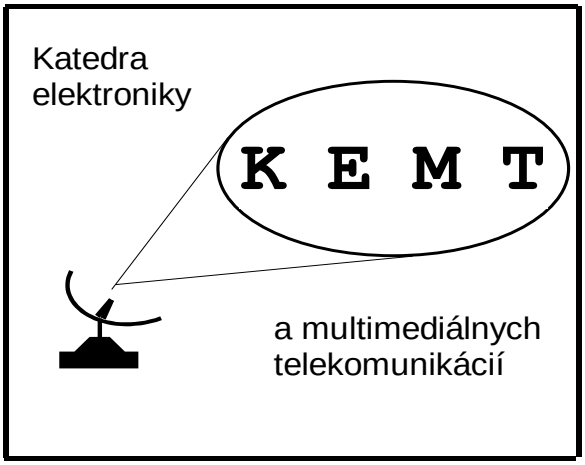
DEPARTMENT OF ELECTRONICS AND MULTIMEDIA TELECOMMUNICATIONS



Annual Report

2003

Technical University of Košice

Faculty of Electrical Engineering and Informatics

TECHNICAL UNIVERSITY OF KOŠICE

Faculty of Electrical Engineering and Informatics
(Slovak Republic)

DEPARTMENT OF ELECTRONICS AND MULTIMEDIA TELECOMMUNICATIONS

ANNUAL REPORT 2003

Edited by Ľuboš Ovseník

Contents

1. BRIEF OVERVIEW

The Department of Electronics and Multimedia Communications is responsible for degree course Electronics and Telecommunication Engineering at MSc. level as wells for degree courses Electronics, Telecommunications and Measurement Techniques at PhD. level.

The subjects in degree course Electronics and Telecommunications Engineering are orientated to the linear and non-linear analogue circuits, digital electronics, microwave technology, optelectronics, signal and systems, acoustics, digital signal processing, digital filtering, VLSI processors and microcontrollers, radioelectronic measurements, television systems, signal recording, digital communication and digital transmission systems, optoelectronic communication systems, photonics, sensor systems, multimedia communication systems, mobile and satellite communication systems, digital image communication systems and medical electronics.

The basic research activities of Department are concentrated on digital image and speech processing, multimedia communications, digital filtering, optoelectronics and optical communication, implementation on neural network in digital signal processing and A/D convertors modelling.

The history of the Department. The Department of Electronics and Multimedia Communications was founded in 1969. The original name of department was Department of Electronics and first head of department was Prof. Špány. In the first 5 years Department was responsible for some subjects in the field of electronics.

The name of Department has been change to Department of Electronic Circuits and System in 1974. It was responsible for the new degree course Electronics Systems. First students have been finished his study in this degree course at 1976. The new degree course Radioelectronics at the Department has been started in 1979, which was orientated in the field of microwave technology, analog and digital electronics, digital signal processing and radioelectronic systems. The name of Department has been change to Department of Radioelectronics. Since 1986 the head of Department is Prof. Levický. The process of degree course Radioelectronics transformation to the new degree course Electronics and Telecommunication engineering at the department has been finished in 1997. The recent name of department since 1997 is Department of Electronics and Multimedia Communications.

2. DEPARTMENT STAFF AND STRUCTURE

Total number of staff members is 26.

- Professors: Čižmár Anton, Levický Dušan, Marchevský Stanislav, Mihalík Ján, Michaeli Linus, Turán Ján

- Associated Professors: Doboš Ľubomír, Drutarovský Miloš, Galajda Pavol, Juhár Jozef, Kocur Dušan, Šaliga Ján

- Assistant Professors: Gamec Ján, Gamcová Mária, Gladišová Iveta, Klenovičová Zita, Matúš Emil, Ovseník Ľuboš, Zavacký Jozef

- Research Assistant: Hroncová Ingrid, Maceková Ľudmila

- Support staff: Botta František, Chocholová Pavlina, Marchevská Božena, Lenárt Jozef, Šumáková Viera

- Ph.D. students: ***Internal form:*** Čížová Jana, Filo Peter, Floriš Peter, Gaňová Renáta, Grega Marián, Kasár Miroslav, Krajňák Jozef, Longauer Leoš, Michalko Peter, Pleva Matúš, Ridzoň Radovan, Šimka Martin, Štefanišin Radoslav, Šurin Stanislav

  External form: Abdulghafoor Jalal Mahmood, Baboľ Miroslav, Benčo Stanislav, Csernok Szabolcz, Fedor Stanislav, Florek Vladimír, Gamcová Mária, Gebeová Gyongyike, Goriľ Jozef, Homolya Viktor, Chochol Peter, Kačír Miloš, Kováč Miloš, Kravecová Daniela, Krivda Marián, Lukáč Martin, Mihalčík Ladislav, Mohamoud Ali Omer, Novikmec Jozef, Papaj Ján, Pillár Slavomír, Siman Roman, Študenc Jozef, Švač Pavol, Vlasatý Anton, Zlacký Marián

3. DIVISIONS OF THE DEPARTMENT

♦ Laboratory of Multimedia Communications

Head: prof. Prof. Ing. Dušan Levický, CSc., Member of the IEEE

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fax: +421-55-636323989

Professor Dr.h.c. Prof. Ing. Anton Čižmár, CSc., Member of the IEEE, Member of the AES

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fax: +421-55-6330115

Assoc. prof. doc. Ing. Ľubomír Doboš, CSc.

phone: +421-55-6022296 e-mail: Lubomir.Dobos@tuke.sk

Assoc. prof. doc. Ing. Jozef Juhár, CSc., Member of the AES

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phone: +421-55-6022829 e-mail: Zita.Klenovicova@tuke.sk

Assist. prof. Ing. Emil Matúš, PhD.

phone: +421-55-6022863 e-mail: Emil.Matus@tuke.sk

Research Assistant:

Dr. Ing. Ingrid Hroncová e-mail: Ingrid.Hroncova@tuke.sk

♦ Laboratory of Digital Signal Processing and Satellite Communications

Head: prof. Prof. Ing. Stanislav Marchevský, CSc.

phone: +421-55-6022030 e-mail: Stanislav.Marchevsky@tuke.sk

Assoc. prof. doc. Ing. Dušan Kocur, CSc.

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Assoc. prof. doc. Ing. Miloš Drutarovský, CSc.

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Assist. prof. Ing. Mária Gamcová

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Researcher Ing. Ľudmila Maceková
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♦ **Laboratory of Digital Image Processing and Videocommunication**

http://www.tuke.sk/fei-ldipv/

Head: prof. Prof. Ing. Ján Mihalík, CSc.
phone: +421-55-6022854 e-mail: Jan.Mihalik@tuke.sk

Assist. prof. Ing. Jozef Zavacký, CSc.
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Assist. prof. Ing. Iveta Gladišová, CSc.
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♦ **Laboratory of Optoelectronic Communications**

Head: prof. Prof. RNDr. Ing. Ján Turán, DrSc., Senior Member of the IEEE
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Assist. prof. Ing. Ján Gamec, CSc.
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Assist. prof. Ing. Ľuboš Ovseník, PhD.
phone: +421-55-6024277 e-mail: Lubos.Ovsenik@tuke.sk

♦ **Laboratory of Electronic Circuits & Measurement**

Head: prof. Prof. Ing. Linus Michaeli, DrSc., Member of the IEEE
phone: +421-55-6022857 e-mail: Linus.Michaeli@tuke.sk

Professor emeritus Prof. Ing. Viktor Špány, DrSc.
phone: +42-55-6022864

Assoc. prof. doc. Ing. Ján Šaliga, CSc.
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Assoc. prof. doc. Ing. Pavol Galajda, CSc.
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4. COURSES

Bachelor Degree Course (title BcC.) –Telecommunications Engineering

The Bachelor degree course is orientated into the field Telecommunication mainly into the basic telecommunication systems and networks. The students achieve good skills in telecommunication services, management of telecommunication networks and economics in telecommunications.

Master Degree Course (title Ing.) – Electronics and Telecommunication Engineering

The Master degree course is orientated into the field of Electronics and Telecommunications. In the field of Electronics the students have been achieve good skills in mathematics, physics, electromagnetic field, electrical measurement, electronics components, linear and non-linear circuits, digital electronics, microprocessors and signal processors, optoelectronics and digital signal processing.

In the field Telecommunications the students have been achieve good skills in digital communication and transmission systems, mobile and satellite communications, optoelectronics communication systems and multimedia communication.

Master Degree Course (title Ing.) – Measurement Techniques

The Master degree course is orientated into the field of Measurement techniques. The degree course is the specialisation of the general programme Electronics. In the field of Mesurement techniques the students have been achieve good skills in electrical measurement, metrology, electronics components, linear and non-linear circuits, digital electronics, microprocessors and signal processors, digital signal processing targeted on enhancement of the metrological properties, virtual instrumentation using ICT, measurement in the biomedicine, measurement in the telecommunications, industrial measurement for process control and TQM.

Ph.D. Degree Courses (title Ph.D.) – Electronics

The Ph.D. degree course 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.) – Telecommunications

The Ph.D. degree course is orientated into the field of multimedia communications, mobile and satellite communications as well as modern telecommunication technologies and networks and digital signal processing in telecommunications.

Ph.D. Degree Courses (title Ph.D.) – Measurement Techniques

The Ph.D. degree course is focused into the methodology of instrumentation in industry, scientific research and monitoring of physical parameters. The related scientific areas are metrology, sensors of different physical qualities, digital signal processing and pre-processing, calibration and self-diagnostic as well as virtual instrumentation.

5. LIST OF SUBJECTS TAUGHT

Master Degree Course (Ing.) *Electronics and Telecommunications*

Subjects	*Hours/Week Lecture/Seminar*	*Lectures*
2nd year of study:		
3rd year of study:		
Transmission of Information in Electroenergetics	2/2	Čižmár
Analog Electronic Systems	2/2	Galajda
Electronic Systems	3/2	Galajda
Linear Analog Circuits	4/3	Kocur
Microwave Technology	3/2	Gamec
Digital Electronics	3/2	Levický
Electronic Devices	3/3	Gamec
Digital Communication Systems	3/3	Levický
Non-Linear Analog Circuits	4/3	Michaeli
Signals and Systems	3/3	Mihalík, Zavacký
Design of Electronic Equipment	3/2	Doboš
Acoustics	3/2	Juhár
4th year of study:		
Radioelectronic Measurement	3/3	Šaliga
Electronic Systems with Microprocessors	3/2	Drutarovský, Matúš
Digital Signal Processing	3/3	Mihalík
Optoelectronics	3/2	Turán
Switching Systems	3/2	Marchevský
Coding and Modulation	2/2	Čižmár
Semestral Projects	0/2	Marchevský
Digital Transmission Systems	3/2	Čižmár
Signal Processors in Telecommunication	3/2	Drutarovský
TV Systems	3/2	Marchevský
Analog & Digital Interfaces	3/2	Michaeli, Šaliga
Optoelectronic Communications Systems	3/2	Turán
Digital Filters	3/2	Kocur, Drutarovský
Applied Cryptography	2/2	Levický
Digital Proc. and Transmission of Speech and Audio	3/2	Juhár
Programmable Integrated Circuits	2/2	Galajda, Drutarovský
5th year of study:		
Photonics	3/2	Turán
Medical Electronics	3/2	Michaeli
Sensor Systems	3/2	Michaeli
Radioelectronic Systems	3/2	Doboš
Multimedia Communications	3/2	Levický
Satellite Communications	3/2	Marchevský
Digital Image Communication Systems	3/3	Mihalík
Mobile Communications Systems	3/2	Doboš
Spread Spectrum Communication Systems	3/2	Kocur

Master Degree Course (Ing.) *Measurement Techniques*

Subjects	***Hours/Week Lecture/Seminar***	***Lectures***
4th year of study:		
Radioelectronic Measurement	3/3	Šaliga
Electronic Systems with Microprocessors	3/2	Drutarovský, Matúš
Digital Signal Processing	3/3	Mihalík
Electromagnetic Compatibility	3/2	Marton
Sensor Systems	2/2	Mojžiš
Semestral Projects	0/2	Michaeli
Digital Transmission Systems	3/2	Čižmár
Signal Processors in Telecommunication	3/2	Drutarovský
Technical Diagnostic	3/2	Smrczek
Virtual instrumentation	3/2	Šaliga
Modelling and Measurement	3/2	Kováč
Measurement in High Voltage Technology	2/2	Kolcunova
Measurement in Electroenergetic	2/2	Leščinský
Digital Filters	3/2	Kocur,
Applied Cryptography	2/2	Levický
Measurement in Experimental Physics	2/2	Kudela
5th year of study:		
Signal Processing in Measurement	3/2	Michaeli
Medical Electronics	3/2	Michaeli
Measurement in Telecommunication	3/2	Šaliga
Diagnostic of Electrical Systems	2/2	Kolcunova
Technology of Sensors	2/3	Banský

Undergraduate Study (Bc.) *Telecommunications*

Subjects	***Hours/Week Lecture/Seminar***	***Lectures***
1st year of study:		
Electronic Devices	3/3	Gamec
2nd year of study:		
Linear Analog Circuits	4/3	Kocur
Microwave Technology	3/2	Gamec
Signals and Systems	3/2	Mihalík, Zavacký
Digital Electronics	3/2	Levický
Data Acquisition Systems	3/3	Michaeli, Šaliga
Optoelectronics	3/2	Turán
Digital Signal Processing	3/2	Mihalík
Basics of Telecommunication Systems	3/2	Levický
Circuits for Communications Systems	4/3	Michaeli
3rd year of study:		
Telecommunications Networks	3/2	Čižmár
Transmissions Systems	3/2	Čižmár
Switching Systems	3/2	Marchevský
Semestral Projects	0/2	Marchevský
Measurement in Telecommunications	3/2	Šaliga
Optoelectronic Communications Systems	3/2	Turán
Videcomunications	3/2	Mihalík
Telecommunications Services	3/2	Čižmár
Management of Telecommunication Networks	3/2	Čižmár
Security of Communications Networks	3/2	Levický
Multimedia Communications	3/2	Levický
Satellite Communications	3/2	Marchevský
Mobile Communications Systems	3/2	Doboš

Undergraduate and Graduate Study for Foreign Students (in English Language)
Study plan for MSC degree in *Telecommunication technology*

Subjects	***Hours/Week Lecture/Seminar***	***Lectures***
1st year of study:		
Digital Signal Processing	3/3	Mihalík
Coding in Communication Systems	3/2	Levický
Optoelectronics	3/2	Turán
Digital Filtration in Communications	3/2	Marchevský
Microwave Technology	3/2	Turán
Telematic Systems	3/2	Levický
Digital Speech in Communication Systems	3/2	Marchevský
Optoelectronic Communications Systems	3/2	Turán
Image Coding	3/2	Mihalík
VLSI Processors in Telecommunications	3/2	Drutarovský
Digital Transmission Systems	3/2	Čižmár
Digital Filters	3/2	Kocur, Drutarovský
2nd year of study:		
Multimedial Communications	3/2	Levický
Satellite Communications	3/2	Marchevský
Mobile Communications	3/2	Doboš
Digital Image Communication Systems	3/3	Mihalík
Digital Proc. and Transmission of Speech and Audio	3/2	Juhár
Distributed Virtual Instrumentation	3/2	Michaeli
Photonics	3/2	Turán
Semestral Projects	0/5	Marchevský

6. RESEARCH AND PROJECTS

Title of the Project: ***Digital signal processing in secure communications and interactive telecommunication services***

Funding: Institutional grant

Duration: 2003-2005

Co-ordinator: Prof.Ing. Dušan Levický,CSc.

Group members: A. Čižmár, S. Marchevský, D. Kocur, M. Drutarovský, J. Juhár, L. Doboš, Z. Klenovičová, P. Foriš, M. Gamcová, Ľ. Maceková, J. Čížová, R. Hovančák, M. Grega, S. Lihan, L. Longauer, R. Pleva, P. Radoczi, R. Ridzoň, M. Šimka, S. Šurin

Scientific goals/research targets:

- Design of new methods in steganography for conceals the existence of message transmission.
- Design of new methods and hardware for data encryption.
- Design of new methods for speech recognition in interactive telecommunication services.
- Application of new approaches of multiuser detection for communication systems based on CDMA.
- Design of new methods of digital watermarks implementation in multimedia.
- Design of new methods of digital image filtration.

Results Achieved:

- Designs of new methods for conceal the message existence in steganography by using CDMA.
- Design and verification of new type of random sequence generators for data encryption.
- Design of new methods of digital image watermarking in fractal domain.
- Design of new method of machine speech recognition for Slovak language based SpeechDat-Sk and analysis of proposed point of view implementation in interactive telecommunication services.
- Design of LUM smoother and impulse detectors for noised sequences.
- Analysis of CDMA systems from point of view MUD.

Title of the Project: *Digital Signal Processing and Watermarking in Multimedia Commu*nications

Funding: VEGA 1/8130/01

Duration: 2001-2003

Co-ordinator: Prof. Ing. Dušan Levický,CSc.

Group members: A. Čižmár, E. Matúš, S. Marchevský, D. Kocur, M. Drutarovský, J. Juhár, Ľ. Doboš, Z. Klenovičová, M. Gamcová, Ľ. Maceková, R. Hovančák, P. Radoczi, M. Marcinek, R. Lukáč, S. Šurin

Scientific goals/research targets:

- Design of the new methods for image coding and digital image watermarking in information technologies for multimedia communications.
- Design of the new method for speech coding, speech recognition and audio watermarking.
- Design of the advanced digital filter applications for digital communication systems.
- Design of the new methods for digital image filtration from point of view digital image processing and watermarking.

Results Achieved:

- Design of new method for digital watermarking of color image by using DWT and DCT and methods for multiembedding watermarks.
- Analysis selected types of attacks on digital watermarks and robustness of watermark techniques.
- Design of new method of speech recognition by using Voice XML language and its implementation in interactive information system.
- Analysis of packet speech transmission over the telecommunication network from point of view error detection and correction and quality of reconstructed speech.
- Design of new modifications of nonlinear digital filter LUM and new algorithms for weighting median filters as wellas impulse detectors.
- Design new modifications of adaptive LMS filters for image filtering.
- Application of Volterra filters in estimators for DS-SS receivers multiuser detection.
- Analysis and design of the applications of non-linear filters (especially Volterra and microstatistic filters) for the narrowband, wideband and combined interference cancellation in mobile communication system based on direct sequences spread spectrum systems.
- Design of time-invariant and LMS adaptive multi-channel microstatistic filters.

Title of the Project: *Spoken Language Interaction in Telecommunication*

Funding: COST 278

Collaboration with: 29 academic and commercial research institutions from 18 European countries

Duration: 2001-2005

Co-ordinator: Prof. Ing. Anton Čižmár, CSc.

Group members: L. Dobošš, J. Juhár, S. Lihan, D. Levický, M. Baboľ, J. Papaj, M. Pleva,

Scientific goals/research targets:

- To improve the knowledge of the issues and problems involved in general in spoken language interaction in telecommunication.
- To achieve knowledge of issues related to robustness and multi-linguality within spoken language processing.
- To achieve knowledge of spoken language interaction in the context of multi-modal communication.
- To achieve knowledge of human-computer dialogue theories, models and systems and associated tools for the establishment of such systems.
- To achieve knowledge of and evaluate telecommunication applications that apply spoken language as one out of more input or output modalities.

Results Achieved:

- Initiation of Slovak language analysis for the purpose of automatic spoken language interaction in telecommunication services.
- Developing a reference automatic speech recognition system based on hidden Markov modelling and SpeechDat-Slovak database.
- Creation an experimental automatic voice service "Departamental telephone numbers directory" based on VoiceXML and through IP/H323 network.

Title of the Project: *Towards Mobile Broadband Multimedia Networks*

Funding: COST 273

Collaboration with: academic and commercial research institutions and groups from 18 European countries

Duration: 2001-2005

Co-ordinator: doc. Ing. Ľubomír Dobošš, CSc.

Group members: J. Juhár, A. Čižmár, M. Pleva, J. Goriľ, J. Novikmec

Scientific goals/research targets:

The main objective of the Action is to increase the knowledge on the radio aspects of mobile broadband multimedia networks, by exploring and developing new methods, models, techniques, strategies and tools towards the implementation of 4th generation mobile communication systems. It will consider frequencies ranging from the upper UHF up to millimetre waves, and data rates higher than 2 Mb/s (probably up to 155 Mb/s).

It is also expected that the Action will contribute to the deployment of systems that are very close to completion of their standardisation phase, in particular UMTS and HIPERLAN 2.

Results Achieved:

- Analysis Medium Access Control protocol for wireless ATM
- Design and simulation of new Call Admission Control algorithm for wireless ATM networks
- Analysis and simulation OFDM technique for high speed mobile communications

Title of the Project: *Non-linear Speech Processing*

Funding: COST 277

Collaboration with: academic and commercial research institutions and groups from 15 European countries

Duration: 2001-2005

Co-ordinator: doc. Ing. Jozef Juhár, CSc.

Group members: D. Kocur, L. Doboš, A. Čižmár, S. Lihan, M. Lukáč, M. Pleva, A. Vlasatý

Scientific goals/research targets:

The ultimate objective of this Action is to improve the voice services in telecommunication systems through the development of new nonlinear speech processing techniques.

The new technologies developed within the Action are to provide:

- higher quality speech synthesis,
- more efficient speech coding,
- improved speech recognition, and
- improved speaker identification and verification.

The methods are expected:

- to contribute significantly to the acceptance of voice interfaces for information systems such as the mobile Internet (by improved synthesis and recognition) and

- to improve efficiency in future generations of speech coders used in wireless networks, including packet-based wireless networks.

The Action intends to accomplish the stated goals by developing techniques based on nonlinear speech processing.

Results Achieved:

Robust non-linear methods for speech recognition in adverse environment has been studied with concentration on:

- noise robust features extraction techniques,
- noise immune auditory features and
- noise-removal preprocessing techniques.

Title of the Project: *Biometrics-Based Recognition of People over the Internet*

Funding: COST 275

Collaboration with: academic and commercial research institutions and groups from 13 European countries

Duration: 2001-2005

Co-ordinator: doc. Ing. Jozef Juhár, CSc.

Group members: L. Doboš, A. Čižmár, S. Lihan, M. Pleva, M. Kováč

Scientific goals/research targets:

The main objective of the Action is to investigate effective methods for the recognition of people over the Internet based on voice and facial characteristics in order to facilitate, protect, and promote various financial and other services over this growing telecommunication medium.

The main objectives can be specified as follows.

- To improve knowledge of the issues and problems involved.
- To study the current techniques for voice and face recognition and to evaluate their performance in the medium considered.
- To investigate methods for the fusion of the considered biometric data and the interpretation of the results.
- To analyse the implementation problems including user-interface issues and investigate effective solutions.
- To identify the potential applications and analyse the requirements of these.

- To develop standard methods and tools for the assessment of biometrics-based identification methods.

Results Achieved:

Preparation of a review of biometrics-based recognition of people over the Internet is being in progress with stress on:

- speaker recognition, verification and identification algorithms,
- development tools and toolkits, that can be used and
- Voice over IP transmission techniques and protocols.

Title of the Project: *Smart spoken language communication system*

Funding: S00034 / National programme for R&D "Building of information society"

Collaboration with: STU Bratislava, SAV Bratislava, ŽU Žilina

Duration: 2003-2005

Co-ordinator: doc. Ing. Jozef Juhár, CSc.

Group members: L. Doboš, A. Čižmár, D. Levický, S. Lihan, M. Pleva, M. Kováč, J. Papaj, M. Baboľ, M. Lukáč

Scientific goals/research targets:

The main objective of the project is research and development of a smart automated voice-interactive dialogue system, enabling the access to distributed information via conversational human-machine dialogue. The solution should have the the following main properties:

- The dialogue system will enable spoken language interaction in Slovak.
- Communication through PSTN, GSM and VoIP telecommunication network
- The system will consists of I/O telephone unit, speech recognition unit, natural language understanding unit, dialogue management unit, natural language generation unit, speech synthesis module and module for communication with external database.
- Open and modular architecture allowing further extensibility to other languages, modalities, and ability to modify them for different purposes.
- The functionality of the system will be proved with minimal two pilot applications from two specific domains (e.g. telecommunications, traveling, ...).

Title of the Project: ***Spectrum and Power Efficient Broadband Communications***

Funding: COST 289

Collaboration with: 15 partners from university, research and industrial institutions from 10 European countries

Duration: 2003-2007

Co-ordinator: doc. Ing. Dušan Kocur, CSc.

Group members: D. Kocur, M. Drutarovský, P. Galajda, S. Marchevský, J. Čížová, J. Krajňák, L. Longauer

Scientific goals/research targets:

- General Goal:
- Design of new architectures of communication systems with intention to increase the capacity of communication systems within a specified transmission bandwidth with minimum available transmitter power, bearing in mind the cost effectiveness and the practical implementability of the system.
- Partial Goals:
- Analysis of multiple access principles (e.g. CDMA, MC-CDMA, CC-CDMA, OFDM, etc.) with regard to design the 4G mobile communication systems and heterogeneous networks.
- Design of sub-systems of the 4G mobile communication systems and heterogeneous networks, especially the multi-user receivers and interference canceller design.
- Design of the software defined radio architectures, mapping selected the software defined radio blocks into the high performance FPGAs.

Results Achieved:

- The analysis of the multi-user receivers for CDMA transmission systems.
- Analysis of the basic performance properties of the blind multi-user receiver for CDMA transmission systems.
- The design the new promising non-linear multi-user receiver based on the multi-channel microstatistic filter application.
- Analysis of the basic architecture of the software defined radio.

Title of the Project: Packet-Oriented Service Delivery via Satellite

Funding: COST 272

Collaboration with: 16 research and industrial institutions from European countries

Duration: 2001-2005

Co-ordinator: Prof. Ing. Stanislav Marchevský,CSc.

Group members: D. Kocur, M. Drutarovský, P. Galajda, M.Gamcová, Ľ. Maceková, S. Benčo, L. Longauer, M. Grega,

Scientific goals/research targets:

- General Goal:
- To contribute to the identification of key requirements, analysis, performance comparison, architectural design and protocol specification of future packet-oriented satellite communication systems, with a clear focus on Internet-type system concepts, applications and protocols/techniques on the various layers.
- Partial Goals:
- the design of efficient receivers with low consumption for mobile terminals,
- the design of low cost reconfigurable terminals
- design and implementation multi-user detection receiver for CDMA signals from satellites,
- to identify suitable models integrating Internet services and worldwide communication
- to identify the tradeoffs between complexity and effectiveness for supporting QoS in multi-network environments using different media or networking technologies

Results Achieved:

- development of multi-user detection receivers for CDMA signals using FIR filters,
- development of multi-user detection receivers for CDMA signals using blind adaptive filtering,
- development of multi-user detection receivers for CDMA signals using microstatistic filtering,
- development of transport protocols for VoIP using satellite channels.

Title of the Project: Embedded Architectures for Applied Cryptography

Funding: French national research program ACI Cryptologie - the project CryptArchi

Collaboration with: academic institutions from France and USA

Duration: 2002-2004

Co-ordinator: doc. Ing. Miloš Drutarovský, CSc.

Group members: M. Drutarovský, D. Kravecová, M. Šimka

Scientific goals/research targets:

- General Goal:
  - Development of architectures of embedded cryptographic systems.
- Partial Goals:
  - Evaluation of the possibilities of hardware/software co-design within different families of configurable logic devices - CPLDs, FPGAs.
  - Estimation of the possibilities of parallelism in hardware (pipeline structures) and in software (multiprocessors structures).
  - Development of the parameterised cryptographic functions adapted to implementation in reconfigurable devices (RSA, ECC, AES-Rijndael, SHA, TRNG, …).
  - Adaptation of the existing algorithms for implementation in reconfigurable devices in order to obtain the best performance.
  - Measurement of the security and performance of the proposed systems.
  - Evaluation of the possibilities of side-channel attacks and finding a way how to increase the resistance of reconfigurable devices against this kind of attacks.

Results Achieved:

- Design of new true random number generator (TRNG).
- Implemented parameterised TRNG IP block embedded in Altera CPLDs.
- Implemented scalable Montgomery multiplication coprocessor.

Title of the Project: ***The algorithms of standard videocodecs H.263 and MPEG-4***
Funding: VEGA, 1/0384/03

Duration: 2003-2005

Co-ordinator: Prof. Ing Ján Mihalík, Ph.D.

Group members: J. Zavacký, I. Gladišová, M. Dulina, V. Michalčin, R. Štefanišin, M. Kasár

Scientific goals/research targets:

The research of algorithms of standard videocodecs H.263 and MPEG-4 for purpose of implementation of videocommunications and multimedia services in heterogenous telecommunication networks with very low bit rates. There are supposed new algorithms of vector quantization of video and texture of videoobjects in domain of DCT or wavelet transform. Next, effective algorithms of arithmetic encoding of binary shapes of videoobjects also chain coding their contour representations. Then precise algorithms of motion estimation with variable block size and mesh based with bilinear or affinne

transformation. Further, modeling and animation of human head on the basis of algorithms of its calibration, deformation, estimation three-dimensional motion and animation parameters, also generation and projection of its texture on wireframe model. Going on in morphing of the texture by using of algorithms of scatter data spline interpolation. Finally shape generalized DCT and wavelet representations of the texture of videoobjects.

Title of the Project: *EuroWorkshops on "ADC Modelling and Testing"*

Funding: 5th Framework Programme (EUR 34000)

Collaboration with: Italy, Hungary, Portugal, Czech Republic, Finland, Germany

Duration: 2000-2003

Project coordinator: Prof. Ing Linus Michaeli, DrSc.

Group members: J. Šaliga , R. Holcer

Scientific goals/research targets:

To develop models of A/D converting systems convenient for simulating correction algorithms and optimisation of testing procedures.·

Results Achieved:

- Estimation of the uncertainties of fast testing procedures·
- Comments to ADC testing standards with respect to the needs of the prospective customers. ·
- Coherency between definitions of ADC parameters in European Standards and US, Japan standards. ·
- New digital processing methods for dynamic error reduction.·
- Proposals for suppresion EMC disturbance on ADCs.

Title of the Project: *Summer school on "Data Acquisition systems"*

Funding: SOCRATES (EUR 15000)

Collaboration with: Italy, Hungary, Czech Republic.

Duration: 2002-2004

Project coordinator: Prof. Ing Linus Michaeli, DrSc.

Group members: J. Šaliga, R. Holcer

Scientific goals/research targets:

The IP course is aimed on the preparation graduates in the hardware and software design of the Data Acquisition Systems integrated with the computerized information

environment. It allows to achieve the requirements of industrial partners for graduates skilled in the relevant field for the organisation according to TQM. The project meets needs of highly qualified graduates, able to work in multinational teams.

Results Achieved:

- Student's skills how to design Data Acquisition Systems using modern approaches from the area of information and communication technologies.
- Knowledge about metrological parameters of DAQ according to actual International standards and informe than about abigouity of the interpretation among various producers.
- Student's skills in the simple testing methods for metrological parameter assessment coherent with ISO standards
- Production teaching materials for students and teacher related with Data Acquisition Systems.

Title of the Project: *AGORA 2000*

Funding: LEONARDO DA VINCI (EUR 27000)

Collaboration with: Italy, Belgium, Slovak Republic.

Duration: 2000-2003

Project coordinator: Prof. Dr. Nicola DeNardi,

Project sub-coordinator: Prof. Ing Linus Michaeli, DrSc.

Group members: J. Šaliga, R. Holcer

Scientific goals/research targets:

The Pilot project Agorà2000 aims at predicting and satisfying the training needs of the SME's, authorities, training organisations in the telematic and multimedia sector in relation to he ICT The project develops training path for: web design, electronic commerce, telework, telecontrol, increasing the potentialities of the ICT in the extension of the sale market of businesses manufacturing goods and services, through a mix of software products, provided in the project, to implement for the direct sale in the Internet .

Results expected:

- multimedia training package on CD-ROM in eight didactic modules; abridged version on the Internet,
- software for the direct sale on the Internet;
- software for case application of the telecontrol via Internet,

- the implementation of web sites of each partner, in order to simulate the situations of e-commerce.

Title of the Project: *Fibre Optic Sensors*

Funding: Institutional grant, G - 4442

Duration: 2003-2005

Co-ordinator: Prof. RNDr. Ing Ján Turán, DrSc.

Group members: J. Gamec, R. Gaňová, P. Filo, P. Serfőző, Ľ. Ovseník, J. Študenc

Collaboration with:

- Prof. E.F. Carome, John Carrol University, Cleveland, USA

Scientific goals/research targets:

- Development *Fiber Optic Refractometer* remotely controlled through WWW.
- Development *Optically Powered Fiber Optic Sensor* with frequency output.
- *Multiplex* in optically powered fiber optic sensor.

Results Achieved:

- Fiber optic refractometer as:
    a) laboratory equipment;
    b) portable equipment;
    c) monitoring equipment.
- GUI for refractometer control through WWW.
- Optically powered fiber optic sensory system with low power consumption.

Title of the Project: Transform Systems for Digital Image Processing

Funding: VEGA 1/0381/03

Duration: 2003-2005

Co-ordinator: Prof. RNDr. Ing Ján Turán, DrSc.

Group members: J. Gamec, R. Gaňová, P. Filo, P. Serfőző, Ľ. Ovseník, J. Študenc

Collaboration with:

- Prof. K. Fazekas, TUB, Budapest, Hungary
- Prof. A. Figuieras and Prof. J. Cid-Sueiro, University Carlos III, Madrid, Spain
- Prof. J. Tasic, TU Ljubljana, Slovenia
- Prof. T. Adam, Technical University, Miskolc, Hungary
- Prof. M. Najim, University Bordeaux, France
- Prof. K. Skala, University Zagreb, Croatia
- Prof. M. Ansorge, University Neushatel, Switzerland

Scientific goals/research targets:

- Development new methods for invariant feature selection based on hybridisation of fast translation invariant transforms (CT, RT and NT) with Radon or Hough Transform.
- Development, implementation and experimental verification of new invariant image recognition systems based on feature selection-using hybridisation of CT with Radon or Hough Transform.
- Study properties of Trace Transform and int application to image processing.
- Study new applications of Hough Transform (robust system identification, metrology problems and signal processing).

Results Achieved:

- Development new methods for invariant feature extraction based on CT, RT, NT, Radon and Hough Transform.
- New Continuous Kernel Hough Transform (CKHT) and its application to feature extraction and system parameters estimation.
- System parameters estimation tool based on CKHT.
- Motion estimation based on inverse rapid transforms.
- Invariant associative memory based on STIR transforms.
- 3D-object recognition system based on using RT for reflected acoustic waves analysis.
- Invariant image recognition systems based on hybridisation of RT, NT with Hough and Radon transform.

Title of the Project: ***Information and Knowledge Management for Integrated Media Communication***

Funding: COST 276

Collaboration with: France, Italy, Norway, Hungary, Spain, Slovenia (Project coordinator: Prof. J. Tasic, University of Ljubljana), Greece, Switzerland, Croatia, Czech Republic, Portugal, Romania, Turkey, Ireland.

Duration: 2001-2005

Co-ordinator: Prof. RNDr. Ing Ján Turán, DrSc.

Group members: J. Gamec, R. Gaňová, P. Filo, P. Serfőző, Ľ. Ovseník, J. Študenc

Scientific goals/research targets:

- Development advanced multimedia data and knowledge management technologies for personal systems and services, including specific signal processing and implementation techniques.

Results Achieved:

- The work is ongoing in Working Groups:
  a) WG.1: Multimedia information, knowledge management and data management;
  b) WG.2: Agent architectures for agent communication and agent mobility;
  c) WG.3: Technologies for user interface personalisation;
  d) WG.4: Dedicated advanced methods for signal, video, speech and sound processing and coding.
- Our research group will focus on development advanced methods for image processing based on the use of fast, linear and non-linear selected transforms (CT, RT, Hough, Radon, Trace, Mojette Transform) and GUI design for teleworking and teleeducation applications.

7. EQUIPMENT

Teaching and Research Laboratories and Special Measuring Instruments and Equipment.

Laboratory	*Equipment*
ATM Laboratory	ATM Laboratory Network, ATM Switch.
DSP Laboratory	Development tools for Analog Devices digital signal processors ADSP218x, ADSP219x, ADSP21535 – Blackfin and ADSP21161 SIMD SHARC. Laboratory is supported by Analog Devices University program (www.kemt.fei.tuke.sk/adsp). Development tools for FPGA Altera circuits, development kid UP-1.
Laboratory of Measurement	Special precise measurement system for ADC testing
Laboratory of Embedded Microcontrollers	Development tools for single chip Analog Devices MicroConverters (Intel 8052 compatible), Microchip PIC microcontrollers and embedded Altera RISC soft processor NIOS.
Laboratory of Optoelectronics	Development tools for optical fibre communications training systems and optical desk with He-Ne laser.
Laboratory of TV System	Special TV system for teaching.
Laboratory of Microwave Technology	Development tools for microwave training systems.
Laboratory of Speech Technology for Telecommunications	Development tools for automatic speech recognition systems and automatic voice services in telecommunications and Internet.

8. CO-OPERATION

Co-operation in Slovakia

Institution	*Type of activity*
Slovak Telecom Bratislava	Research, Leonardo
Alcatel SEL Liptovský Hrádok	Leonardo
Siemens Software House Bratislava	Leonardo
Ericsson Slovakia	Leonardo
Telenor Slovakia	Leonardo
Alcatel Bussiness System Bratislava	Leonardo
VSE, Košice	Research
Volkswagen Slovakia a.s.	Development and education
Slovak Academy of Science	Research and development

International Co-operation

Institution	*Type of activity*
Alcatel SEL Stuttgart	Leonardo
Siemens Viena	Leonardo
UPC Barcelona	Leonardo
Politechnico di Torino	Leonardo
Loracom France Nancy	INCO/COPERNICUS
University of Catania Italy	INCO/COPERNICUS
University of Mining and Mettalorgy Krakow	INCO/COPERNICUS, JOINT
MEDAV GmbH Germany	Bilateral Contract
Technical University Ilmenau Germany	SOCRATES
Technical University Budapest	COST
Technical University of Ljubljana	COST
Technical University of Delft	COST
Technical University of Clju-Napoca	COST
University of Firenza Italy	COST
University of Gent	COST
University of Sannio Italy	Leonardo / SOCRATES
University of Calabria Italy	Leonardo / SOCRATES
University of Mediteranea Italy	SOCRATES
Universite Jean Monnet-Saint-Etienne France	SOCRATES
Universite Jean Monnet-Saint-Etienne France	CryptArchi

9. FACULTY ESSAYS

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 interests are in the linear adaptive digital filters, least Mean Square algorithms, QR decomposition and wireless communication systems (GSM, UMTS), wireless ATM and wireless LAN.

Drutarovský Miloš
Associated professor
His research interests include applied cryptography, digital signal processing (digital filters and spectral analysis), algorithms and architectures for embedded cryptographic architectures, digital signal processors, field programmable devices and soft microcontrollers embedded into field programmable devices.

Galajda Pavol
Associated professor
His research interest is in nonlinear circuit's theory, CHAOS in spread spectrum communication systems and programmable logic devices- ALTERA and FPGA circuits.

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

Gamcová Mária
Assistant professor
Her general research interests includes one and two dimensional processing based on the method of digital filtering.

Gladišová Iveta
Assistant professor
Her research interests are in the digital signal processing, geometric source coding and vector quantization, an algorithm for lattice and pyramid quantizers and codes.

Hroncová Ingrid
Research assistant
Her professional area of interests is digital signal processing, digital speech processing, transform coding and metropolitan area networks.

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

Klenovičová Zita
Assistant professor
Her research interests include digital circuits and digital picture processing.

Kocur Dušan
Associated professor
His research interest is in digital signal processing, spread spectrum communication systems, CDMA systems, adaptive linear and non-linear filters, polyspectral signal analysis and psychoacoustics.

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

Maceková Ľudmila
Research assistant
Her general research interest includes design and implementation algorithms for two and three-dimensional filters for image processing.

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.

Matúš Emil
Assistant professor
His research interest includes digital picture processing.

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

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 PSTN, mobile, ISDN, ATM telecommunication networks and Internet on the basis of the standards.

Ovseník Ľuboš
Assistant professor
His general research interests include fiber optics, fiber optical sensors and the fiber optical application in the microwave domain.

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

Špány Viktor
Professor Emeritus
His main interests and activities are in the non-linear circuits theory, smart sensors, flip-flop sensors, integrated functional blocks and statistical sensors.

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.

Zavacký Jozef
Assistant professor
His current interest includes signal and information theory, sampling of the one-dimensional and multidimensional signals.

10. Ph.D. STUDENTS

Name	*Supervisor*	*Degree Course*
First year of study		
Gaňová Renáta	Turán	Electronics
Kasár Miroslav	Mihalík	Telecommunications
Krajňák Jozef	Kocur	Electronics
Ridzoň Radovan	Levický	Telecommunications
Baboľ Miroslav (df.)	Čižmár	Telecommunications
Fedor Stanislav (df.)	Doboš	Telecommunications
Kačír Miloš (df.)	Doboš	Telecommunications
Lukáč Martin (df.)	Juhár	Telecommunications
Študenc Jozef (df.)	Turán	Electronics
Second year of study		
Filo Peter	Turán	Electronics
Floriš Peter	Levický	Telecommunications
Grega Marián	Marchevský	Telecommunications
Michalko Peter	Michaeli	Measurement technique
Šimka Martin	Drutarovský	Electronics
Csernok Szabolcz (df.)	Michaeli	Measurement technique
Florek Vladimír (df.)	Michaeli	Measurement technique
Homolya Viktor (df.)	Juhár	Telecommunications
Kravecová Daniela (df.)	Drutarovský	Telecommunications
Siman Roman (df.)	Doboš	Telecommunications
Zlacký Marián (df.)	Doboš	Telecommunications
Third year of study		
Čížová Jana	Kocur	Electronics
Longauer Leoš	Marchevský	Telecommunications
Pleva Matúš	Čižmár	Telecommunications
Štefanišin Radoslav	Mihalík	Telecommunications
Šurin Stanislav	Levický	Telecommunications
Gamcová Mária (df.)	Marchevský	Telecommunications
Gebeová Gyongyike (df.)	Čižmár	Telecommunications
Kováč Miloš (df.)	Juhár	Telecommunications
Krivda Marián (df.)	Levický	Electronics
Mohamoud Ali Omer (df.)	Doboš	Telecommunications
Novikmec Jozef (df.)	Doboš	Telecommunications
Papaj Ján (df.)	Čižmár	Telecommunications
Pillár Slavomír (df.)	Marchevský	Telecommunications
Švač Pavol (df.)	Kocur	Electronics
Vlasatý Anton (df.)	Juhár	Telecommunications
Fourth year of study		
Goriľ Jozef (df.)	Doboš	Telecommunications
Chochol Peter (df.)	Marchevský	Telecommunications
Mihalčík Ladislav (df.)	Marchevský	Electronics
Fifth year of study		
Abdulghafoor Jalal Mahmood (df.)	Levický	Telecommunications
Benčo Stanislav (df.)	Marchevský	Telecommunications

11. MEMBERS

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

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 in Slovakia.

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

Juhár Jozef, Member of the Audio Engineering Society, New York, I.D. 44164

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

Kocur Dušan, Chairman of the editorial board of the journal " Acta Electrotechnica et Informatica".

Levický Dušan, Member of the editorial board "Radioengineering".

Levický Dušan, Member of the IEEE.

Levický Dušan, Member of Czech and Slovak Radioelectronics Society.

Levický Dušan, Scientific Grant Agency of Slovak Republic.

Marchevský Stanislav, Member of the Scientific Board Military Academy, Lipt. Mikuláš.

Marchevský Stanislav, Member of Technical Standardization Commission No. 60, Sound, Image and Audiovideo Equipment and Systems in Slovakia.

Marchevský Stanislav, Member of Scientific Board of Faculty of Environmental and Manufactural Technology, Technical University of Zvolen.

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

Michaeli Linus, Slovak Metrological Institute, Member of the Scientific Board.

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, Member of the Scientific Board University of Transport and Communication, Žilina, Slovakia.

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

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

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

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.

PUBLICATION ACTIVITY OF THE DEPARTMENT

Books:

ACB - Vysokoškolské učebnice vydané v domácich vydavateľstvách

[1] Čižmár,A.-Baboľ,M.-Jakab,F.: Technológia Ipv6 a možnosti jej nasadenia. Elfa Pres. Košice, 2003, ISBN 80–89066–68–2.

[2] Michaeli,L.-Šaliga,J.: Data Acquisition Systems. Mercury – Smekal, Publ. House 2003, ISBN 80-89061-80-8.

[3] Michaeli,L,-Šaliga,J.–Holcer,J.: Telecontrol. Učebnica vydaná v rámci projektu "AGORA´2000", Mercury – Smekal, Publ. House 2003.

[4] Michaeli,L,-Šaliga,J.–Holcer,J.: Telework, Učebnica vydaná v rámci projektu "AGORA´2000", Mercury – Smekal, Publ. House 2003.

[5] Michaeli,L,-Šaliga,J.–Holcer,J.: Internet Security. Učebnica vydaná v rámci projektu "AGORA´2000", Mercury – Smekal, Publ. House 2003.

[6] Turán,J.-Ovseník,Ľ: Optické komunikačné systémy (príklady, merania, testy). Harlequin, repro štúdio, Košice, Slovakia, 2003, ISBN 80-89082-05-X, pp.272.

[7] Turán,J.: Fotonika. Harlequin, repro štúdio, Košice, Slovakia, 2003, ISBN 80-89082-05-X, pp 412.

BCI - Skriptá a učebné texty

[1] Levický,D.-Čižmár,A.-Doboš,Ľ.-Gamec,J.-Foriš,P.: Informačné, telekomunikačné a multimediálne technológie pre výučbu. EkF TU Košice, Slovakia, 2003, ISBN 80-8073-032-6, pp.102.

BCK – Kapitoly v učebniciach a učebných textoch

[1] Holcer,R.: Internet security. Kapitola v učebnom texte "Telework, e-commerce, telecontrol-Handbook", ITIS E.Fermi-, Fuscaldo-Italy, November 2003, pp.69-79.

[2] Levický,D.: Informačná bezpečnosť v prostredí E-biznis (problémy, princípy, systémy a prostriedky). WEB-technológie pre podnikateľov (elektronická komercia), SK 0009.03 Grantová schéma rozvoja zdrojov prostredníctvom poradenstva a vzdelávania v regiónoch Prešov, Košice, Banská Bystrica. Košice, 2003, TU Košice, Elfa Košice, ISBN 80-89066-66-6, pp.243-257.

[3] Michaeli,L.: Telework. Kapitola v učebnom texte "Telework, e-commerce, telecontrol-Handbook", ITIS E.Fermi-, Fuscaldo-Italy, November 2003, pp.15-30.

[4] Šaliga,J.: Telecontrol. Kapitola v učebnom texte "Telework, e-commerce, telecontrol-Handbook", ITIS E.Fermi-, Fuscaldo-Italy, November 2003, pp.83-99.

Journal Papers:

ADC - Vedecké práce v zahraničných karentovaných časopisoch

[1] Holcer,R.-Michaeli,L.-Šaliga,J.: DNL ADC Testing by the Exponential Shaped Voltage. IEEE Transactions on Instrumentation and Measurement, Vol.52, No.3, June 2003, USA, ISSN 0018-9456, pp.946-949.

[2] Šaliga,J.-Michaeli,L.: Software for Metrological Characterisation of PC Sound Cards. Computer Standards and Interfaces. Volume 25, Issue 1, March 2003, ISSN0920-5489, pp.45-55.

ADE - Vedecké práce v zahraničných nekarentovaných časopisoch

[1] Kocur,D.-Zetík,R.: Volterra Filters: A Promising Tool for Wideband and Narrowband Interference Suppression in DS-SS Communication Systems. Iranian Journal of Electrical Engineering, Wintr-Spring 2003, Vol.2, Number 1, IJECE, Iran, ISSN 1682-0053, pp.61-68.

[2] Levický,D.-Foriš,P.: Technika digitálnych vodoznakov vo fraktálovom kódovaní statických obrazov. Slaboproudý obzor, Prosinec 2002, Ročník 59, Číslo 4, 2002, Czech Republic ISSN 0037-668X, pp.13-18.

[3] Mihalík,J.: Štandardný videokodek H.263 a jeho porovnanie s H.261. Slaboproudý obzor, Ročník 60, Číslo 1, 2003, Czech Republic ISSN 0037-669X.

[4] Šaliga,J.-Michaeli,L.: Software for Metrological Characterisation of PC Sound Cards. Computer Standards Interfaces, Vol.25, Issue 1, March 2003, NL-Niderland, pp.45-55.

[5] Turán,JR.,Fazekaš,K.-Turán,J.-Ovseník,L.: Invariant Associative Image Memory Based on STIR and MPEG4. Hiradástechnika, Vol.LVII, Hungary, 12/2002, pp.26-29, HU ISSN 0018-2028.

[6] Turán,J.-Ovseník,Ľ.-Carome,E.-Fazekaš,K.: Laboratory Equipment Type Fiber Optic Refractometry System. Híradástechnika, Vol.LVII, Hungary, 12/2002, pp.44-49, HU ISSN 0018-2028.

ADF - Vedecké práce v domácich nekarentovaných časopisoch

[1] Gladišová,I.-Mihalík,J.: Stavové aritmetické kódovanie binárnych obrazov. Acta Electrotechnica et Informatica, Vol.3, No.3, 2003, Košice, Slovak Republic, pp.36-43.

[2] Holcer,R.-Michaeli,L.-Šaliga,J.: Histogram Testing of ADC by the Exponential Signal. Acta Electrotechnica et Informatica, Vol.3, No.1, 2003, ISSN 1335-8243, Košice, Slovak Republic, pp.10-13.

[3] Kocur,D.-Čížová,J.: Multi –User Detection Techniques for CDMA:A Review of Basic Principles. Acta Electrotechnica et Informatica, Vol.3, No.1, 2003, Košice, Slovak Republic, ISSN 1335-8243, pp.28-35.

[4] Kocur,D.-Čížová,J.-Marchevský,S.: Non-Linear Microstatistic Multi-User Receiver. Acta Electrotechnica et Informatica, Vol.3, No. 3, 2003, Košice, Slovak Republic, ISSN 1335-8243, pp.10-15.

[5] Turan,J.-Benča,M.: Hardware Implementation of Invariant Object Recognition System . Acta Electrotechnica et Informatica, Vol.3, No.1, 2003, Košice, Slovak Republic, ISSN 1335-8243, pp. 21-27.

[6] Turán,J.-Ovseník,Ľ.: Laboratórny optický vláknový refraktometer. (Laboratory of Fiber Optic Refractometer) Acta Electrotechnica et Informatica, Vol.3, No.3, 2003, Košice, Slovak Republic, ISSN 1335-8243, pp.52-57.

Conference papers:

AEC Vedecké práce v zahraničných recenzovaných vedeckých zborníkoch

[1] Bača,M.-Drutarovský,M.: Information Hiding Using Dither Modulation in JPEG 2000 Standard. 13th International Czech-Republik Scientific Conference Radioelektronika 2003, Brno, ČR, 6-7.5.03, pp.384-387, ISBN 80-214-2383-8.

[2] Čižmár,A.-Gamec,J.-Pleva,M.-Juhár,J.-Doboš,Ľ.-Gamcová,M.: Indoor PLC Solution. 7th International Conference on ENGINEERING of MODERN ELECTRICAL SYSTEMS "EMES '03", Oradea, Romania, May 29–31, 2003. (in press)

[3] Čižmár,A.-Goril,J.-Dobos,L.-Juhar,J.: Overview of CAC Algorithms for Future Generation Mobile Systems. Conference Proceedingds ICETA 2003 (2nd International Conference on Emerging Telecommunications Technologies and Applications), Košice, Slovakia, Sept. 11-13, 2003, ISBN 80-89066-67-4, pp.117-122.

[4] Čižmár,A.-Gamec,J.-Juhar,J.-Dobos,L.-Pleva,M.: PLC- A Possible Alternative Data Transmission Technology. Conference Proceedingds ICETA 2003 (2nd International Conference on Emerging Telecommunications Technologies and Applications), Košice, Slovakia, Sept. 11-13, 2003, ISBN 80-89066-67-4, pp.111-116

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