the design and implementation of the experimental UWB SN based on novel signal processing methods and new knowledge of SN theory developed within the project. Besides, the design and implementation of UWB sensor components by 0.35µm SiGe BiCMOS technology will be also studied.

Project title : **Selected Security Topics in Advanced Telecommunications**
Acronym:
Number: 1/0075/15
Program/agenc : VEGA
Coordinator from TU: prof. Ing. Dušan Levický, PhD.
Project partners:
Start of project: 01/2015
End of project: 12/2017
Funding in 2015: 17500 EUR
Annotation: Proposed scientific project is oriented to selected security aspects in the advanced telecommunication with refences to the three areas: multimedia content protection with orientation into image content authentication, image steganography and steganalysis, security of mobile networks with orientation into protected communication in network enviroment with active attacks and emotional speech analysis for speaker verification . In the area of multimedia content security the development of the new methods for multimedia content protection by using digital watermarking in colour images and image steganography are expected. In the field of mobile networks security design of new routing algorithms and algorithms for node localization are expected. In the field of emotional speech analysis design of new methods for emotional features extraction and reduction of obtained feature vectors for

Project title: **Interactive Multiview Video Streaming for Supporting Education**
Acronym:
Number: 062TUKE-4/2014
Program/agency: KEGA of Ministry of education of Slovak Republic
Coordinator from TU: Ing. Ľudmila Maceková, PhD.
Project partners:
Start of project: 01/2014
End of project: 12/2016
Funding in 2015: 8.185,00 EUR
Total founding: not defined
Annotation: The project is oriented to development and application of accessible software and hardware for interactive streaming of multimedia content, without necessity to save it in local data store. The aim of project is to elaborate and realize methods of access to various formats of multimedia content, such as video, sound record, and access to web cameras array with multiple visual angles (multiview video streaming), as well. It is planned to design multimedia educational content for exploitation of such access. That all will be dedicated for supporting teaching in 1-st to 3-rd degrees of university education in the frame of telecommunication subjects as follows: Switching Technology, Digital Television, Satellite Technologies and Services, etc. Access to learning materials mentioned above will serve naturally to support distance education.

Project title: **The Research of Coexistence between Broadband LTE Networks and Digital Terrestrial TV Broadcasting DVB-T/DVB-T2**
Acronym:
Number: APVV-0696-12
Program/agency: APVV
Coordinator from TU: prof. Ing. Stanislav Marchevský, CSc.
Project partners: Výskumný ústav spojov, n.o., Banská Bystrica
Start of project: 2013
End of project: 2016
Total founding: not defined
Annotation: The objectives of the project can be divided into main and sub-objectives, while the sub-objectives are based on the main ones and their content is supplemented.
The main objectives of the project are: 1.) Identification of areas of the Slovak Republic, which may result in degradation of the reception of DVB-T/-T2 signal as a result of the introduction of LTE800 transmission. 2.) Establishment the functional public information system to identify the risk of interference of terrestrial DVB-T/-T2 system. 3.) Proposals on measures to prevent unwanted interactions between LTE800 and DVB-T/-T2 systems and solutions leading to elimination of problems in practical operation.
The sub-objectives of the project are as follows: 1.) Analysis of the impact of mutual interference of LTE800 and DVB-T/-T2 systems on population coverage with TV signal and the ability to access broadband services to residents. 2.) The elaboration of principles for the design of LTE800 networks in order to prevent possible future problems caused by interference with networks DVB-T/-T2. 3.) Providing technical support with the design of measures to prevent adverse effects caused by interference between LTE800 and DVB-T/-T2 systems in specific cases of practical operation. 4.) Set-up the testing facility for measurement and evaluation of user equipment in terms of immunity to interference and assessment of specific user equipment.

Project title: **Electromagnetic Compatibility of Technological Equipment in Tyre Industry**
Acronym: INTRO
Number: APVV-0333-11

Program/agency: EMC-IND
Coordinator from TU: prof. Ing. Ján Šaliga, PhD.
Project partners: STU in Bratislava, Koštrukta Trenčín, a.s.
Start of project: 07/2012
End of project: 12/2015
Funding in 2015: 65.449,00 EUR
Total funding: 248.469,00 EUR
Annotation: The project deals with innovation of technological equipments in tire industry in term of EMC properties, that increase the usability, utility value and also the competitiveness of the equipment developed and designed in Slovakia, which is reflected particularly at international level. The project involves identifying sources of interference, their analysis in term of behaviour in the electromagnetic environment and suppression of their negative effects. Also parts of equipments will be identifies which are sensitive to electromagnetic interference and other task within the project realisation is to ensure their failure-free operation.

Project title: **Utilization of the Maximum Likelihood Method for Analog to Digital Interface Testing and for the Measurement of Distorted Waveforms by the Non-orthogonal Components**
Acronym:
Number: 1/0281/14
Program/agency: VEGA
Coordinator from TU: prof. Ing. Ján Šaliga, PhD.
Project partners:
Start of project: 01/2014
End of project: 12/2016
Funding in 2015: 7.641,00 EUR
Total funding: not defined
Annotation: The aim of the project is testing of the analogue to digital interfaces using the maximum likelihood method applied on the output signal samples within the time domain analysis. The research is focused on the determination of the initial conditions and iterative maximum likelihood procedures with respect to systematic errors and parasitic noise. Studied method is devoted to these application areas.
Dynamic testing properties of the AD interfaces by the method of analysis in the time domain. The proposed procedures allow to determine the parameters of static and dynamic nonlinearities in the selected points of the input range using error model as well as distortion measurement of the various stimulus signals.
The use of the maximum likelihood method on the measurement of waveforms sampled in the time and amplitude domain will be studied for identified ADC error model. The proposed method will be implemented as well as on the waveform identification where partial components are non-ortogonal.

Project title: **Mitigation of Stochastic Effect in High-Bitrate All Optical Networks**
Acronym: MISTICAL
Number: APVV-0025-12
Program/agency: EMC-IND
Coordinator from TU: Dr.h.c. prof. RNDr. Ing. Ján Turán, DrSc.
Project partners: KEMT FEI TUKE (Ovseník Ľ., Ružbarský J., Tatarko M., Tóth J.), EF ŽU
Start of project: 10/2013
End of project: 09/2016
Total founding: not defined

Annotation: The project is focused investigation in the are of linear and non-linear influences of the transmitted optical signals in the multichannel all-optical systems and networks. Main goal is to investigate origin of these effects and their impact on the transmission of various types of the high-order modulated optical signals and on mitigation of degradation mechanisms using switching and routing in all-optical multi-channel networks.

The project will be solved in three phases. In first phase the physical layer in investigated considering different mainly the stochastic effects. In the second phase also protocols for switching and routing in high-speed all-optical multichannel networks are investigated. Third phase is focused on the integration of the influences in the physical layer with the protocol design for switching and routing into one platform. It will be main precognition for creation of the new properties of the reservation protocols which will meet basic requirements for achieving most effective data transmission with the high-level quality of services through the nodes of the high-speed multichannel all-optical networks based on the OPS with next targeting into all-optical IP networks.

Project title: **The Use of TUKE PON Experimental Model in Teaching**
Acronym: PONEMT
Number: 006TUKE-4/2014
Program/agency: KEGA of Ministry of education of Slovak Republic
Coordinator from TU: Dr.h.c. prof. RNDr. Ing. Ján Turán, DrSc.
Project partners:
Start of project: 01/2014
End of project: 12/2016
Total founding: not defined
Annotation: The project will solve the implementation of broad access for students to unique equipment PON TUKE physical network model and its application in teaching.
The significant objective is the cost reduction on experimental classes, thanks instruments and accessibility of laboratory stands out of regular time schedule devoted for laboratory experiments. Developed system will be an example of measuring system for students in the subject Optical Fibre Networks.

Project title: **Digital Signature Power Analysis Attack and Countermeasures**
Acronym: DISIPA
Number: APVV-0586-11
Program/agency: EMC-IND
Coordinator from TU: Ing. Michal Varchola, PhD.
Project partners: STU in Bratislava, Micronic, s.r.o.
Start of project: 07/2012
End of project: 12/2015
Total funding: 246.658,00 EUR
Annotation: Research and development of advanced methods of side channel attacks against elliptic curve cryptography (ECC) based digital signatures schemes is main focus of this project as well as research and development of suitable countermeasures. Power analysis attack can reveal the secret of digital signatures and so alien person can sign documents using a false identity. We intend to develop and evaluate rigorous algorithmic countermeasures and countermeasures based on suitable topology of electronic circuits. These countermeasures should practically inhibit the successful attacks based on the power analysis. The result of this project will be suite of regulations, instructions, and recommendations how to use various countermeasure methods in order to avoid the power analysis attacks against digital signatures based on the ECC in various commercial or diplomatic cryptographic devices. Next goal of project is to optimize power analysis attack methods using highly parallel processor structure of the CUDA video adapters in order to shorten time which

is needed for the successful attack. The Micronic Company will be a purchaser of the developed technology. Micronic develops and produces various cryptographic devices and systems for the various state institutions and agencies as well as for the commercial market. Digital signatures based on the ECC are essential component of their devices. That is why the secure implementation of digital signatures is highly top priority for them.

5 CO-OPERATION

5.1 National co-operation

- Elcom s.r.o., Prešov
- Slovak Academy of Science
- Slovak Telekom, a.s.
- VUS - Výskumný ústav spojov, n.o., Banská Bystrica
- ZŤS výskumno-vývojový ústav Košice, a.s.

5.2 International co-operation

- Austrian Research Institute for Artificial Intelligence (OFAI) of the Austrian Society for Cybernetic Studies
- FTW Telecommunications Research Center Vienna, Austria
- Ingenieur Büro Ralf Klukas, Germany
- INESC Lisabon, Portugal
- Instituto Superior Técnico (IST), Lisbon, Portugal
- Statens Räddningsverk, Sweden
- ŠkodaAuto Mladá Boleslav, Czech Republic
- Wuhan Technological Institute, Wuhan, China
- Second University of Naples, Italy
- Technische Universität Ilmenau, Germany
- Hamburg University of Technology, Germany
- AGH University of Science and Technology Krakow, Poland
- Gdansk University of Technology, Poland
- Bulgarian Academy of Sciences, Bulgaria
- Technische Universiteit Delft, Netherlands
- Universitat Ramon Llull, Barcelona, Spain
- Universitat Politècnica de Catalunya Barcelona Tech (UPC), Barcelona, Spain
- Technical University Budapest, Hungary
- Technical University of Ljubljana, Slovenia
- Technical University of Cluj-Napoca, Romania
- University of Firenza, Italy
- University of Gent, Belgium
- University of Maribor, Slovenia
- University of Sannio, Benevento, Italy
- University of Reggio Di Calabria, Italy
- University of Gävle, Sweden
- University in Oulu, Finland
- Gjøvik University College, Norway
- Mississippi State University, Starkville, USA

6 FACULTY ESSAYS

Bugár Gabriel
Assistant professor
His research interests include hidden communication systems, steganography, steganalysis, digital image processing and watermarking, network technologies, information and network security.

Čižmár Anton
Full professor
His research interests include speech processing, data compression, digital communications, project management, telecommunication technologies and services.

Doboš Ľubomír
Associated professor
His current research interests include mobile and wireless communication systems with focus on Call Admission Control algorithms for next generation mobile systems, Routing protocols for Mobile Ad-Hoc systems, MIMO systems and Multimodal mobile systems and services (focus on Speech processing).

Drutarovský Miloš
Associated professor
His research interests include applied cryptography, digital signal processing, algorithms and architectures for embedded cryptographic architectures and sensor networks, digital signal processors, FPGAs, microcontrollers and soft microcontrollers embedded into the FPGAs.

Galajda Pavol
Associated professor
His research interests include nonlinear circuit's theory and Chaos theory, nonlinearities in digital transmission systems, analog and mixed signal ASIC design and implementation for UWB sensor systems.

Gamec Ján
Associated professor
His general research interests include digital signal processing, block - matching algorithm and motion estimation.

Gamcová Mária
Assistant professor
Her actual scientific research focuses on sensor networks and wireless communication technologies for automobiles, electronic devices, circuit theory and e-learning technologies.

Gladišová Iveta
Assistant professor
Her research interests include signal theory, vector quantization, source coding, morphology and segmentation in image processing, radar and image sensor signals processing.

Hládek Daniel
Assistant professor
His current research interests include natural language processing, language modelling and text processing for LVCSR language databases.

Juhár Jozef
Full professor
His research interests are in digital speech/audio processing and transmission, automatic speech/speaker recognition, speech synthesis, dialogue modelling and application of speech technologies in developing and deploying automatic voice services in telecommunications and Internet.

Kiktová Eva
Research assistant
Her research is oriented on the field of the acoustic event detection and classification, speaker recognition and digital speech and audio processing.

Kocur Dušan
Full professor
His research interest is in short-range UWB radar systems and sensor networks applied for detection, localization and tracking of people under disaster situations; as well as in the physical layer of wireless communication systems with the special stress to OFDM, SC-FDMA, FBMD, and OFDM/OQAM transmission systems.

Levický Dušan
Full professor
His main interests and activities are in the multimedia communications, cryptography and watermarking.

Lojka Martin
Research assistant
His current research interests include speech decoding based on WFST and front-end speech processing.

Maceková Ľudmila
Assistant professor
Her research interests or activities are in areas as follows: communications in various types of access networks, digital television, satellite communications, advanced e-learning methods and wireless sensor networks.

Marchevský Stanislav
Full professor
His main research interests are multidimensional digital filters, linear and non-linear digital filters for image processing, and design of multi-user detectors for CDMA signals from satellites.

Mihalík Ján
Full professor
His current research interest includes signal and information theory, image and video coding, digital image and video processing, application the techniques of coding and processing in the standard image and video codecs, finally multimedia videocommunications in telecommunication networks and Internet on the basis of the standards.

Michaeli Linus
Full professor
His research interests are the pre-processing systems in the instrumentation, modelling of AD and DA converters and methods for correction of their uncertainties, industrial measurement and virtual instrumentation.

Ondáš Stanislav
Assistant professor
His research interests include spoken dialogue systems, dialogue processing, spoken language understanding, speech processing and conversational agents.

Ovseník Ľuboš
Associated professor
His general research interests include digital signal processing (Video Control and Video Surveillance Systems), fiber optical sensors and the fiber optics and its applications in communications (FSO-Free Space Optics, VLC-Visible Light Communication, etc.), sensing and signal processing (Optical Correlator, etc.).

Papaj Ján
Assistant professor
His current research interests include mobile ad hoc networks (MANET), QoS, security and routing protocols for MANET.

Pleva Matúš
Research assistant
His research interests include speech processing, automatic broadcast news processing, digital communications, Voice over IP technologies and services, telecommunication technologies biometric applications and routing backbone networks.

Staš Ján
Assistant professor
His current research interests include computational linguistics, natural language processing and statistical modeling of the Slovak language for LVCSR.

Šaliga Ján
Full professor
His general research interests include ADC testing, distributed measurement systems, measurement instruments, systems and methods.

Švecová Mária
Research assistant
Her general research interests and activities are in the UWB radar signal processing for detection, localization and tracking of people under disaster situations.

Turán Ján

Full professor

His main interests and activities are in the digital signal processing, Hough transform, rapid transform, fiber optics and its applications in communications, sensing and signal processing.

Michal Varchola

Research assistant

His main research interests are cryptography for embedded systems, particularly true random number generators and elliptic curve crypto-processors, wireless sensor networks and embedded systems based on FPGAs and microprocessors generally.

Jozef Vavrek

Research assistant

His current research activities cover area of speech processing, audio events classification, automatic audio information retrieving. He is also interested in pattern recognition utilizing support vector machine classifier.

Peter Viszlay

Research assistant

His current research interests include robust speech processing and feature transformations, acoustic modeling of speech and speech recognition. He is also interested in separation of speech signals in different environments and new speech analysis approaches.

7 Ph.D. STUDENTS

Name	Supervisor	Degree Course

First year of study

Internal form:

Ing. Imrich Andráš	prof. Šaliga	Electronic Systems and Signal Processing
Ing. Pavol Dolinský	prof. Šaliga	Electronic Systems and Signal Processing
Ing. Jozef Greššák	prof. Čižmár	Multimedia Communication Technologies
Ing. Jakub Oravec	prof. Turán	Multimedia Communication Technologies
Ing. Miroslav Repko	doc. Gamec	Electronic Systems and Signal Processing
Ing. Stanislav Slovák	doc. Galajda	Electronic Systems and Signal Processing

Second year of study

Internal form:

Ing. Dávid Čonka	prof. Čižmár	Multimedia Communication Technologies
Ing. Vladimír Hajduk	prof. Levický	Multimedia Communication Technologies
Ing. Tomáš Ivaniga	prof. Turán	Electronic Systems and Signal Processing
Ing. Tomáš Koctúr	prof. Juhár	Multimedia Communication Technologies
Ing. Martin Matis	doc. Doboš	Multimedia Communication Technologies
Ing. Dávid Solus	doc. Ovseník	Electronic Systems and Signal Processing

Third year of study
Internal form:

Ing. Daniel Novák	prof. Kocur	Electronic Systems and Signal Processing
Ing. Ján Pastirčák	prof. Kocur	Multimedia Communication Technologies
Ing. Ján Ružbarský	prof. Turán	Electronic Systems and Signal Processing
Ing. Ján Schneider	doc. Gamec	Electronic Systems and Signal Processing
Ing. Ján Tóth	doc. Ovseník	Electronic Systems and Signal Processing

External form:

Ing. Peter Strnisko	doc. Ovseník	Electronic Systems and Signal Processing

Fourth year of study
Internal form:

Ing. Martin Broda	prof. Levický	Multimedia Communication Technologies
Ing. Peter Kažimír	prof. Kocur	Electronic Systems and Signal Processing
Ing. Lenka Macková	prof. Čižmár	Multimedia Communication Technologies
Ing. Martin Petrvalský	doc. Drutarovský	Electronic Systems and Signal Processing
Ing. Lukáš Sendrei	prof. Marchevský	Electronic Systems and Signal Processing
Ing. Martin Sulír	prof. Juhár	Multimedia Communication Technologies
Ing. Daniel Zlacký	prof. Čižmár	Multimedia Communication Technologies

External form:

Ing. Matej Žiga	doc. Galajda	Electronic Systems and Signal Processing

Fifth year of study

External form:

Ing. Martin Kmec	doc. Galajda	Electronic Systems and Signal Processing
Ing. Matúš Kozák	prof. Kocur	Electronic Systems and Signal Processing
Ing. František Rakoci	doc. Ovseník	Electronic Systems and Signal Processing

8 MEMBERSHIP

Čižmár Anton, Member of Technical Standardization Commission No.41 for Telecommunications.

Čižmár Anton, Member IEEE Affiliate Computer Society, No. 41237162.

Čižmár Anton, Member of AES (Audio Engineering Society), New York, I.D. 44 154.

Doboš Ľubomír, Member of Technical Standardization Commission No.80 for Radiocommunications.

Drutarovský Miloš, Member of the editorial board of the journal "Acta Electrotechnica et Informatica".

Galajda Pavol, Member of Czech and Slovak Radioelectronics Engineering Society.

Galajda Pavol, Member of the editorial board of the journal "Radioengineering".

Galajda Pavol, Member of EUROPRACTICE IC Service.

Juhár Jozef, Member of ISCA (International Speech Communication Association).

Juhár Jozef, Member of AES (Audio Engineering Society), Memb. No. 76122.

Juhár Jozef, Member of IEEE, Memb. No. 90402602.

Juhár Jozef, Member of EU Domain Committee COST for ICT (Information and Communication Technologies) – national delegate.

Juhár Jozef, Member of the editorial board "International Journal of Signal and Imaging Systems Engineering", Issued by Inderscience Publishers, Geneva, Switzerland.

Juhár Jozef, Member of the editorial board of the journal "Slaboproudý obzor".

Juhár Jozef, Member of Technical Standardization Commission No.55 for Electroacoustics and ultrasound.

Kocur Dušan, Member of the editorial board of the journal "Infocommunications Journal 2014".

Kocur Dušan, Member of committee of Scientific Grant Agency of the Ministry of Education of the Slovak Republic and of Slovak Academy of Sciences.

Levický Dušan, Member of the editorial board of the journal "Acta Electrotechnica et Informatica".

Levický Dušan, Member of Czech and Slovak Radioelectronics Society.

Michaeli Linus, Head of Slovak IMEKO National Committee and head of the IMEKO Technical Committee TC-4 "Measurement of Electrical Quantities".

Michaeli Linus, Member of the editorial board „Computer Standard & Interfaces", Issued by Elsevier, Amsterdam, New York.

Michaeli Linus, Member of the reviewer board "Measurement". Journal IMEKO, Issued by Elsevier, Amsterdam, New York.

Michaeli Linus, Co-ordinator of IMEKO Working Group "AD and DA metrology".

Michaeli Linus, Member of the IEEE, Instrumentation & Measurement Society.

Michaeli Linus, Member of the scientific board of Electrotechnical Faculty, University Transport and Communication, Žilina, Slovakia.

Michaeli Linus, Member of the editorial board „Measurement Science Review", Issued by SAV, Bratislava.

Michaeli Linus, Editor in Chief of the editorial board of the journal "Acta Electrotechnica et Informatica".

Šaliga Ján, Scientific Grant Agency of Slovak Republic.

Šaliga Ján, Member of scientific board of Slovak Institute of Metrology.

Šaliga Ján, Member of the international board of IMEKO Technical Committee TC-4 "Measurement of Electrical Quantities".

Šaliga Ján, Member of the editorial board of the journal "Acta Electrotechnica et Informatica".

Šaliga Ján, Member of the editorial board of the journal "Radioengineering".

Turán Ján, Member of the Slovak Technical Standardization Committee No.53 for Cables, Conductors and Isolating Materials.

Turán Ján, Member of the Slovak Technical Standardization Committee No.43 for Terminology.

Turán Ján, Senior Member of the IEEE.

Turán Ján, Member of Czech and Slovak Radioelectronics Society.

Turán Ján, Member of the editorial board of the journal "Acta Electrotechnica et Informatica".

9 PUBLICATION ACTIVITY OF THE DEPARTMENT

9.1 Books

1. DOBOŠ,Ľ.: Mobile technologies and services. In: Košice: TU, Slovakia, 2015, 123 pp.
2. GALAJDA,P.-GAMCOVÁ,M.: Základy elektroniky. In: Košice: TU, Slovakia, 2015, 404 pp.
3. GAMEC,J.: Automobilová elektronika 1. In: Košice: TU, Slovakia, 2015, 248 pp.
4. GLADIŠOVÁ,I.-MIHALÍK,J.: Spojité signály. In: Košice: TU, Slovakia, 2015, 62 pp.
5. JUHÁR,J.-ONDÁŠ,S.: Spracovanie a prenos rečových a audio signálov. In: Košice: TU, Slovakia, 2015, 90 pp.
6. JUHÁR,J.-ONDÁŠ,S.: Interaktívne telekomunikačné systémy a služby. In: Košice: TU, Slovakia, 2015, 90 pp.
7. KOCUR,D.-GAMEC,J.-GAMCOVÁ,M.-FORTES,J.-URDZÍK,D.: UWB senzorové systémy. In: Košice: TU, Slovakia, 2015, 172 pp.
8. KOCUR,D.-GAZDA,J.: Prenosové systémy s rozprestretým spektrom. In: Košice: TU, Slovakia, 2015, 220 pp.
9. MACEKOVÁ,Ľ.: Malá encyklopédia prístupových sietí. In: Košice: TU, Slovakia, 2015, 133 pp.
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14. MIHALÍK,J.: Videokomunikácie. In: Košice: TU, Slovakia, 2015, 80 pp.

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5. IVANIGA,T.-OVSENÍK,Ľ.-TURÁN,J.: Influence of Self-Phase Modulation on 8 and 16-Channel DWDM System with NRZ and Miller Coding. In: Carpathian Journal of Electronic and Computer Engineering, Vol. 8, no. 1 (2015), pp. 17-22.
6. IVANIGA,T.-OVSENÍK,Ľ.: Experimentálne overenie vplyvu SPM na DWDM systém v programovom prostredí OptSim. In: Posterus.sk, Vol. 8, no. 7 (2015), pp. 1-10.
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21. REPKA,M.-VARCHOLA,M.-DRUTAROVSKÝ,M.: Improving CPA Attack Against DSA and ECDSA. In: Journal of Electrical Engineering, Vol. 66, no. 3 (2015), pp. 159-163.

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35. ZAVACKÝ,J.-MIHALÍK,J.: Diskrétna multiwaveletová transformácia a jej implementácia s DGHM multiwaveletmi. In: Posterus.sk, Vol. 8, no. 3 (2015), pp. 1-14.

9.3 Conference papers

1. ANDRÁŠ,I.-JUHÁR,J.: Návrh a konštrukcia mikrofónového poľa. In: Electrical Engineering and Informatics 6: Proceedings of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, TU Košice, 2015, pp. 722-727.

2. BRODA,M.: Universal Image Steganalysis. In: SCYR 2015: 15th Scientific Conference of Young Researchers, May 19th, 2015, Herľany, Slovakia, pp. 328-329.

3. BUGÁR,G.-ORAVEC,J.-LEVICKÝ,D.-GALLO,P.: Robustná steganografická metóda využívajúca vlastnosti kompresného štandardu MJPEG. In: Electrical Engineering and Informatics 6: Proceedings of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, TU Košice, 2015, pp. 797-801.

4. BUGÁR,G.-DUDÁŠ,M.-LEVICKÝ,D.-GALLO,P.: Metóda digitálnej vodotlače s využitím kombinácie DCT a SVD. In: Electrical Engineering and Informatics 6: Proceedings of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, TU Košice, 2015, pp. 641-646.

5. ČONKA,D.-VISZLAY,P.-JUHÁR,J.: Improved Class Definition in Two Dimensional Linear Discriminant Analysis of Speech. In: Radioelektronika 2015, Piscataway: IEEE, April 21-22, 2015, Pardubice, Czech Republic, pp. 261-263.

6. ČONKA,D.-VISZLAY,P.-JUHÁR,J.: Vylepšená reprezentácia tried v dvojrozmernej lineárnej diskriminačnej analýze reči. In: Electrical Engineering and Informatics 6: Proceedings of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, TU Košice, 2015, pp. 882-885.

7. ČONKA,D.: Neural Networks for Speech Recognition. In: SCYR 2015: 15th Scientific Conference of Young Researchers, May 19th, 2015, Herľany, Slovakia, pp. 254-257.

8. DOLINSKÝ,P.-ŠALIGA,J.: Demonštračné pracovisko pre vybrané senzory fyzikálnych veličín. In: Electrical Engineering and Informatics 6: Proceedings of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, TU Košice, 2015, pp. 35-39.

9. DROTÁR,P.-MEKYSKA,J.-REKTOROVÁ,I.-MASAROVÁ,L.-SMÉKAL,Z.-FAUNDEZ-ZANUY,M.: A New Modality for Quantitative Evaluation of Parkinson's Disease: In- Air Movement. In: Bioinformatics and Bioengineering (BIBE), Greece: IEEE, 2015, pp. 1-4.

10. DROTÁR,P.-MEKYSKA,J.-SMÉKAL,Z.-REKTOROVA,I.-MASAROVA,L.-FAUNDEZ-ZANUY,M.: Contribution of Different Handwriting Modalities to Differential Diagnosis of Parkinson's Disease. In: MEMEA 2015, Piscataway: IEEE, 2015, pp. 344-348.

11. DROTÁR,P.-SMÉKAL,Z.: Comparison of stability measures for feature selection. In: SAMI 2015, Danvers: IEEE, 2015 pp. 71-75.

12. GALAJDA,P.-DRUTAROVSKÝ,M.-ŠALIGA,J.-ŽIGA,M.-MACEKOVÁ,Ľ.-MARCHEVSKÝ,S.-KOCUR,D.: Sensor Node for the Remote River Water Quality Monitoring. In: Measurement 2015, Bratislava: Slovak Academic of Science, 2015, pp. 313-316.

13. GAMEC,J.-GAMCOVÁ,M.: Experimental Frequency Modulated Continuous Wave Radar. In: IRS 2015, Gottinger, Germany: CUVILLIER VERLAG, 2015, pp. 1-6.

14. GLADIŠOVÁ,I.: Adaptívne aritmetické kódovanie binárnych obrazov. In: Electrical Engineering and Informatics 6: Proceedings of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, TU Košice, 2015, pp. 12-16.

15. GLADIŠOVÁ,I.-GAMEC,J.-GAMCOVÁ,M.: Praktické skúsenosti zo spracovania signálov modulárneho MIMO systému na báze PXIe. In: Electrical Engineering and Informatics 6: Proceedings of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, TU Košice, 2015, pp. 236-241.

16. HAJDUK,V.-LEVICKÝ,D.: Kernel Types Benchmark of Support Vector Machines in Image Steganalysis. In: Electrical Engineering and Informatics 6: Proceedings of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, TU Košice, 2015, pp. 626-629.

17. HAJDUK,V.: Blind Image Steganalysis. In: SCYR 2015: 15th Scientific Conference of Young Researchers, May 19th, 2015, Herľany, Slovakia, pp. 174-177.

18. HEDVIG,Š.-DRUTAROVSKÝ,M.: Komunikačné rozhranie pre UWB radarovú sieť v pásme SRD. In: Electrical Engineering and Informatics 6: Proceedings of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, TU Košice, 2015, pp. 106-110.

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Informatics 6: Proceedings of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, TU Košice, 2015, pp. 320-325.

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